Birla Institute of Technology and Science-Pilani
Hyderabad Campus

INSTRUCTIONS FOR MEOW ASSIGNMENT-II

- Fifteen sets of topics/questions are listed below.
  (See SAMPLE ASSIGNMENT PAPER Pages 2 and 3)
- The assignment sheet given to you has one responses/statement for each of the fifteen topics/questions.
- Read the responses/statements carefully and rank them.
- Rank the statements on a scale 0 to 6 as explained in the table given below.
- Write ranks against each item in the answer sheet.
- Log on to http://0space.org and fill in the following information in the form available there.
  - Roll No.
  - SetId; (SetId is an integer between 1 and 720)
  - Question wise rank for the fifteen questions

  Note that The SetId appears on every page of the assignment sheet in the left and right margins.
- You need not submit print copy. Print copy will be accepted only in case of problem in on line submission. In case of problem in on line submission. As before for the first assignment, click on your tutorial section. You will be taken to a page which will have a link to the Answer Form form for Assignment-II
- You will have only one chance for online submission.
- Preserve the print copy till the examination results are announced.
- In case of any problem in on line submission contact

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  email: akkhcu@gmail
  (M) 9618932066

- While contacting by email please mention your Name, Roll Number, Tutorial Section and nature of the problem.
- A sample question paper is made available on CMS

Type	Rank	Type	Rank
Fully correct	5.	Mostly wrong	2.
Mostly Correct	4	Completely wrong	1
About 50% correct 50% wrong	3	Parts totally irrelevant, or not clear or ambiguous; On the whole does not tell much about the question.	0

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Sem-I 2014-15 Mechanics Waves and Oscillations MM:15

Assignment-II **Due On : Nov 18, 2014**

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SetId=1

[1] Distance is equal to the length of the path covered. Displacement is the shortest distance between initial and final points.

[2] When the net external torque acting on a body or a system of bodies is zero about a particular axis, then the angular momentum of each body is conserved about that axis.

[3] An example where law of conservation of angular momentum holds:
The Law of conservation of angular momentum holds in the case of a ballet dancer performing a pirouette.

When the dancer extends her arms outward, the angular velocity of her rotation decreases whereas when she keeps her arms close to her body, the angular velocity increases. This is because her moment of inertia changes as she moves her arms outward and inward. It can be noted that she as a system has no external torque acting upon her.

[4] In the Sun Earth system the angular momentum of the Earth is conserved in every frame of reference

[5] Only the z component of angular momentum of a conical pendulum is conserved w.r.t. the origin fixed at the point of suspension. SetId=1

[6] Let us consider a rotating skew rod. In the absence of friction or any other drag force, the rod should continuously spin without stopping. Here the net torque about the axis of rotation is 0 and hence angular momentum is conserved. It therefore follows from law of conservation of angular momentum that a spinning skew rod will keep rotating with constant angular velocity if there is no external torque. So law of conservation of angular momentum does not hold.

[7] Statement: Law of Conservation of energy states that "ENERGY CAN NEITHER BE CREATED NOR DESTROYED",but it can be changed from one form to other.

EXPLANATION: Statement implies that the total amount of energy in an isolated system remains constant although it may change forms. viz, kinetic energy may change to potential;chemical to electrical energies etc.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then check if the laws is applicable or not.

So if there is no *net external force* acting on the system all the three conservation laws will hold.

[9] A non conservative force is the force with the property that the work done in moving a particle between two points is dependent of the path taken.If a particle travels in a closed path, the net work done(the some of the forces acting along the path multiplied

SetId=1

by the distance travelled) by a non conservative force is non zero. When an object moves from one location to another, the force changes the potential energy of the object by an amount that depends on the path taken.Non conservative force depends only on the path followed by the object.

[10] For a particle moving on circle the acceleration is always constant in magnitude and directed towards the centre of the circle.

[11] Distance is equal to the length of the path covered. Displacement is the shortest distance between initial and final points.

[12] If K is an inertial frame, any frame that moves w.r.t. the frame K with uniform velocity is also an inertial frame.

[13] Let us consider that a pendulum is oscillating moving in a vertical plane. Mean while let another bob which is attached to a spring and is executing a simple harmonic motion in horizontal direction comes and hits the pendulum. Here conservation of momentum does not hold good as tension(external force) is acting on the system.(pendulum)

[14] The total work done on a particle is always equal to the change in kinetic energy. SetId=1

[15] A force is any interaction which tends to change the motion of an object. It is also *defined* as rate of change of momentum.It is a vector quantity.
A physically apparent but nonexistent force felt by an observer in a noninertial frame (that is, a frame undergoing acceleration).

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SetId=2

[1] Distance is a scalar quantity where as the displacement is a vector quantity.

[2] The law of conservation of angular momentum states that in absence of an external torque on an object or a closed system of objects the total angular momentum of the system remains constant. Thus if $\vec{\tau} = 0 => \vec{L} =$ constant where τ is the torque and $\vec{L}$ is the angular momentum of the system.

[3] In case of a skater, who can be considered an isolated system, so no torue will be acting on him/her. When the arms are extended, the moment of inertia is more. When his hands are closely held, the moment of inertia is lesser. Since the angular momentum is same, the angular acceleration changes accordingly.

[4] In the motion of earth around sun, the angular momentum of the earth about an axis passing through the sun and perpendicular to the plane of motion of earth is conserved.

[5] The projection of angular momentum of a conical pendulum in the horizontal plane is a constant of motion when the origin is chosen to be at fixed at the point of suspension. SetId=2

[6] In the example of skew rod the angular velocity does not change even though the torque applied is nonzero. However there is no contradiction as in this case the law of conservation of momentum is not applicable. conservation is violated.

[7] Oscillating simple pendulum is a very good example where potential energy gets converted to kinetic energy and kinetic to potential energy. Some energy gets dissipated as heat if we consider air resistance. Energy as a whole is conserved if we consider universe as system, the energy has just changed its form.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then check we should if the laws are applicable or not.

So if there is no *external force* acting on the system all the three quantities, total momentum is conserved. The total angular momentum is also because the torque of internal forces will be zero. The conservation of energy depends on the nature of forces. will be conserved.

[9] In this type of force the work done depends on the path taken by the body.Mechanical energy is not conserved in the system if non conservative force acts on it.

SetId=2

[10] The motion of a bomb dropped from a plane does is not a uniform motion as it follows a parabolic path and not a straight line path.

[11] Distance is a scalar quantity where as the displacement is a vector quantity.

[12] If K is an inertial frame, any frame that moves w.r.t. the frame K with uniform speed is also an inertial frame.

[13] The law of conservation of momentum does not hold in relativistic situations, i.e., where the speeds of the masses involved are close to the speed of light.

[14] A particle is acted upon by a force of constant magnitude which is always perpendicular to the velocity of the particle and the motion of the particle takes place in a plane, Then its kinetic energy, speed, velocity acceleration will not change. SetId=2

[15] Psuedo Force is defined as an apparent force that acts in only non-inertial frames. Pseudo Forces are also called Fictitious Forces. It is an Imaginary force. It is independent of mass.

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ASSIGNMENT-II **Due On : Nov 18, 2014**

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SetId=3

[1] The speed is rate of change of distance and the velocity is the rate of change of displacement.

[2] If no net external torque acts on a system, the total angular momentum of the system remains constant.

[3] Example where law of conservation of angular momentum holds:
Let us assume a student seated on a stool that can rotate freely about a vertical axis. The student has been set into rotation at a modest initial angular speed ω . He holds two dumbbells in his outstretched hands. His angular momentum vector L lies along the vertical rotation axis, pointing upwards. Now he pulls in his arms;this action reduces his rotational inertia from its value I_{initial} to a final value I_{final} because he moves the mass closer to the rotational axis. His rate of rotation increases markedly, from ω_{initial} to ω_{final}. The student can then slow down by extending his arms once more,moving the dumbbells outward. No external torque acts on the system consisting of the student, stool and the dumbbells. Thus the angular momentum of the system about the rotational axis remains constant. $I_{\text{initial}} * \omega_{\text{initial}} = I_{\text{final}} * \omega_{\text{final}}$.

[4] For the motion of earth around sun, the angular momentum of the earth about the center of mass of the sun + earth system and perpendicular to the plane of motion of earth is conserved.

[5] The law of angular momentum of a is not applicable for the conical pendulum conserved w.r.t. the origin fixed at the point of suspension. SetId=3

[6] Example where law of conservation of angular momentum does not hold:If a particle undergoes conical motion and the only force acting on particle is central force like tension of the string.Then total external torque about fixed point A is zero,yet angular momentum is not conserved,as angular momentum keeps on changing direction.

[7] Law of conservation of momentum does not hold whenever an external force or impulse acts on the system. For example,when a body collides with earth then it bounces back to a lesser height as it loses some velocity.

In this example the momentum of a ball is not conserved due to impulsive force by ground in the normal direction.

However, strictly speaking the system that should be considered here is the ball-earth system and the total momentum is conserved.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *net external force* acting on the system, the momentum is conserved. The definition of angular momentum and torque depends on the choice of axes, and therefore it may not be be conserved. The conservation of total energy holds only for conservative forces.

When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *net external force* acting on the system, the energy and momentum will be conserved. However, the total angular momentum may not be conserved because the torque may not be zero.

[9] A force is said to be a non-conservative force if the work done by the force in a closed path is non-zero;(i.e) the cyclic integral of the work done is non-zero.

Work done by a non-conservative force is equal to change in total energy of the system.Work-Energy theorem is not applicable in the case of a non-conservative force.Work done by conservative force depends on the path.It differs with the paths taken by the partical even if the initial and final points are same.In case of non-conservative forces,the total mechanical energy is not constant as the energy is dissipated in various forms such as heat energy,sound energy,etc and cannot be recovered.

SetId=3

[10] A wagon sliding on a roller coaster designed in such a way that the wagon covers equal distances in equal times. As the motion of the wagon is uniform, there will be no net force acting on it.

[11] Both displacement and distance tell us about the motion of a body but their study does not tell much about the forces on the body

[12] A frame rotating w.r.t K with uniform angular velocity is also an inertial frame.

[13] when we are in accelerating frame if we observe any collision between two bodies then the law of conservation of momentum does not hold in that frame of reference.

[14] The kinetic energy of a particle is continuously increasing with time, then the angle bewteen the net force and the velocity cannot be greater than or equal to 90^{o} at any time.

SetId=3

[15] Psuedo Force is defined as an apparent force that acts in only non-inertial frames. Pseudo Forces are also called Fictious Forces. It is an Imaginary force. It is always proportional to mass. It is sometimes dependent on speed.

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ASSIGNMENT-II **Due On : Nov 18, 2014**

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SetId=4

[1] For any type of translational motion of a body, the displacement cannot be zero, where as the distance travelled can be zero.

[2] The law of conservation of angular momentum states that when no external torque is applied on an object or a closed system of objects about an axis, the angular momentum about that axis remains constant.

[3] A bob is attached to ceiling by a string and moves in a horizontal circular plane is an example. In this case the law of conservation of angular momentum does not hold.

[4] In the Sun Earth system the angular momentum of the Earth about the pole star is conserved

[5] The law of angular momentum of a is not applicable for the conical pendulum conserved when the origin is chosen to be at the pendulum bob itself. SetId=4

[6] A nonzero torque always causes the angular velocity to change, because a change in angular momentum means a change in angular velocity $L = I\omega$

[7] If a bullet hits a wooden board and gets embedded in the board, the total energy and the total momentum of the bullet and the board are conserved.

[8] In order to apply the law of conservation of momentum we must first identify the system. If there is no *net external forces* acting on the system then conservation laws of momentum always holds. The total energy and the total angular momentum may not be conserved.

[9] A non conservative force is a force where work done in moving a particle between two points depends on the path through which it is taken.Friction is an example of non conservative force.Mechanical energy is not conserved in case of a non conservative force

SetId=4

[10] A simple pendulum moves along a circular arc and does not have constant speed and therefore its motion is not uniform.

[11] Displacement is the shortest distance between initial and final points with direction specified.

[12] The Newton's Laws of motion will hold in all frames which are at rest w.r.t. K but do not remain valid in a frame that move with respect to K.

[13] Give an example where law of conservation of momentum does not hold all cases when seen from non inertial frame of references for example when we see two cars collide from a moving bus there momentum is not conserved

[14] A heavy body is attached from a spring and is held at point A and is such that the spring is not slack nor is it stretched. It is then released. It goes down upto a point B and then it rises upto point C and executes an oscillatory motion between B and C. During the motion from A to C is first positive (from A to B) and then it is negative from B to A and again remains negative from A to C. SetId=4

[15] Since pseudo forces are not real forces, they do not affect the conservation laws and all the three conservation laws hold in noninertial frames.

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SetId=5

[1] Displacements, being vector quantity can not compared with, a scalar quantity such as distance.

[2] The angular momentum of a given system of bodies shall remain conserved unless acted upon by an external unbalanced torque.

[3] Consider a disc rotating about an axis perpendicular to its plane. On placing a smaller disc with its surface parallel to the surface of the rotating disc, the angular momentum of the system of two discs remains constant as there is no external torque.

[4] For the motion of earth around sun, the angular momentum of the sun about the center of mass of the sun + earth system and perpendicular to the orbital plane of earth is conserved.

For the motion of earth around sun, the angular momentum of the sun about and axis passing through the Earth and perpendicular to the orbital plane of motion of earth is conserved.

[5] The three components of angular momentum of a conical pendulum is conserved w.r.t. the origin at the position of the center of mass of the pendulum. SetId=5

[6] A nonzero torque always implies change in angular momentum and may not give rise to a change in magnitude of angular velocity. A non zero torque may mean change only the direction of the angular momentum and not the angular velocity.

[7] If a bullet hits a wooden board and gets embedded in the board, the total energy of the bullet and the board system is conserved but the total momentum is not conserved.

[8] In order to apply the law of conservation of momentum we must first identify the system. Then even if there is no *net external forces* acting on the system, all the three conservation laws of momentum, angular momentum and energy may not hold due to presence of internal forces.

SetId=5

[9] A force:A force is said to be a *non-//**conservative force* if the*/ work done by it in a closed path is/*/ non-zero./For such forces,potential energy cannot be defined.

[10] A satellite goes around the earth in a circular orbit of 600km with a time period of $5.8 \times 10^3 s$. Its motion will be uniform as it will cover equal distances in equal times.

[11] Displacements, being vector quantity can not compared with, a scalar quantity such as distance.

[12] Staying inside a bullet train moving with constant velocity (no jerks etc) an experiment can always be performed which will tell us the numerical velocity of the bullet train

[13] When a tennis ball hits the ground at an oblique angle, the angle of reflection is equal to the angle of incidence. This is a simple consequence of conservation of horizontal component of momentum.

[14] The kinetic energy of a body does not change if any one of the following is true
(i)force is always perpendicular to the velocity
(ii) the force is always perpendicular to the acceleration
(iii) the object remains stationary
(iv) the object moves in such a way that the point of application of the force remains fixed. $\boxed{\text{SetId=5}}$

[15] A force is any interaction which tends to change the motion of an object. Newtons' second tell us that it is *equal* to the rate of change of momentum.It is a vector quantity. Real forces can be distinguished from pseudo forces because the pseudo forces always proportional to the mass of the body. All real forces, except the gravitational force, do not depend on the mass of the body.

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SetId=6

[1] Distance depends on the path where as the displacement depends on the end point only.

[2] When the net external torque acting on a system about a given axis is zero, the total angular momentum of the system about that axis remains consant.

[3] Consider a man standing on a spinning platform. Initially, the man spreads out his arms and he spins with a certain angular velocity. The next moment, he pulls his arms inwards keeping them close to his body. We will observe that the angular velocity with which he is spinning now increases. This phenomenon can be explained by the Law Of Conservation of Angular momentum. Initially, since his arms were spread wide, his moment of inertia was large. However, when he pulled them close to his body, his moment of inertia decreased.
In this example the angular velocity of the man increases and therefore the angular momentum also increases.The law of conservation of angular momentum does not apply because the torque of muscular forces is not zero.

[4] For the motion of earth around sun, the sum of angular momenta of the Sun and the Earth about the center of mass of the sun + earth system is conserved.

[5] Only the z component of the angular momentum of a conical pendulum is conserved w.r.t. the origin fixed at the point of suspension. SetId=6

[6] In the example of a rotating skew rod the torque due to the external gravitational forces is zero , but the angular momentum is not constant Therefore the law of conservation of angular momentum is violated.

[7] If a bullet hits a wooden board and gets embedded in the board, both total energy and the total momentum of the bullet and the board are not conserved.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then check we should if the laws are applicable or not.

So if there is no *external force* acting on the system all the three quantities, total momentum, total angular momentum, and total kinetic energy will be conserved independent of the nature of forces.

[9] A force that is not conservative is nonconservative force. The work done by a noconservative force cannot be represented by a potential energy function. That is work done by a nonconservative force is dependent on the path through which the system is moved. Some nonconservative forces cause the mechanical energy to be lost or dissipiated. Such forces are called dissipiative forces. There is no way to get back the lost mechanical energy. Nonconservative forces can also increase the mechanical energy. This is arrived from the concept of irreversible process.

SetId=6

[10] A uniform motion is defined to be the one in which a body covers equal distances in equal time intervals.

[11] Distance depends on the path where as the displacement depends on the end point only

[12] Staying inside a bullet train moving with constant velocity (no jerks etc) an experiment can always be performed which will tell us the numerical value of the acceleration of the bullet train

[13] when a ball is dropped from a height, it gains momentum down if we consider the ball as our system.This is because the force of gravity acts as an external force.

However, if we change our system and consider earth as a part of our system too, then the momentum remains conserved because the earth gains momentum up.

[14] The total work done on a particle is always equal to the change in kinetic energy. SetId=6

[15] Examples of pseudoforce are Coriolis Force, Centrifugal Force, and magnetic force on currents.
Psuedo force also called as fictitious force is an apparent force that are needed for masses whose their motion is described using a non inertial frame of reference.

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SetId=7

[1] Distance equal to zero implies displacement=0; and Displacement=0 also implies distance = 0

[2] This law sates that when no net torque of all forces acts on a object or a system of objects then total angular momentum of system is conserved.The angular momentum before an event is equal to angular momentum after that event.mathematically explained by when, net torque=0 ;then, total angular momentum(L)=constant.

[3] In the Sun-Earth system, angular momentum of the earth is not conserved but the total angular momentum of the sun and the earth is constant of motion.

[4] For the motion of the Earth around the sun, the total of angular momenta of the Earth and the Sun, about in a reference frame fixed in the pole star, is conserved.

[5] The z component of angular momentum of a conical pendulum is not conserved w.r.t. the origin fixed at the point of suspension; but the x and y components are conserved. SetId=7

[6] In the example of skew rod, the angular momentum changes with time and there is a non zero torque coming from action of forces other than gravitational forces. Hence the law of conservation of angular momentum dos not apply.

[7] There are certain situations where it appears that the law of conservation of linear momentum does not hold. For example if we take some amount of a substance like construction putty, cement, cake batter, playing dough,etc and drop it on the ground, it does not bounce back like a rubber ball would and hence the momentum it had before striking the ground seems to have been lost. Hence it appears that the law of conservation of linear momentum does not hold.

[8] If we want to apply the conservation laws of momentum, energy and angular momentum, we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *external force* acting on the system, the momentum and angular momentum will be conserved, and depending on the nature of the forces but total energy may or may not be conserved.

[9] Nonconservative forces are forces, such that the work done by these forces are path dependent. Work done by these forces around a close path is not necessarily equal to zero. Hence if a particle is acted on by a non-conservative force and that particle returns to its original position, that particle will experience a net loss of energy. Energy will thus not be conserved for particle. Potential Energy can not be defined for these type of forces.

SetId=7

[10] A particle moves on a circular path. Then its speed, direction of force, velocity and acceleration must always change with time.

[11] Distance equal to zero $\Rightarrow$ displacement=0; but Displacement=0

[12] Assume bullet train, moving with out any jerks, is going on a circular arc of radius R with constant speed. Then an experiment is to be performed entirely within the train without any measurement on objects outside the train. Such an experiment can tell only radius of the track.

[13] There is no known exception to the law of conservation of momentum in classical mechanics however when two bodies collide and their mass converts to energy, an exception in nuclear physics is observed. In real life this is observed in nuclear reactions at atomic level.

[14] A particle is acted upon by a force of constant magnitude which is always perpendicular to the velocity of the particle and the motion of the particle takes place in a plane, Then its kinetic energy, speed, velocity acceleration will not change. SetId=7

[15] Examples of pseudo-force are Coriolis Force, Centrifugal Force, Centripetal force and magnetic force on currents. The pseudo forces do not obey Newton's third law and therefore the total momentum does not appear to be conserved in a non-inertial frame.

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SetId=8

[1] If P and Q are the initial and the final points of a path of a particle, displacement is a vector whose direction is along PQ and has magnitude is equal to the length of line PQ

[2] Statement of Law of Conservation of Angular Momentum:

Differentiating $\vec{L} = \vec{r} \times \vec{p}$ w.r.t, time,

$$\begin{aligned} \frac{dL}{dt} &= \frac{d\vec{r} \times \vec{p}}{dt} = \frac{d\vec{r}}{dt} \times \vec{p} + \vec{r} \times \frac{d\vec{p}}{dt} = \vec{v} \times (m\vec{v}) + \vec{r} \times \vec{F} \\ &= \vec{r} \times \vec{F} (\because v \times v = 0) \\ &= \vec{\tau} \end{aligned}$$

here $\vec{\tau}$ represents the net torque acting on a rigid body rotating about a fixed axis.This torque must take into account of all the forces, be it external or internal forces

[3] Consider a disc and a man system. man is standing on center of the disc rotating with angular velocity.initially man folded his hand.when man stretches his hands then momentum of inertia of system increases.and angular velocity decreases.and total angular momentum remains constant.

[4] For the motion of the Earth around the sun, the total of angular momenta of the Earth and the Sun, is conserved in every inertial frame of reference; but the angular momentum of the Earth (or of the sun)is not conserved in every inertial frame.

[5] Only the z component of angular momentum of a conical pendulum is conserved w.r.t. the origin fixed at the point of suspension. SetId=8

[6] In the example of conical pendulum, the z- component of angular momentum does not change. This follows from the angular momentum conservation as there is no external torque.

[7] A tennis ball is dropped from height h and after hitting the ground and it bounces back and rises to the same height. In this case the momentum of the ball is conserved because (under ideal conditions) the momentum after it hits the ground will be equal to the momentum it had before hitting the ground.

[8] To apply the conservation laws of momentum, energy and angular momentum, we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *external force* acting on the system, the energy and momentum will be conserved. However, depending on the nature of the system and of the forces, the total angular momentum may not be conserved.

[9] Non Conservative force is a force with the property that workdone in moving an object from one point to another is dependent on the path taken .

Non Conservative Force can arise in classical physics due to neglected degrees of freedom or time dependent potentials.

Friction may be treated without resorting the use of non conservative forces by considering the motion of individual molecules.

SetId=8

[10] A particle moves on a circular path. Then its speed, direction offorce, can remain constant by velocity and acceleration must always change with time.

[11] If P and Q are the initial and the final points of a path of a particle, displacement is a vector whose direction is along PQ and has magnitude is equal to the length of line PQ

[12] Assume bullet train, moving with out any jerks, is going on a circular arc of radius R with constant speed. Then an experiment is to be performed entirely within the train without any measurement on objects outside the train. Such an experiment can tell both speed of the train and radius of the track.

[13] When there is no external forces act on a system of many particles, and there are only internal forces acting on the particles. The third law gives that the internal forces are pairwise equal and opposite.Thus the sum of internal forces is zero and the momentum of each particle is conserved.

[14] The kinetic energy of a particle is continuously increasing with time, then the angle bewteen the net force and the velocity cannot be greater than or equal to 90^o at any time.

SetId=8

[15] FORCE is any interaction which tends to change the motion of an object.It has both magnitude and direction,making it a vector quantity.

A psuedo force is an apparent force that acts on all masses whose motion is described with respect to a non-inertial frame of reference like a rotating frame of reference.This force is needed by an observer in an non-inertial frame to make all the Newtons Laws of motion hold true.

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SetId=9

[1] If P and Q are the initial and the final points of a path of a particle,the displacement is the vector $\overrightarrow{PQ}$.

[2] Statement of Law of Conservation of Angular Momentum: For a system of many particles The net torque due all the forces, be it external or internal forces. But as the torque due to all the internal forces cancel out, it sufficient to consider the external forces acting on the system.

[3] The conservation of angular momentum of a system of bodies requires that the the sum of torque due to all forces be equal to zero. Now consider a situation where the forces are such that the sum of torques of external forces is zero w.r.t. some axes K. Since the value of torque depends of the choices of axes, the sum of torques due to all internal forces will depend on the choice of axes and in general it will be non zero. Therefore, for a system of several bodies, for a given choice of axes K, there will be situations when the total angular momentum may not be conserved.

[4] In the Sun Earth system the angular momentum of the Earth is conserved in every frame of reference

[5] The projection of angular momentum of a conical pendulum in the horizontal plane is a constant of motion when the origin is chosen to be at fixed at the point of suspension. SetId=9

[6] In the example of conical pendulum, the x and$y$ components of angular momentum change. This follows from the angular momentum conservation as the z components external torque is zero and horizontal components of torque are non zero.

[7] Law of conservation of momentum does not hold when Newton's laws are not valid, e.g. in a non-inertial frame of reference. For example, when we consider collision between two bodies in a non-inertial frame of reference, the law of conservation of momentum cannot be applied because there will be a pseudo force acting on the frame itself.

[8] In order to apply the law of conservation of momentum we must first identify the system. If there is no *external forces* acting on the system then conservation laws of momentum always holds. And depending on the nature of the system and of the forces, the total kinetic energy and the total angular momentum may not be conserved.

[9] A non-conservative force is a force with the property that the work done in moving a particle between two points is dependent of the path taken . Mostly the enery of the particle in a non conservative force field dissipates in the form of heat or sound . Since the lost energy cannot be bought back ,conservation of mechanical energy does not hold true .

SetId=9

[10] A particle moves on a circular path. Then under suitable conditions its speed may remain constant, but the force, velocity and acceleration must always change with time.

[11] If P and Q are the initial and the final points of a path of a particle,the displacement is the vector $\overrightarrow{PQ}$.

[12] Assume bullet train, moving with out any jerks, is going on a circular arc of radius R with constant speed. Then an experiment is to be performed entirely within the train without any measurement on objects outside the train. Such an experiment can tell only speed of the track.

[13] During collision of billiard balls momentum is conserved. During explosion of a bomb also momentum is conserved and the total momentum of the fragments of bomb will be zero. This is because all the forces are only internal forces.

[14] A heavy body is attached from a spring and is held at point A and is such that the spring is not slack nor is it stretched. It is then released. It goes down upto a point B and then it rises upto point C and executes an oscillatory motion between B and C. During the motion from A to C is first positive (from A to B) and then it is negative from B to A and again remains negative from A to C. $\boxed{\text{SetId=9}}$

[15] FORCE is any interaction which tends to change the motion of an object.It has both magnitude and direction,making it a vector quantity. A pseudo-force F doesn't arise from any physical interaction between two objects, but rather from the acceleration 'a' of the non-inertial reference frame itself. These forces have no real existence but must be taken into account in an accelerating frame of reference to make all the three Newton's Laws of motion applicable to the system

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[1] If two bodies starting from a point A reach a point B, following different paths, their displacement will be, in general different, but the distances covered will always be the same.

SetId=10

[2] Depending on the torques acting on a system, the angular momentum can be conserved only in one or two directions, but may not be conserved in all. For instance, if an isolated body has no torque acting on it only in the direction along the Z axis, then the angular momentum is conserved only in that direction.

[3] Example where law of conservation of angular momentum does not hold:
When there is external force like frictional force acting on a object when it is rotating we cannot use conservation of angular momentum as the friction force acting on the object produces an external torque.

[4] In the motion of earth around sun, the angular momentum of the earth about an axis passing through the sun and perpendicular to the plane of motion of earth is conserved.

[5] The law of angular momentum of a is not applicable for the conical pendulum conserved w.r.t. the origin fixed at the point of suspension.

SetId=10

[6] Example where law of conservation of angular momentum does not hold: A disc rotating on a horizontal rough surface will not have a constant angular momentum because there will be a constant torque by frictional force. Hence, its angular momentum will decrease, and the law of conservation of angular momentum does not apply.

[7] If I throw a ball upward, it's speed decreases as it rises upwards. There is an external force (gravity) acting on the ball, so the momentum conservation law does not apply. Momentum of the ball is not conserved, however the momentum of the Earth-ball system is conserved as gravity will become an internal force in this case.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then check if the laws is applicable or not.

So if there is no *net external force* acting on the system all the three conservation laws will hold.

[9] If the work done by a force depends on the path followed by the particle, it is called a Non conservative force. Work done by a non conservative force is not zero in round trip.

SetId=10

[10] A particle moves on a circular path. Then under suitable conditions its speed and acceleration may remain constant, but the force, and velocity must always change with time.

[11] If two bodies starting from a point A reach a point B, following different paths, their displacement will be, in general different, but the distances covered will always be the same.

[12] A particle is observed from two frames S_1 and S_2. The frame S_2 moves with respect to S_1 with an acceleration a. If F_1 and F_2 be the pseudoforces when seen from S_1 and S_2 respectively it is not possible to have $F_1 = F_2 = 0$

[13] Give an example where law of conservation of momentum holds: A mass exploding into several pieces in a conservative field like gravitational field(if air resistance is neglected), obeys law of conservation of momentum. If air resistance cannot be neglected then the law of conservation of momentum will not hold.

[14] The kinetic energy of a body does not change if any one of the following is true
(i)force is always perpendicular to the velocity
(ii) the force is always perpendicular to the acceleration
(iii) the object remains stationary
(iv) the object moves in such a way that the point of application of the force remains fixed. SetId=10

[15] FORCE is any interaction which tends to change the motion of an object.It has both magnitude and direction,making it a vector quantity.
A pseudo-force results from acceleration of the frame of reference in which the objects reside. It is taken into account so that Newton's second law isn't invalidated. The pseudo force acting on an object can always be mathematically expressed as the product of the mass of the object and the acceleration of the frame of reference.

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SetId=11

[1] Displacement is equal to the vector difference $\vec{r}_f - \vec{r}_i$ of the position vectors of initial and final points. The distance covered will be $|\vec{r}_f - \vec{r}_i|$

[2] According to Law of Conservation of Angular momentum,if no external torque acts on an object or system of objects,angular momentum of an object or system of objects remains CONSTANT or no change in angular momentum can occur.

Also it states that,only external torque can change angular momentm of the system where as the torque produced by internal forces can not change the angular momentum of the system

[3] A bob attached to a ceiling by a string moving in a horizontal circular plane is an example where the total angular momentum of the bob about the point of suspension is not conserved. This is because the the torque due to the weight of the bob about the point of suspension does not vanish and has non zero horizontal component. Only the vertical component of the angular component is conserved.

[4] For the motion of earth around sun, the angular momentum of the earth about the center of mass of the sun + earth system and perpendicular to the plane of motion of earth is conserved.

[5] The law of angular momentum of a is not applicable for the conical pendulum conserved when the origin is chosen to be at the pendulum bob itself. SetId=11

[6] Example where law of conservation of angular momentum does not hold:Consider a vertical stick on the ground falling to a horizontal position. During the fall, the conservation of angular momentum applied at the point of rotation on the ground and perpendicular to the plane of the stick is not applicable as, the gravitational force which acts vertically downwards assumed at the centre of mass produces an external torque about the axis of rotation

[7] A soldier accelerating away, after detonating a bomb, will find that the total momentum of the fragments of the bomb is zero. This is an example where the law of conservation of momentum holds as the forces on the fragments are internal forces only and sum of all such forces is zero.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then check we should if the laws are applicable or not.

So if there is no *external force* acting on the system all the three quantities, total momentum is conserved. The total angular momentum is also because the torque of internal forces will be zero. The conservation of energy depends on the nature of forces. will be conserved.

SetId=11

[9] The workdone by a non conservative force is dependant on its path. the work varies as the path varies.

[10] When the force is kept constant as function of time, it is possible for a particle to move on a circular path in such a way that its speed remains constant, but the velocity and acceleration must always change with time.

[11] Distance is equal to the length of the path covered. Displacement is the shortest distance between initial and final points.

[12] A particle is observed from two frames S_1 and S_2. The frame S_2 moves with respect to S_1 with an acceleration a. If F_1 and F_2 be the pseudoforces when seen from S_1 and S_2 respectively and if $F_1 = 0$ then we must have $F_2 \neq 0$

[13] Also a good example of law of conservation momentum can be seen when a bullet from a rifle is fired.As the bullet is fired and gets out of the rifle, the rifle gives a backward jerk due to the phenomenon of conservation of momentum.

[14] The total work done on a particle is always equal to the change in kinetic energy. SetId=11

[15] Explain Force:FORCE is any interaction which tends to change the motion of an object.It has both magnitude and direction,making it a vector quantity.
In the case of a non inertial frame, we can use the second law of motion by adding a pseudo force to the system which makes it an inertial frame of reference.

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SetId=12

[1] Distance is equal to the length of the path covered. Displacement is the shortest distance between initial and final points.

[2] The law of conservation of angular momentum states that when the net external torque acting on the system is zero, then the angular momentum of the system remains constant.both the initial and final momentum should be taken from a fixed inertial frame of reference provided.

[3] Law of conservation of angular momentum holds in case of long jump. When a athlete takes off from the ground in a running long jump, the forces on the launching foot give the athlete an angular momentum with a forward rotation around a horizontal axis. Such rotation would not allow the jumper to land properly. In the landing, the legs should be together and extended forward at an angle so that the heels mark the sand at the greatest distance. Once airborne, the angular momentum cannot change (it is conserved) because no external torque acts to change it. However, the jumper can shift most of the angular momentum to the arms by rotating them in windmill fashion. Then the body remains upright in the proper orientation of landing.

[4] In the Sun Earth system the angular momentum of the Earth about the pole star is conserved

[5] The three components of angular momentum of a conical pendulum is conserved w.r.t. the origin at the position of the center of mass of the pendulum. SetId=12

[6] We have a conical pendulum .The forces acting on the bob are tension (along the direction of the string) and gravitational force acting in the vertically downward direction.we have an additional force called the drag force which is tangential to the motion of the bob and acts in the direction opposite to the motion of the bob.The axis of rotation passes through the hinge point and is vertical.The torque due to tension is 0 because the force passes through the axis of rotation.The torque due to mg is also zero since it is parallel to the axis of rotation.but the torque due to drag force is not zero.since the net external torque acting on the bob is not zero,therefore the law of conservation of angular momentum does not hold here

[7] There is no known exception to the law of conservation of momentum in classical mechanics However, an exception to conservation of energy in nuclear physics is observed. In nuclear reactions when two nuclei collide and their mass converts to energy and energy momentum are not conserved.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *net external force* acting on the system, the momentum is conserved. The definition of angular momentum and torque depends on the choice of axes, and therefore it may not be be conserved. The conservation of total energy holds only for conservative forces.

When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *net external force* acting on the system, the energy and momentum will be conserved. However, the total angular momentum may not be conserved because the torque may not be zero.

[9] A non conservative force is a force with the property that the work done in moving a particle between two points is dependent on the path followed.

SetId=12

[10] It is not possible for a particle to move on a circular path in such a way that its speed and force remains constant, and only the velocity and acceleration may (or may not) always change with time.

[11] Distance is a scalar quantity where as the displacement is a vector quantity.

[12] If K is an inertial frame, any frame that moves w.r.t. the frame K with uniform velocity is also an inertial frame.

[13] when a man walks on the ice slab where friction does not exist between the ice block and the floor but between the feet of the man and the slab the slab moves back as per the law of conservation of momentum

[14] A particle is acted upon by a force of constant magnitude which is always perpendicular to the velocity of the particle and the motion of the particle takes place in a plane, Then its kinetic energy, speed, velocity acceleration will not change. SetId=12

[15] For the Newton's Law of Motion to hold true,the physically apparent but nonexistent force needed by an observer in a non-inertial frame is called the pseudo force.
1) Caused by relative acceleration of the origin in a straight line
2) Centrifugal and Centripetal forces
3) Coriolis force
4) Euler force

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SetId=13

[1] Distance is a scalar quantity where as the displacement is a vector quantity.

[2] The law of conservation of angular momentum states that The total angular momentum of a system is constant in both magnitude and direction if the resultant torque, of the external forces acting on the system, is zero.

[3] The total angular momentum of a body remains constant of motion when the net torque of the external forces acting on the body is zero.
In general, we have a system of particles such that the net torque of the external forces on the system, w.r.t. some axes K, is zero, the total angular momentum may not remain conserved, because the torque due to the internal forces may not be zero.

[4] For the motion of earth around sun, the angular momentum of the sun about the center of mass of the sun + earth system and perpendicular to the orbital plane of earth is conserved.

For the motion of earth around sun, the angular momentum of the sun about and axis passing through the Earth and perpendicular to the orbital plane of motion of earth is conserved.

[5] Only the z component of the angular momentum of a conical pendulum is conserved w.r.t. the origin fixed at the point of suspension. SetId=13

[6] When you release a toy gyroscope on its pedestal, it initially has no precessional rotation around that pedestal, i.e, the orientation of rotation is fixed. However, it instantaneously starts precessing around the pedestal. Both Kinetic Energy and Angular Momentum now exist where they did not exist a moment earlier. The Kinetic Energy is easy to explain, as appearing due to the body of the gyroscope dropping a tiny fraction of a millimeter in the Earth's gravitational field, giving up exactly the correct amount of Potential Energy. But the Angular Momentum of the Precession which just appeared, does not come from anywhere. This is therefore a Violation of the Conservation of Angular Momentum.

[7] In a system of a canon and a canon ball, total momentum of the system is zero before canon ball is fired. After firing the canon ball, the momentum of the system seems to be conserved as the ball moves forward and the canon moves backward.

[8] In order to apply the law of conservation of momentum we must first identify the system. If there is no *net external forces* acting on the system then conservation laws of momentum always holds. The total energy and the total angular momentum may not be conserved.

[9] A non conservative force is a force with the property that the work done in moving a particle between two points is dependent of the taken path.

Friction, for example, does less work on a book dragged across a table if the book is dragged straight across than if the book is dragged in a curved path.

To write the equation for conservation of energy for non conservative forces we need to include the work done by the non conservative force also.This is because forces like friction liberate heat which are not included in the mechanical energy.

SetId=13

[10] For a particle moving on circle the acceleration is always constant in magnitude and directed towards the centre of the circle.

[11] Both displacement and distance tell us about the motion of a body but their study does not tell much about the forces on the body

[12] If K is an inertial frame, any frame that moves w.r.t. the frame K with uniform speed is also an inertial frame.

[13] When a freely falling rigid body collides another body in its path momentum the system of two particles is not conserved in the collision as there is external force mg acting on the system.

[14] The kinetic energy of a particle is continuously increasing with time, then the angle bewteen the net force and the velocity cannot be greater than or equal to 90^{o} at any time.

SetId=13

[15] A force is any interaction which tends to change the motion of an object. It is also *defined* as rate of change of momentum.It is a vector quantity.

Pseudo-force is a fictitious force it is taken by an observer from non inertial frame of reference. This force arises from acceleration of reference frame that is a reference frame which is accelerating or rotating.

The equation of motion is then written by balancing all forces. As an example a particle moving in a circle is seen to be at rest by balancing the centripetal and centrifugal forces.

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SetId=14

[1] The speed is rate of change of distance and the velocity is the rate of change of displacement.

[2] If the net external torque acting on a system is zero,the angular momentum L(vector) of the system remains constant,no matter what changes take place within the system.L(vector)=a constant (net external torque acting on system is zero)

[3] An example where law of conservation of angular momentum holds:
The Law of conservation of angular momentum holds in the case of a ballet dancer performing a pirouette.

When the dancer extends her arms outward, the angular velocity of her rotation decreases whereas when she keeps her arms close to her body, the angular velocity increases. This is because her moment of inertia changes as she moves her arms outward and inward. It can be noted that she as a system has no external torque acting upon her.

[4] For the motion of earth around sun, the sum of angular momenta of the Sun and the Earth about the center of mass of the sun + earth system is conserved.

[5] The z component of angular momentum of a conical pendulum is not conserved w.r.t. the origin fixed at the point of suspension; but the x and y components are conserved. SetId=14

[6] There is no case where LAW OF CONSERVATION OF ANGULAR MOMENTUM does'nt hold.But there are cases where conservation of angular momentum does not hold.A body in vertical circular motion is an example where angular momentum is not conserved. Here the law of conservation does not apply.

[7] When applying the conservation laws of momentum, energy and angular momentum we must define the system first.Only then check if the laws is applicable or not.

As an example: when a ball is dropped from a height, it gains momentum down if we consider the ball as our system.This is because the force of gravity acts as an external force.

However, if we change our system and consider earth as a part of our system too, then the momentum remains conserved because the earth gains momentum up.

[8] In order to apply the law of conservation of momentum we must first identify the system. Then even if there is no *net external forces* acting on the system, all the three conservation laws of momentum, angular momentum and energy may not hold due to presence of internal forces.

[9] A non conservative force is a force with the property that the work done in moving a particle between two points is dependent of the taken path.

Friction, for example, does less work on a book dragged across a table if the book is dragged straight across than if the book is dragged in a curved path.

To write the equation for conservation of energy for nonconservative forces we need toinclude the work done by the non conservative force also.This is because forces like friction liberate heat which are not included in the mechanical energy. SetId=14

[10] The motion of a bomb dropped from a plane does is not a uniform motion as it follows a parabolic path and not a straight line path.

[11] Displacement is the shortest distance between initial and final points with direction specified.

[12] A frame rotating w.r.t K with uniform angular velocity is also an inertial frame.

[13] If we take some amount of a substance like construction putty, cement, cake batter, playing dough,etc and drop it on the ground, it does not bounce back, like a rubber ball would bounce, and hence the momentum it had before striking the ground seems to have been lost. Hence it appears that the law of conservation of linear momentum does not hold.

[14] A heavy body is attached from a spring and is held at point A and is such that the spring is not slack nor is it stretched. It is then released. It goes down upto a point B and then it rises upto point C and executes an oscillatory motion between B and C. During the motion from A to C is first positive (from A to B) and then it is negative from B to A and again remains negative from A to C. SetId=14

[15] A psuedo force is an apparent force that acts on all masses whose motion is described with respect to a non-inertial frame of reference like a rotating frame of reference. This force is needed by an observer in an non-inertial frame to make all the Newtons second laws to write correct equation of motion..

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SetId=15

[1] For any type of translational motion of a body, the displacement cannot be zero, where as the distance travelled can be zero.

[2] The Law of conservation of angular momentum states that when no external torque acts on an object or a closed system of objects undergoing motion about a given axis, the change in angular momentum is zero. Therefore, considering an event where only internal torque or no torque is involved, the total angular momentum of the system before the event is equal to the total angular momentum after the event

[3] In case of a skater, who can be considered an isolated system, so no torue will be acting on him/her. When the arms are extended, the moment of inertia is more. When his hands are closely held, the moment of inertia is lesser. Since the angular momentum is same, the angular acceleration changes accordingly.

[4] For the motion of the Earth around the sun, the total of angular momenta of the Earth and the Sun, about in a reference frame fixed in the pole star, is conserved.

[5] Only the z component of angular momentum of a conical pendulum is conserved w.r.t. the origin fixed at the point of suspension.

SetId=15

[6] A sphere rolling on a rough surface.Due to friction there is external torque so the angular momentum changes which results in the slowing of the sphere. The angular momentum keeps changing. Even in case like this one, it is wrong to say that the Law of Angular Momentum Conservation does not hold.

[7] Statement: Law of Conservation of energy states that "ENERGY CAN NEITHER BE CREATED NOR DESTROYED",but it can be changed from one form to other.

EXPLANATION: Statement implies that the total amount of energy in an isolated system remains constant although it may change forms. viz, kinetic energy may change to potential;chemical to electrical energies etc.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then check we should if the laws are applicable or not.

So if there is no *external force* acting on the system all the three quantities, total momentum, total angular momentum, and total kinetic energy will be conserved independent of the nature of forces.

[9] The non conservative force is a force with a property thet the work done between two points depends on path taken. If a particle moves along a curve path, to know about the work done by a non conservative force we should have the equation of the path along which the particle had move.The work done would be

WORK = INTEGRAL (F.dx)

The equation of conservation of mechanical energy for a non conservative force would be

SetId=15

$KE_{\text{final}} + PE_{final} = KE_{initial} + PE_{initial} + W_{nc}$

[10] A wagon sliding on a roller coaster designed in such a way that the wagon covers equal distances in equal times. As the motion of the wagon is uniform, there will be no net force acting on it.

[11] Displacements, being vector quantity can not compared with, a scalar quantity such as distance.

[12] The Newton's Laws of motion will hold in all frames which are at rest w.r.t. K but do not remain valid in a frame that move with respect to K.

[13] When we consider collision between two bodies in a non-inertial frame of reference, the law of conservation of momentum cannot be applied because there will be a pseudo force acting on the frame itself.

[14] The kinetic energy of a body does not change if any one of the following is true
(i)force is always perpendicular to the velocity
(ii) the force is always perpendicular to the acceleration
(iii) the object remains stationary
(iv) the object moves in such a way that the point of application of the force remains fixed. SetId=15

[15] One indication that pseudo forces are NON-NEWTONIAN is that they violate Newton's III law and violate the Newton's third law.

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SetId=16

[1] Displacements, being vector quantity can not compared with, a scalar quantity such as distance.

[2] The law of conservation of angular momentum states that when no external torque acts on an object or a closed system of objects, no change of angular momentum can occur. Hence, the angular momentum before an event involving only internal torques or no torques is equal to the angular momentum after the event . Angular momentum can be calculated with the help of the formula $L = I\omega$ where L stands for Angular momentum, I stands for moment of inertia and ω stands for angular velocity

[3] Example where law of conservation of angular momentum holds:
Let us assume a student seated on a stool that can rotate freely about a vertical axis. The student has been set into rotation at a modest initial angular speed ω . He holds two dumbbells in his outstretched hands. His angular momentum vector L lies along the vertical rotation axis, pointing upwards. Now he pulls in his arms;this action reduces his rotational inertia from its value I_{initial} to a final value I_{final} because he moves the mass closer to the rotational axis. His rate of rotation increases markedly, from ω_{initial} to ω_{final}. The student can then slow down by extending his arms once more,moving the dumbbells outward. No external torque acts on the system consisting of the student, stool and the dumbbells. Thus the angular momentum of the system about the rotational axis remains constant. $I_{\text{initial}} * \omega_{\text{initial}} = I_{\text{final}} * \omega_{\text{final}}$.

[4] For the motion of the Earth around the sun, the total of angular momenta of the Earth and the Sun, is conserved in every inertial frame of reference; but the angular momentum of the Earth (or of the sun)is not conserved in every inertial frame.

[5] The projection of angular momentum of a conical pendulum in the horizontal plane is a constant of motion when the origin is chosen to be at fixed at the point of suspension. SetId=16

[6] Consider a rod of length l. Let us give an impulse to one end . Now the angular momentum about the oposite end is not zero since the impulse provides some torque . So the angular momentum is not conserved .

$$\text{torque} = \text{impulse} * \ell.$$

$d\ell/dt$ is not equal to zero and the law of conservation of angular momentum does not hold.

[7] Oscillating simple pendulum is a very good example where potential energy gets converted to kinetic energy and kinetic to potential energy. Some energy gets dissipated as heat if we consider air resistance. Energy as a whole is conserved if we consider universe as system, the energy has just changed its form.

[8] If we want to apply the conservation laws of momentum, energy and angular momentum, we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *external force* acting on the system, the momentum and angular momentum will be conserved, and depending on the nature of the forces but total energy may or may not be conserved.

[9] Nonconservative forces arise due to neglected degrees of freedom or from time dependent potentials. The work done by a nonconservative force depends upon the path taken. It causes a change in the mechanical energy of the system. It adds or removes mechanical energy from a system.

SetId=16

[10] A simple pendulum moves along a circular arc and does not have constant speed and therefore its motion is not uniform.

[11] Distance depends on the path where as the displacement depends on the end point only

[12] Staying inside a bullet train moving with constant velocity (no jerks etc) an experiment can always be performed which will tell us the numerical velocity of the bullet train

[13] When a system is acted upon by external forces like friction etc, the conservation principle does not hold good,there will be impulse imparted and so we cant conserve momentum. This is case when a collision between two elastic balls take place on a rough horizontal table. The total momentum just after the collision will be different from the total momentum just before the collision. Here momentum is not conserved as there is external force friction is present.

[14] The total work done on a particle is always equal to the change in kinetic energy. SetId=16

[15] The apparent force which seems to act on an object in an accelerating frame of reference if we wish to describe the object's motion is called a pseudo force.Its a nonexistent force used only to describe the motion completely using Newton's second law even though the agent causing the force is undefined.

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SetId=17

[1] Distance depends on the path where as the displacement depends on the end point only.

[2] Newton's Second Law of Motion is defined by the expression $F = \frac{dp}{dT}$, where F gives the force vector acting on the system and p gives its momentum vector; in linear motion. A similar expression can be written to describe angular motion, i.e. : $\tau = \frac{dL}{dt}$, where τ is the external torque vector acting on the system, and L is the angular momentum.

If the external torque on the system is zero, then we get the expression as: dL/dt=0. This points out to the fact that, when no external torque is acting on the system, then its angular momentum is constant, no matter what changes occur in the system. This is the Law of Conservation Of Angular Momentum.

[3] A bob is attached to ceiling by a string and moves in a horizontal circular plane is an example. In this case the law of conservation of angular momentum does not hold.

[4] In the Sun Earth system the angular momentum of the Earth is conserved in every frame of reference

[5] The law of angular momentum of a is not applicable for the conical pendulum conserved w.r.t. the origin fixed at the point of suspension. SetId=17

[6] Let us consider a rotating skew rod. In the absence of friction or any other drag force, the rod should continuously spin without stopping. Here the net torque about the axis of rotation is 0 and hence angular momentum is conserved. It therefore follows from law of conservation of angular momentum that a spinning skew rod will keep rotating with constant angular velocity if there is no external torque. So law of conservation of angular momentum does not hold.

[7] Law of conservation of momentum does not hold whenever an external force or impulse acts on the system. For example,when a body collides with earth then it bounces back to a lesser height as it loses some velocity.

In this example the momentum of a ball is not conserved due to impulsive force by ground in the normal direction.

However, strictly speaking the system that should be considered here is the ball-earth system and the total momentum is conserved.

[8] To apply the conservation laws of momentum, energy and angular momentum, we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *external force* acting on the system, the energy and momentum will be conserved. However, depending on the nature of the system and of the forces, the total angular momentum may not be conserved.

[9] The work done by a *Nonconservative Force *is not recoverable*.*The work done by a *Non Conservative force* is usually dissipated in the form of Heat and Sound.

SetId=17 Non conservative force *cannot* be expressed in the form of *Potential Energy*.

[10] A satellite goes around the earth in a circular orbit of 600km with a time period of $5.8 \times 10^3 s$. Its motion will be uniform as it will cover equal distances in equal times.

[11] Distance equal to zero $\Rightarrow$ displacement=0; but Displacement=0

[12] Staying inside a bullet train moving with constant velocity (no jerks etc) an experiment can always be performed which will tell us the numerical value of the acceleration of the bullet train

[13] When we are in accelerating frame if we observe any collision between two bodies then the law of conservation of momentum does not hold in that frame of reference. On the other hand the law of conservation of momentum holds in all inertial frames.

[14] A particle is acted upon by a force of constant magnitude which is always perpendicular to the velocity of the particle and the motion of the particle takes place in a plane, Then its kinetic energy, speed, velocity acceleration will not change. SetId=17

[15] The physically apparent, but nonexistent, force needed by an observer in a noninertial frame to make Newton's laws of motion hold true is called pseudoforce.

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SetId=18

[1] Distance equal to zero implies displacement=0; and Displacement=0 also implies distance = 0

[2] If the net external torque acting on a system is zero, the angular momentum L of the system remains constant, no matter what changes take place within the system.

$$\sum(T_{\text{ext}}) = \frac{dL}{dt}$$

The law states that when there is no net external torque, $\frac{dL}{dt}$ is zero implying that the total angular momentum of system is constant.

i.e. $L = a$ constant (isolated system)

[3] Consider a disc rotating about an axis perpendicular to its plane. On placing a smaller disc with its surface parallel to the surface of the rotating disc, the angular momentum of the system of two discs remains constant as there is no external torque.

[4] In the motion of earth around sun, the angular momentum of the earth about an axis passing through the sun and perpendicular to the plane of motion of earth is conserved.

[5] The law of angular momentum of a is not applicable for the conical pendulum conserved when the origin is chosen to be at the pendulum bob itself. SetId=18

[6] In the example of skew rod the angular velocity does not change even though the torque applied is nonzero. However there is no contradiction as in this case the law of conservation of momentum is not applicable. conservation is violated.

[7] If a bullet hits a wooden board and gets embedded in the board, the total energy and the total momentum of the bullet and the board are conserved.

[8] In order to apply the law of conservation of momentum we must first identify the system. If there is no *external forces* acting on the system then conservation laws of momentum always holds. And depending on the nature of the system and of the forces, the total kinetic energy and the total angular momentum may not be conserved.

[9] * A non conservative force is a force that acts on a particle(or point), such that the work done by this force in moving this particle from one point to another is */dependent of path taken/* that is the work done depends on the path itself. * For example frictional force is non conservative because the work done by friction always acts in the direction of travel and therefore depends on length L of the path taken.

SetId=18

[10] A uniform motion is defined to be the one in which a body covers equal distances in equal time intervals.

[11] If P and Q are the initial and the final points of a path of a particle, displacement is a vector whose direction is along PQ and has magnitude is equal to the length of line PQ

[12] Assume bullet train, moving with out any jerks, is going on a circular arc of radius R with constant speed. Then an experiment is to be performed entirely within the train without any measurement on objects outside the train. Such an experiment can tell only radius of the track.

[13] When a freely falling body hits another rigid body in its path then momentum is not conserved as external force mg acts on both the bodies. The total momentum after the collision will be different from the total momentum before the hit.

[14] The kinetic energy of a particle is continuously increasing with time, then the angle bewteen the net force and the velocity cannot be greater than or equal to 90° at any time. SetId=18

[15] Pseudo forces come into picture when Newton's laws of motion have to be applied to describe the motion of bodies in non-inertial frames. These forces have no real existence.

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SetId=19

[1] If P and Q are the initial and the final points of a path of a particle, displacement is a vector whose direction is along PQ and has magnitude is equal to the length of line PQ

[2] When the net external torque acting on a body or a system of bodies is zero about a particular axis, then the angular momentum of each body is conserved about that axis.

[3] Consider a man standing on a spinning platform. Initially, the man spreads out his arms and he spins with a certain angular velocity. The next moment, he pulls his arms inwards keeping them close to his body. We will observe that the angular velocity with which he is spinning now increases. This phenomenon can be explained by the Law Of Conservation of Angular momentum. Initially, since his arms were spread wide, his moment of inertia was large. However, when he pulled them close to his body, his moment of inertia decreased.
In this example the angular velocity of the man increases and therefore the angular momentum also increases.The law of conservation of angular momentum does not apply because the torque of muscular forces is not zero.

[4] For the motion of earth around sun, the angular momentum of the earth about the center of mass of the sun + earth system and perpendicular to the plane of motion of earth is conserved.

[5] The three components of angular momentum of a conical pendulum is conserved w.r.t. the origin at the position of the center of mass of the pendulum. SetId=19

[6] Example where law of conservation of angular momentum does not hold:If a particle undergoes conical motion and the only force acting on particle is central force like tension of the string.Then total external torque about fixed point A is zero,yet angular momentum is not conserved,as angular momentum keeps on changing direction.

[7] If a bullet hits a wooden board and gets embedded in the board, the total energy of the bullet and the board system is conserved but the total momentum is not conserved.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then check if the laws is applicable or not.

So if there is no *net external force* acting on the system all the three conservation laws will hold.

SetId=19

[9] A force with the property that the work done in moving a particle is dependent on the path followed. The work done by a conservative force in moving a body from an initial location to a final location is dependent on the path taken between the two points

[10] A particle moves on a circular path. Then its speed, direction of force, velocity and acceleration must always change with time.

[11] If P and Q are the initial and the final points of a path of a particle,the displacement is the vector $\overrightarrow{PQ}$.

[12] Assume bullet train, moving with out any jerks, is going on a circular arc of radius R with constant speed. Then an experiment is to be performed entirely within the train without any measurement on objects outside the train. Such an experiment can tell both speed of the train and radius of the track.

[13] .The law of conservation of momentum does not hold good when net external forces acting on the system is not zero.when two bodies collide law of conservation of momentum is applicable on system of two bodies but on not individual bodies because external impulse acts on them.

[14] A heavy body is attached from a spring and is held at point A and is such that the spring is not slack nor is it stretched. It is then released. It goes down upto a point B and then it rises upto point C and executes an oscillatory motion between B and C. During the motion from A to C is first positive (from A to B) and then it is negative from B to A and again remains negative from A to C. SetId=19

[15] In a non-inertial frame of reference the accelration of the body that we measure, is not the true acceleration, as the frame itself accelerates.Thus,force(F=ma) is also not the true force acting on the body.The extra force added to make it a true value is called pseudo force.Thus pseudo force does not really act on a body but just compensates the change produced by the non inertial frame, in true acceleration.

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SetId=20

[1] If P and Q are the initial and the final points of a path of a particle,the displacement is the vector $\overrightarrow{PQ}$.

[2] The law of conservation of angular momentum states that in absence of an external torque on an object or a closed system of objects the total angular momentum of the system remains constant. Thus if $\vec{\tau} = 0 => \vec{L} =$ constant where τ is the torque and $\vec{L}$ is the angular momentum of the system.

[3] In the Sun-Earth system, angular momentum of the earth is not conserved but the total angular momentum of the sun and the earth is constant of motion.

[4] In the Sun Earth system the angular momentum of the Earth about the pole star is conserved

[5] Only the z component of the angular momentum of a conical pendulum is conserved w.r.t. the origin fixed at the point of suspension. SetId=20

[6] A nonzero torque always causes the angular velocity to change, because a change in angular momentum means a change in angular velocity $L = I\omega$

[7] If a bullet hits a wooden board and gets embedded in the board, both total energy and the total momentum of the bullet and the board are not conserved.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then check we should if the laws are applicable or not.

So if there is no *external force* acting on the system all the three quantities, total momentum is conserved. The total angular momentum is also because the torque of internal forces will be zero. The conservation of energy depends on the nature of forces. will be conserved.

SetId=20

[9] The work done by non conservative force is dependent on the path taken by the particle in reaching final position from initial position. Non conservative force depends on the distance travelled by the particle

[10] A particle moves on a circular path. Then its speed, direction offorce, can remain constant by velocity and acceleration must always change with time.

[11] If two bodies starting from a point A reach a point B, following different paths, their displacement will be, in general different, but the distances covered will always be the same.

[12] Assume bullet train, moving with out any jerks, is going on a circular arc of radius R with constant speed. Then an experiment is to be performed entirely within the train without any measurement on objects outside the train. Such an experiment can tell only speed of the track.

[13] A block moving in the air breaks up into two parts and the parts separate, then the total momentum must be the same before and after the break.

[14] The kinetic energy of a body does not change if any one of the following is true
(i)force is always perpendicular to the velocity
(ii) the force is always perpendicular to the acceleration
(iii) the object remains stationary
(iv) the object moves in such a way that the point of application of the force remains fixed. SetId=20

[15] A force is any interaction which tends to change the motion of an object. It is *equal to* the rate of change of momentum by Newton's second law.

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SetId=21

[1] If two bodies starting from a point A reach a point B, following different paths, their displacement will be, in general different, but the distances covered will always be the same.

[2] If no net external torque acts on a system, the total angular momentum of the system remains constant.

[3] Consider a disc and a man system. man is standing on center of the disc rotating with angular velocity.initially man folded his hand.when man stretches his hands then momentum of inertia of system increases.and angular velocity decreases.and total angular momentum remains constant.

[4] For the motion of earth around sun, the angular momentum of the sun about the center of mass of the sun + earth system and perpendicular to the orbital plane of earth is conserved.

For the motion of earth around sun, the angular momentum of the sun about and axis passing through the Earth and perpendicular to the orbital plane of motion of earth is conserved.

[5] The z component of angular momentum of a conical pendulum is not conserved w.r.t. the origin fixed at the point of suspension; but the x and y components are conserved. SetId=21

[6] A nonzero torque always implies change in angular momentum and may not give rise to a change in magnitude of angular velocity. A non zero torque may mean change only the direction of the angular momentum and not the angular velocity.

[7] There are certain situations where it appears that the law of conservation of linear momentum does not hold. For example if we take some amount of a substance like construction putty, cement, cake batter, playing dough,etc and drop it on the ground, it does not bounce back like a rubber ball would and hence the momentum it had before striking the ground seems to have been lost. Hence it appears that the law of conservation of linear momentum does not hold.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *net external force* acting on the system, the momentum is conserved. The definition of angular momentum and torque depends on the choice of axes, and therefore it may not be be conserved. The conservation of total energy holds only for conservative forces.

When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *net external force* acting on the system, the energy and momentum will be conserved. However, the total angular momentum may not be conserved because the torque may not be zero.

[9] The work done by non conservative force is dependent on the path taken by the particle in reaching final position from initial position. Non conservative force depends on the distance travelled by the particle

SetId=21

[10] A particle moves on a circular path. Then under suitable conditions its speed may remain constant, but the force, velocity and acceleration must always change with time.

[11] Distance is equal to the length of the path covered. Displacement is the shortest distance between initial and final points.

[12] A particle is observed from two frames S_1 and S_2. The frame S_2 moves with respect to S_1 with an acceleration a. If F_1 and F_2 be the pseudoforces when seen from S_1 and S_2 respectively it is not possible to have $F_1 = F_2 = 0$

[13] A ball hits the floor and rebounds after an inelastic collision. In this case the total momentum of the ball before and after the collsion is conserved. Also the total enrgy of the ball and the earth remains the same

[14] The total work done on a particle is always equal to the change in kinetic energy. SetId=21

[15] Newton's laws are not valid on non-inertial frame of reference. So to validate Newton's laws of motion pseudo force (fictious or virtual force) is introduced.
Pseudo force acts in non-inertial frame. Its magnitude is always mass of the body multiplied by acceleration of the frame. It is always in direction opposite to the acceleration of the frame of reference. The resultant of pseudo forces and real forces is always zero.

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SetId=22

[1] Displacement is equal to the vector difference $\vec{r}_f - \vec{r}_i$ of the position vectors of initial and final points. The distance covered will be $|\vec{r}_f - \vec{r}_i|$

[2] The law of conservation of angular momentum states that when no external torque is applied on an object or a closed system of objects about an axis, the angular momentum about that axis remains constant.

[3] The conservation of angular momentum of a system of bodies requires that the the sum of torque due to all forces be equal to zero. Now consider a situation where the forces are such that the sum of torques of external forces is zero w.r.t. some axes K. Since the value of torque depends of the choices of axes, the sum of torques due to all internal forces will depend on the choice of axes and in general it will be non zero. Therefore, for a system of several bodies, for a given choice of axes K, there will be situations when the total angular momentum may not be conserved.

[4] For the motion of earth around sun, the sum of angular momenta of the Sun and the Earth about the center of mass of the sun + earth system is conserved.

[5] Only the z component of angular momentum of a conical pendulum is conserved w.r.t. the origin fixed at the point of suspension. SetId=22

[6] In the example of a rotating skew rod the torque due to the external gravitational forces is zero , but the angular momentum is not constant Therefore the law of conservation of angular momentum is violated.

[7] A tennis ball is dropped from height h and after hitting the ground and it bounces back and rises to the same height. In this case the momentum of the ball is conserved because (under ideal conditions) the momentum after it hits the ground will be equal to the momentum it had before hitting the ground.

[8] In order to apply the law of conservation of momentum we must first identify the system. If there is no *net external forces* acting on the system then conservation laws of momentum always holds. The total energy and the total angular momentum may not be conserved.

[9] Nonconservative forces are those forces in which the work done in moving a particle is dependant on the path taken to cover the distance. Some energy woul be lost to the environment in the form of heat, sound, etc. The energy in the final state is less than that in the initial state.

SetId=22

[10] A particle moves on a circular path. Then under suitable conditions its speed and acceleration may remain constant, but the force, and velocity must always change with time.

[11] Distance is a scalar quantity where as the displacement is a vector quantity.

[12] A particle is observed from two frames S_1 and S_2. The frame S_2 moves with respect to S_1 with an acceleration a. If F_1 and F_2 be the pseudoforces when seen from S_1 and S_2 respectively and if $F_1 = 0$ then we must have $F_2 \neq 0$

[13] In a head on elastic collision of two identical bodies of equal masses the velocities, the speeds, the momenta and the kinetic energy are all exchanged.

[14] A particle is acted upon by a force of constant magnitude which is always perpendicular to the velocity of the particle and the motion of the particle takes place in a plane, Then its kinetic energy, speed, velocity acceleration will not change. SetId=22

[15] These forces are non-real forces but must be taken into account while applying Newton's Law's of Motion in accelerating frame of reference as compared to an inertial frame of reference.

The centrifugal and centripetal forces are examples of pesudo-forces.

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SetId=23

[1] Distance is equal to the length of the path covered. Displacement is the shortest distance between initial and final points.

[2] The angular momentum of a given system of bodies shall remain conserved unless acted upon by an external unbalanced torque.

[3] Example where law of conservation of angular momentum does not hold:
When there is external force like frictional force acting on a object when it is rotating we cannot use conservation of angular momentum as the friction force acting on the object produces an external torque.

[4] For the motion of the Earth around the sun, the total of angular momenta of the Earth and the Sun, about in a reference frame fixed in the pole star, is conserved.

[5] The projection of angular momentum of a conical pendulum in the horizontal plane is a constant of motion when the origin is chosen to be at fixed at the point of suspension. SetId=23

[6] In the example of skew rod, the angular momentum changes with time and there is a non zero torque coming from action of forces other than gravitational forces. Hence the law of conservation of angular momentum dos not apply.

[7] Law of conservation of momentum does not hold when Newton's laws are not valid, e.g. in a non-inertial frame of reference. For example, when we consider collision between two bodies in a non-inertial frame of reference, the law of conservation of momentum cannot be applied because there will be a pseudo force acting on the frame itself.

[8] In order to apply the law of conservation of momentum we must first identify the system. Then even if there is no *net external forces* acting on the system, all the three conservation laws of momentum, angular momentum and energy may not hold due to presence of internal forces.

SetId=23

[9] The work done by such forces depends on the path taken. The work done cannot be represented as a potential energy function.Work done by such forces is always negative.

[10] When the force is kept constant as function of time, it is possible for a particle to move on a circular path in such a way that its speed remains constant, but the velocity and acceleration must always change with time.

[11] Both displacement and distance tell us about the motion of a body but their study does not tell much about the forces on the body

[12] If K is an inertial frame, any frame that moves w.r.t. the frame K with uniform velocity is also an inertial frame.

[13] For a system of several particles the conservation of total linear momentum is equivalent to the statement that their centre of mass moves like a free particle.

[14] The kinetic energy of a particle is continuously increasing with time, then the angle bewteen the net force and the velocity cannot be greater than or equal to 90^o at any time. SetId=23

[15] When observing our system from a reference frame which is accelerating compared to an inertial frame,in order to make it easier to apply newtons laws, we can apply a pseudo force on all objects in the universe proportional to their mass capable of causing an acceleration equal and opposite to that of our reference frame. Hence serving to in a way "stop"(or make inertial) our reference frame, and making it easier for us to investigate the motion.

This application of pseudo force doesn't change the motion of the object because just as we can choose an arbitrary reference frame, we can choose an arbitrary force to cause the same acceleration in every object in the whole universe without changing the relative motions of objects. (as all motion is truly relative, we will still get correct answers for our investigations.

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SetId=24

[1] Distance is a scalar quantity where as the displacement is a vector quantity.

[2] When the net external torque acting on a system about a given axis is zero, the total angular momentum of the system about that axis remains consant.

[3] A bob attached to a ceiling by a string moving in a horizontal circular plane is an example where the total angular momentum of the bob about the point of suspension is not conserved. This is because the the torque due to the weight of the bob about the point of suspension does not vanish and has non zero horizontal component. Only the vertical component of the angular component is conserved.

[4] For the motion of the Earth around the sun, the total of angular momenta of the Earth and the Sun, is conserved in every inertial frame of reference; but the angular momentum of the Earth (or of the sun)is not conserved in every inertial frame.

[5] The law of angular momentum of a is not applicable for the conical pendulum conserved w.r.t. the origin fixed at the point of suspension. SetId=24

[6] In the example of conical pendulum, the z- component of angular momentum does not change. This follows from the angular momentum conservation as there is no external torque.

[7] If I throw a ball upward, it's speed decreases as it rises upwards. There is an external force (gravity) acting on the ball, so the momentum conservation law does not apply. Momentum of the ball is not conserved, however the momentum of the Earth-ball system is conserved as gravity will become an internal force in this case.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then check we should if the laws are applicable or not.

So if there is no *external force* acting on the system all the three quantities, total momentum, total angular momentum, and total kinetic energy will be conserved independent of the nature of forces.

[9] A nonconservative force is a force with the property that the work done in moving a particle depends on the path taken.Also, the net work done in a closed loop is non
SetId=24 zero.

[10] It is not possible for a particle to move on a circular path in such a way that its speed and force remains constant, and only the velocity and acceleration may (or may not) always change with time.

[11] Displacement is the shortest distance between initial and final points with direction specified.

[12] If K is an inertial frame, any frame that moves w.r.t. the frame K with uniform speed is also an inertial frame.

[13] The total mechanical energy of a system may not be conserved if there are no external forces and the internal forces are conservative.

[14] A heavy body is attached from a spring and is held at point A and is such that the spring is not slack nor is it stretched. It is then released. It goes down upto a point B and then it rises upto point C and executes an oscillatory motion between B and C. During the motion from A to C is first positive (from A to B) and then it is negative from B to A and again remains negative from A to C. SetId=24

[15] Various types of forces in nature can be grouped in four categories:
(a)Gravitational; (b)Electromagnetic; (c)Nuclear; (d)Weak
There are also some non-fundamental forces such as:
(i)Normal reaction on bodies in contact with surfaces , (ii) Friction,(iii) Tension,(iv)Elastic force.

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SetId=25

[1] The speed is rate of change of distance and the velocity is the rate of change of displacement.

[2] This law sates that when no net torque of all forces acts on a object or a system of objects then total angular momentum of system is conserved.The angular momentum before an event is equal to angular momentum after that event.mathematically explained by when, net torque=0 ;then, total angular momentum(L)=constant.

[3] Law of conservation of angular momentum holds in case of long jump. When a athlete takes off from the ground in a running long jump, the forces on the launching foot give the athlete an angular momentum with a forward rotation around a horizontal axis. Such rotation would not allow the jumper to land properly. In the landing, the legs should be together and extended forward at an angle so that the heels mark the sand at the greatest distance. Once airborne, the angular momentum cannot change (it is conserved) because no external torque acts to change it. However, the jumper can shift most of the angular momentum to the arms by rotating them in windmill fashion. Then the body remains upright in the proper orientation of landing.

[4] In the Sun Earth system the angular momentum of the Earth is conserved in every frame of reference

[5] The law of angular momentum of a is not applicable for the conical pendulum conserved when the origin is chosen to be at the pendulum bob itself. SetId=25

[6] In the example of conical pendulum, the x and$y$ components of angular momentum change. This follows from the angular momentum conservation as the z components external torque is zero and horizontal components of torque are non zero.

[7] A soldier accelerating away, after detonating a bomb, will find that the total momentum of the fragments of the bomb is zero. This is an example where the law of conservation of momentum holds as the forces on the fragments are internal forces only and sum of all such forces is zero.

[8] If we want to apply the conservation laws of momentum, energy and angular momentum, we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *external force* acting on the system, the momentum and angular momentum will be conserved, and depending on the nature of the forces but total energy may or may not be conserved.

[9] A force whose work done is a path function is called a non-conservative force. All the forces which do not satisfy the definition of conservative forces are non-conservative

in nature. The work done by these forces dissipates into heat energy, sound energy, light energy, etc. Therefore, law of conservation of mechanical energy cannot be applied to a system on which a non-conservative force is acting. No potential function can be defined for these forces.

SetId=25

[10] For a particle moving on circle the acceleration is always constant in magnitude and directed towards the centre of the circle.

[11] Displacements, being vector quantity can not compared with, a scalar quantity such as distance.

[12] A frame rotating w.r.t K with uniform angular velocity is also an inertial frame.

[13] When a bullet fired on a wooden block, some energy is transferred to the block and the total mechanical energy of the block and the bullet is conserved.

[14] The kinetic energy of a body does not change if any one of the following is true
(i)force is always perpendicular to the velocity
(ii) the force is always perpendicular to the acceleration
(iii) the object remains stationary
(iv) the object moves in such a way that the point of application of the force remains fixed. SetId=25

[15] A force is agency that which changes or tends to change the state of rest or motion of a body.

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SetId=26

[1] For any type of translational motion of a body, the displacement cannot be zero, where as the distance travelled can be zero.

[2] Statement of Law of Conservation of Angular Momentum:
Differentiating $\vec{L} = \vec{r} \times \vec{p}$ w.r.t, time,

$$\begin{aligned} \frac{dL}{dt} &= \frac{d\vec{r} \times \vec{p}}{dt} = \frac{d\vec{r}}{dt} \times \vec{p} + \vec{r} \times \frac{d\vec{p}}{dt} = \vec{v} \times (m\vec{v}) + \vec{r} \times \vec{F} \\ &= \vec{r} \times \vec{F}(\because v \times v = 0) \\ &= \vec{\tau} \end{aligned}$$

here $\vec{\tau}$ represents the net torque acting on a rigid body rotating about a fixed axis.This torque must take into account of all the forces, be it external or internal forces

[3] The total angular momentum of a body remains constant of motion when the net torque of the external forces acting on the body is zero.
In general, we have a system of particles such that the net torque of the external forces on the system, w.r.t. some axes K, is zero, the total angular momentum may not remain conserved, because the torque due to the internal forces may not be zero.

[4] In the motion of earth around sun, the angular momentum of the earth about an axis passing through the sun and perpendicular to the plane of motion of earth is conserved.

[5] The three components of angular momentum of a conical pendulum is conserved w.r.t. the origin at the position of the center of mass of the pendulum. SetId=26

[6] Example where law of conservation of angular momentum does not hold: A disc rotating on a horizontal rough surface will not have a constant angular momentum because there will be a constant torque by frictional force. Hence, its angular momentum will decrease, and the law of conservation of angular momentum does not apply.

[7] There is no known exception to the law of conservation of momentum in classical mechanics However, an exception to conservation of energy in nuclear physics is observed. In nuclear reactions when two nuclei collide and their mass converts to energy and energy momentum are not conserved.

[8] To apply the conservation laws of momentum, energy and angular momentum, we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *external force* acting on the system, the energy and momentum will be conserved. However, depending on the nature of the system and of the forces, the total angular momentum may not be conserved.

[9] *Non conservative forces* are the type of forces in which the work done by the forces is purely dependent on the path taken by the body.Thus the net work done by the forces in cyclic path is never equal to zero.

SetId=26

[10] The motion of a bomb dropped from a plane does is not a uniform motion as it follows a parabolic path and not a straight line path.

[11] Distance depends on the path where as the displacement depends on the end point only

[12] The Newton's Laws of motion will hold in all frames which are at rest w.r.t. K but do not remain valid in a frame that move with respect to K.

[13] When a moving car hits a parked lorry and causes the parked lorry to move ,energy is transferred from moving the car to the lorry and the total energy of the lorry and the car is conserved.

[14] The total work done on a particle is always equal to the change in kinetic energy. SetId=26

[15] The forces may be of the following two types - *Contact forces* (those that act when bodies are in physical contact) eg. friction, normal reaction, bouyancy etc. and*Action-at-a-distance forces* (those that act when bodies are not in contact) eg. Gravity, electostatic forces, magnetic forces etc. There At the root level, forces are of the following fundamental types :- (a) *Gravitational forces* - weakest of all forces, always attractive
(b) *Electromagnetic forces* - stronger than gravitational forces, can be attractive or repulsive,
(c) *Nuclear forces* - exist at atomic level, have very short range,
(d) *Weak nuclear forces* associated with beta particle emission

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[1] Displacements, being vector quantity can not compared with, a scalar quantity such as distance.

[2] Statement of Law of Conservation of Angular Momentum: For a system of many particles The net torque due all the forces, be it external or internal forces. But as the torque due to all the internal forces cancel out, it sufficient to consider the external forces acting on the system.

[3] An example where law of conservation of angular momentum holds:
The Law of conservation of angular momentum holds in the case of a ballet dancer performing a pirouette.

When the dancer extends her arms outward, the angular velocity of her rotation decreases whereas when she keeps her arms close to her body, the angular velocity increases. This is because her moment of inertia changes as she moves her arms outward and inward. It can be noted that she as a system has no external torque acting upon her.

[4] For the motion of earth around sun, the angular momentum of the earth about the center of mass of the sun + earth system and perpendicular to the plane of motion of earth is conserved.

[5] Only the z component of the angular momentum of a conical pendulum is conserved w.r.t. the origin fixed at the point of suspension. SetId=27

[6] Example where law of conservation of angular momentum does not hold:Consider a vertical stick on the ground falling to a horizontal position. During the fall, the conservation of angular momentum applied at the point of rotation on the ground and perpendicular to the plane of the stick is not applicable as, the gravitational force which acts vertically downwards assumed at the centre of mass produces an external torque about the axis of rotation

[7] In a system of a canon and a canon ball, total momentum of the system is zero before canon ball is fired. After firing the canon ball, the momentum of the system seems to be conserved as the ball moves forward and the canon moves backward.

[8] In order to apply the law of conservation of momentum we must first identify the system. If there is no *external forces* acting on the system then conservation laws of momentum always holds. And depending on the nature of the system and of the forces, the total kinetic energy and the total angular momentum may not be conserved.

[9] Non-conservative forces are path-dependent forces, i.e. the work done on a body by these forces depends on the path taken by the body. Mechanical energy of a

system is not conserved when a conservative force acts on it but the total energy is conserved. Therefore, the mechanical energy lost by the system is liberated in some other form such as light energy, heat energy, etc.

For example, when a body is moving along a surface, frictional force acts on the body as well. Due to this frictional force, the body loses its mechanical energy, and this loss is generally released in the form of heat energy to the surroundings. Thus, the mechanical energy will not be conserved and frictional force can be classified as

SetId=27 a non-conservative force.

[10] A wagon sliding on a roller coaster designed in such a way that the wagon covers equal distances in equal times. As the motion of the wagon is uniform, there will be no net force acting on it.

[11] Distance equal to zero $\Rightarrow$ displacement=0; but Displacement=0

[12] Staying inside a bullet train moving with constant velocity (no jerks etc) an experiment can always be performed which will tell us the numerical velocity of the bullet train

[13] When a bomb explodes the total mechanical energy is not conserved. But the total chemical energy and the mechanical energy is conserved.

[14] A particle is acted upon by a force of constant magnitude which is always perpendicular to the velocity of the particle and the motion of the particle takes place in a plane, Then its kinetic energy, speed, velocity acceleration will not change. SetId=27

[15] The main differences between force and pseudo force are -
(1) Forces have a real presence while pseudo forces don't.
(2) Forces can be accounted for by Newton's laws.
(3) Pseudo forces are only taken into account when the reference frame is accelerated.

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[1] Distance depends on the path where as the displacement depends on the end point only.

[2] Depending on the torques acting on a system, the angular momentum can be conserved only in one or two directions, but may not be conserved in all. For instance, if an isolated body has no torque acting on it only in the direction along the Z axis, then the angular momentum is conserved only in that direction.

[3] In case of a skater, who can be considered an isolated system, so no torue will be acting on him/her. When the arms are extended, the moment of inertia is more. When his hands are closely held, the moment of inertia is lesser. Since the angular momentum is same, the angular acceleration changes accordingly.

[4] In the Sun Earth system the angular momentum of the Earth about the pole star is conserved

[5] The z component of angular momentum of a conical pendulum is not conserved w.r.t. the origin fixed at the point of suspension; but the x and y components are conserved. SetId=28

[6] We have a conical pendulum .The forces acting on the bob are tension (along the direction of the string) and gravitational force acting in the vertically downward direction.we have an additional force called the drag force which is tangential to the motion of the bob and acts in the direction opposite to the motion of the bob.The axis of rotation passes through the hinge point and is vertical.The torque due to tension is 0 because the force passes through the axis of rotation.The torque due to mg is also zero since it is parallel to the axis of rotation.but the torque due to drag force is not zero.since the net external torque acting on the bob is not zero,therefore the law of conservation of angular momentum does not hold here

[7] When applying the conservation laws of momentum, energy and angular momentum we must define the system first.Only then check if the laws is applicable or not.

As an example: when a ball is dropped from a height, it gains momentum down if we consider the ball as our system.This is because the force of gravity acts as an external force.

However, if we change our system and consider earth as a part of our system too, then the momentum remains conserved because the earth gains momentum up.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then check if the laws is applicable or not.

So if there is no *net external force* acting on the system all the three conservation laws will hold.

[9] It is a force for which the work done by that force on an object or a particle in moving it between any two points depends on its path travelled.This force doesn't conserves the mechanical energy.The work done by a non-conservative force on an object in moving it in a circular path is not equal to zero.

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[10] A simple pendulum moves along a circular arc and does not have constant speed and therefore its motion is not uniform.

[11] If P and Q are the initial and the final points of a path of a particle, displacement is a vector whose direction is along PQ and has magnitude is equal to the length of line PQ

[12] Staying inside a bullet train moving with constant velocity (no jerks etc) an experiment can always be performed which will tell us the numerical value of the acceleration of the bullet train

[13] When a ball rolls over a rough surface, it comes to stop after some time. This is because transational and rotational kinetic energy initially present in the ball continuosly gets converted to heat due to friction. When all the kinetic energy changes to heat, the ball stops. The total mechanical energy of the ball is not conserved.

[14] The kinetic energy of a particle is continuously increasing with time, then the angle bewteen the net force and the velocity cannot be greater than or equal to 90° at any time.

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[15] A force is any interaction which tends to change the motion of an object. It is also *defined* as rate of change of momentum. It is a vector quantity.

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[1] Distance equal to zero implies displacement=0; and Displacement=0 also implies distance = 0

[2] According to Law of Conservation of Angular momentum,if no external torque acts on an object or system of objects,angular momentum of an object or system of objects remains CONSTANT or no change in angular momentum can occur.

Also it states that,only external torque can change angular momentm of the system where as the torque produced by internal forces can not change the angular momentum of the system

[3] Example where law of conservation of angular momentum holds:
Let us assume a student seated on a stool that can rotate freely about a vertical axis. The student has been set into rotation at a modest initial angular speed ω . He holds two dumbbells in his outstretched hands. His angular momentum vector L lies along the vertical rotation axis, pointing upwards. Now he pulls in his arms;this action reduces his rotational inertia from its value I_{initial} to a final value I_{final} because he moves the mass closer to the rotational axis. His rate of rotation increases markedly, from ω_{initial} to ω_{final}. The student can then slow down by extending his arms once more,moving the dumbbells outward. No external torque acts on the system consisting of the student, stool and the dumbbells. Thus the angular momentum of the system about the rotational axis remains constant. $I_{\text{initial}} * \omega_{\text{initial}} = I_{\text{final}} * \omega_{\text{final}}$.

[4] For the motion of earth around sun, the angular momentum of the sun about the center of mass of the sun + earth system and perpendicular to the orbital plane of earth is conserved.

For the motion of earth around sun, the angular momentum of the sun about and axis passing through the Earth and perpendicular to the orbital plane of motion of earth is conserved.

[5] Only the z component of angular momentum of a conical pendulum is conserved w.r.t. the origin fixed at the point of suspension. SetId=29

[6] When you release a toy gyroscope on its pedestal, it initially has no precessional rotation around that pedestal, i.e, the orientation of rotation is fixed. However, it instantaneously starts precessing around the pedestal. Both Kinetic Energy and Angular Momentum now exist where they did not exist a moment earlier. The Kinetic Energy is easy to explain, as appearing due to the body of the gyroscope dropping a tiny fraction of a millimeter in the Earth's gravitational field, giving up exactly the correct amount of Potential Energy. But the Angular Momentum of the Precession which just appeared, does not come from anywhere. This is therefore a Violation of the Conservation of Angular Momentum.

[7] Statement: Law of Conservation of energy states that "ENERGY CAN NEITHER BE CREATED NOR DESTROYED",but it can be changed from one form to other.

EXPLANATION: Statement implies that the total amount of energy in an isolated system remains constant although it may change forms. viz, kinetic energy may change to potential;chemical to electrical energies etc.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then check we should if the laws are applicable or not.

So if there is no *external force* acting on the system all the three quantities, total momentum is conserved. The total angular momentum is also because the torque of internal forces will be zero. The conservation of energy depends on the nature of forces. will be conserved.

[9] Explain Nonconservative force: This force is just opposite to that of conservative force. The work done by this force depends on the path taken by the particle on which the force is applied.This force does not conserve mechanical energy.If a particle travels in a closed loop, the net work done by a non consevative force is non zero.

SetId=29

[10] A satellite goes around the earth in a circular orbit of 600km with a time period of $5.8 \times 10^3 s$. Its motion will be uniform as it will cover equal distances in equal times.

[11] If P and Q are the initial and the final points of a path of a particle,the displacement is the vector $\overrightarrow{PQ}$.

[12] Assume bullet train, moving with out any jerks, is going on a circular arc of radius R with constant speed. Then an experiment is to be performed entirely within the train without any measurement on objects outside the train. Such an experiment can tell only radius of the track.

[13] Let us consider that a pendulum is oscillating moving in a vertical plane. Mean while let another bob which is attached to a spring and is executing a simple harmonic motion in horizontal direction comes and hits the pendulum. Here conservation of momentum does not hold good as tension(external force) is acting on the system.(pendulum)

[14] A heavy body is attached from a spring and is held at point A and is such that the spring is not slack nor is it stretched. It is then released. It goes down upto a point B and then it rises upto point C and executes an oscillatory motion between B and C. During the motion from A to C is first positive (from A to B) and then it is negative from B to A and again remains negative from A to C. SetId=29

[15] Explain Pseudo Force: While applying Newton's laws of motion in non-inertial frame of reference it gives answers which contradict observations. Thus, to account for this,using Newton's Laws, we introduce a "fake" or pseudo force which gives answers that match the observations in a non-inertial frame.

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SetId=30

[1] If P and Q are the initial and the final points of a path of a particle, displacement is a vector whose direction is along PQ and has magnitude is equal to the length of line PQ

[2] The law of conservation of angular momentum states that when the net external torque acting on the system is zero, then the angular momentum of the system remains constant.both the initial and final momentum should be taken from a fixed inertial frame of reference provided.

[3] A bob is attached to ceiling by a string and moves in a horizontal circular plane is an example. In this case the law of conservation of angular momentum does not hold.

[4] For the motion of earth around sun, the sum of angular momenta of the Sun and the Earth about the center of mass of the sun + earth system is conserved.

[5] The projection of angular momentum of a conical pendulum in the horizontal plane is a constant of motion when the origin is chosen to be at fixed at the point of suspension.

SetId=30

[6] There is no case where LAW OF CONSERVATION OF ANGULAR MOMENTUM does'nt hold.But there are cases where conservation of angular momentum does not hold.A body in vertical circular motion is an example where angular momentum is not conserved. Here the law of conservation does not apply.

[7] Oscillating simple pendulum is a very good example where potential energy gets converted to kinetic energy and kinetic to potential energy. Some energy gets dissipated as heat if we consider air resistance. Energy as a whole is conserved if we consider universe as system, the energy has just changed its form.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *net external force* acting on the system, the momentum is conserved. The definition of angular momentum and torque depends on the choice of axes, and therefore it may not be be conserved. The conservation of total energy holds only for conservative forces.

When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *net external force* acting on the system, the energy and momentum will be conserved. However, the total angular momentum may not be conserved because the torque may not be zero.

[9] Non conservative force is the force in which the work done by a particle in going from one point to another is path dependent.

For non conservative forces mechanical energy is not conserved,mostly lost in the form of heat and light.The work done by a non conservative force is equal to the change in mechanical energy.

SetId=30 For non conservative force $E_{\text{initial}} > E_{\text{final}}$

[10] A uniform motion is defined to be the one in which a body covers equal distances in equal time intervals.

[11] If two bodies starting from a point A reach a point B, following different paths, their displacement will be, in general different, but the distances covered will always be the same.

[12] Assume bullet train, moving with out any jerks, is going on a circular arc of radius R with constant speed. Then an experiment is to be performed entirely within the train without any measurement on objects outside the train. Such an experiment can tell both speed of the train and radius of the track.

[13] The law of conservation of momentum does not hold in relativistic situations, i.e., where the speeds of the masses involved are close to the speed of light.

[14] The kinetic energy of a body does not change if any one of the following is true
(i)force is always perpendicular to the velocity
(ii) the force is always perpendicular to the acceleration
(iii) the object remains stationary
(iv) the object moves in such a way that the point of application of the force remains fixed. SetId=30

[15] When a train is at rest and a ball is hung from the ceiling with a string, an observer in the train sees that the string is vertical. But when the train starts moving, the observer sees that the string makes an angle with the vertical and is tilted in forward direction . This means that some force other than gravity and tension must act on the ball. That force is the pseudo force.

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[1] If P and Q are the initial and the final points of a path of a particle,the displacement is the vector $\overrightarrow{PQ}$.

SetId=31

[2] The law of conservation of angular momentum states that The total angular momentum of a system is constant in both magnitude and direction if the resultant torque, of the external forces acting on the system, is zero.

[3] Consider a disc rotating about an axis perpendicular to its plane. On placing a smaller disc with its surface parallel to the surface of the rotating disc, the angular momentum of the system of two discs remains constant as there is no external torque.

[4] For the motion of the Earth around the sun, the total of angular momenta of the Earth and the Sun, about in a reference frame fixed in the pole star, is conserved.

[5] The law of angular momentum of a is not applicable for the conical pendulum conserved w.r.t. the origin fixed at the point of suspension. SetId=31

[6] A sphere rolling on a rough surface.Due to friction there is external torque so the angular momentum changes which results in the slowing of the sphere. The angular momentum keeps changing. Even in case like this one, it is wrong to say that the Law of Angular Momentum Conservation does not hold.

[7] Law of conservation of momentum does not hold whenever an external force or impulse acts on the system. For example,when a body collides with earth then it bounces back to a lesser height as it loses some velocity.

In this example the momentum of a ball is not conserved due to impulsive force by ground in the normal direction.

However, strictly speaking the system that should be considered here is the ball-earth system and the total momentum is conserved.

[8] In order to apply the law of conservation of momentum we must first identify the system. If there is no *net external forces* acting on the system then conservation laws of momentum always holds. The total energy and the total angular momentum may not be conserved.

[9] A force is said to be non-conservative, if the work done by the force is dependent on the path taken. It could also be defined as a force for which the work done during a cyclic process is non-zero.

SetId=31

[10] A particle moves on a circular path. Then its speed, direction of force, velocity and acceleration must always change with time.

[11] Distance is equal to the length of the path covered. Displacement is the shortest distance between initial and final points.

[12] Assume bullet train, moving with out any jerks, is going on a circular arc of radius R with constant speed. Then an experiment is to be performed entirely within the train without any measurement on objects outside the train. Such an experiment can tell only speed of the track.

[13] when we are in accelerating frame if we observe any collision between two bodies then the law of conservation of momentum does not hold in that frame of reference.

[14] The total work done on a particle is always equal to the change in kinetic energy. $\boxed{\text{SetId=31}}$

[15] Since newton's laws are not valid in non-inertial frames, pseudoforces (which do not exist in reality) are used to help us formualate and use Newton's laws of motion in non-inertial frames.

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[1] If two bodies starting from a point A reach a point B, following different paths, their displacement will be, in general different, but the distances covered will always be the same.

SetId=32

[2] If the net external torque acting on a system is zero,the angular momentum L(vector) of the system remains constant,no matter what changes take place within the system.L(vector)=a constant (net external torque acting on system is zero)

[3] Consider a man standing on a spinning platform. Initially, the man spreads out his arms and he spins with a certain angular velocity. The next moment, he pulls his arms inwards keeping them close to his body. We will observe that the angular velocity with which he is spinning now increases. This phenomenon can be explained by the Law Of Conservation of Angular momentum. Initially, since his arms were spread wide, his moment of inertia was large. However, when he pulled them close to his body, his moment of inertia decreased.
In this example the angular velocity of the man increases and therefore the angular momentum also increases.The law of conservation of angular momentum does not apply because the torque of muscular forces is not zero.

[4] For the motion of the Earth around the sun, the total of angular momenta of the Earth and the Sun, is conserved in every inertial frame of reference; but the angular momentum of the Earth (or of the sun)is not conserved in every inertial frame.

[5] The law of angular momentum of a is not applicable for the conical pendulum conserved when the origin is chosen to be at the pendulum bob itself. SetId=32

[6] Consider a rod of length l. Let us give an impulse to one end . Now the angular momentum about the oposite end is not zero since the impulse provides some torque . So the angular momentum is not conserved .

$$\text{torque} = \text{impulse} * \ell.$$

$d\ell/dt$ is not equal to zero and the law of conservation of angular momentum does not hold.

[7] If a bullet hits a wooden board and gets embedded in the board, the total energy and the total momentum of the bullet and the board are conserved.

[8] In order to apply the law of conservation of momentum we must first identify the system. Then even if there is no *net external forces* acting on the system, all the three conservation laws of momentum, angular momentum and energy may not hold due to presence of internal forces.

[9] a force is said to be non conservative if work done is dependent on the path of the particle.potential cannot be defined in the case of non conservative forces.work done in closed loop is not equal to zero.

SetId=32

[10] A particle moves on a circular path. Then its speed, direction offorce, can remain constant by velocity and acceleration must always change with time.

[11] Distance is a scalar quantity where as the displacement is a vector quantity.

[12] A particle is observed from two frames S_1 and S_2. The frame S_2 moves with respect to S_1 with an acceleration a. If F_1 and F_2 be the pseudoforces when seen from S_1 and S_2 respectively it is not possible to have $F_1 = F_2 = 0$

[13] Give an example where law of conservation of momentum does not hold all cases when seen from non inertial frame of references for example when we see two cars collide from a moving bus there momentum is not conserved

[14] A particle is acted upon by a force of constant magnitude which is always perpendicular to the velocity of the particle and the motion of the particle takes place in a plane, Then its kinetic energy, speed, velocity acceleration will not change. SetId=32

[15] Force is defined as the rate of change of linear momentum. In other words it is the agency which changes or tends to change the (a) State of rest; (b)State of uniform motion (c) Direction of body's motion; (d) Shape of the body

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[1] Displacement is equal to the vector difference $\vec{r}_f - \vec{r}_i$ of the position vectors of initial and final points. The distance covered will be $|\vec{r}_f - \vec{r}_i|$

[2] The Law of conservation of angular momentum states that when no external torque acts on an object or a closed system of objects undergoing motion about a given axis, the change in angular momentum is zero. Therefore, considering an event where only internal torque or no torque is involved, the total angular momentum of the system before the event is equal to the total angular momentum after the event

[3] In the Sun-Earth system, angular momentum of the earth is not conserved but the total angular momentum of the sun and the earth is constant of motion.

[4] In the Sun Earth system the angular momentum of the Earth is conserved in every frame of reference

[5] The three components of angular momentum of a conical pendulum is conserved w.r.t. the origin at the position of the center of mass of the pendulum. SetId=33

[6] Let us consider a rotating skew rod. In the absence of friction or any other drag force, the rod should continuously spin without stopping. Here the net torque about the axis of rotation is 0 and hence angular momentum is conserved. It therefore follows from law of conservation of angular momentum that a spinning skew rod will keep rotating with constant angular velocity if there is no external torque. So law of conservation of angular momentum does not hold.

[7] If a bullet hits a wooden board and gets embedded in the board, the total energy of the bullet and the board system is conserved but the total momentum is not conserved.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then check we should if the laws are applicable or not.

So if there is no *external force* acting on the system all the three quantities, total momentum, total angular momentum, and total kinetic energy will be conserved independent of the nature of forces.

[9] Explain Nonconservative Forces:

The forces that depend on the path taken by the particle are called non-conservative forces.

Mechanical energy is not conserved during the action of a non conservative force, instead, it is lost as other forms of enery like heat, light, etc.

Potential energy is not defined for a non-conservative force.

The initial and final kinetic energy in a closed loop is not equal.

The work done by a non conservative force in a closed loop is non zero. In practice, the net work is invariably negative.

Work done by a non conservative force cannot be completely recovered.

For a non conservative force,

$/text(KE)//_f//+(\mathrm{PE})//_f// = (\mathrm{KE})_i+(\mathrm{PE})_i//+//\text{Work Done})//\text{non-conservative force}//$

SetId=33

[10] A particle moves on a circular path. Then under suitable conditions its speed may remain constant, but the force, velocity and acceleration must always change with time.

[11] Both displacement and distance tell us about the motion of a body but their study does not tell much about the forces on the body

[12] A particle is observed from two frames S_1 and S_2. The frame S_2 moves with respect to S_1 with an acceleration a. If F_1 and F_2 be the pseudoforces when seen from S_1 and S_2 respectively and if $F_1 = 0$ then we must have $F_2 \neq 0$

[13] When a tennis ball hits the ground at an oblique angle, the angle of reflection is equal to the angle of incidence. This is a simple consequence of conservation of horizontal component of momentum.

[14] The kinetic energy of a particle is continuously increasing with time, then the angle bewteen the net force and the velocity cannot be greater than or equal to 90^{o} at any time. SetId=33

[15] Real forces have their origin in matter such as electricity, gravitation etc., while pseudo forces are caused by inertial motion.

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[1] Distance is equal to the length of the path covered. Displacement is the shortest distance between initial and final points.

[2] The law of conservation of angular momentum states that when no external torque acts on an object or a closed system of objects, no change of angular momentum can occur. Hence, the angular momentum before an event involving only internal torques or no torques is equal to the angular momentum after the event . Angular momentum can be calculated with the help of the formula $L = I\omega$ where L stands for Angular momentum, I stands for moment of inertia and ω stands for angular velocity

[3] Consider a disc and a man system. man is standing on center of the disc rotating with angular velocity.initially man folded his hand.when man stretches his hands then momentum of inertia of system increases.and angular velocity decreases.and total angular momentum remains constant.

[4] In the motion of earth around sun, the angular momentum of the earth about an axis passing through the sun and perpendicular to the plane of motion of earth is conserved.

[5] Only the z component of the angular momentum of a conical pendulum is conserved w.r.t. the origin fixed at the point of suspension. SetId=34

[6] In the example of skew rod the angular velocity does not change even though the torque applied is nonzero. However there is no contradiction as in this case the law of conservation of momentum is not applicable. conservation is violated.

[7] If a bullet hits a wooden board and gets embedded in the board, both total energy and the total momentum of the bullet and the board are not conserved.

[8] If we want to apply the conservation laws of momentum, energy and angular momentum, we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *external force* acting on the system, the momentum and angular momentum will be conserved, and depending on the nature of the forces but total energy may or may not be conserved.

[9] A non conservative force is one where the mechanical energy is not conserved.Here the work done is dependent on the path taken .Different amounts of work need to be done in different paths.Here potential energy would have no meaning as it would keep changing with the path.Here some amount of mechanical energy is lost as sound energy or heat energy and hence is not conserved.

SetId=34

[10] A particle moves on a circular path. Then under suitable conditions its speed and acceleration may remain constant, but the force, and velocity must always change with time.

[11] Displacement is the shortest distance between initial and final points with direction specified.

[12] If K is an inertial frame, any frame that moves w.r.t. the frame K with uniform velocity is also an inertial frame.

[13] when a ball is dropped from a height, it gains momentum down if we consider the ball as our system.This is because the force of gravity acts as an external force.

However, if we change our system and consider earth as a part of our system too, then the momentum remains conserved because the earth gains momentum up.

[14] A heavy body is attached from a spring and is held at point A and is such that the spring is not slack nor is it stretched. It is then released. It goes down upto a point B and then it rises upto point C and executes an oscillatory motion between B and C. During the motion from A to C is first positive (from A to B) and then it is negative from B to A and again remains negative from A to C. SetId=34

[15] 1)When we start rolling a body on a rough ground, it stops rolling after certain period because of frictional force.
2)When we leave a body from a certain height, it falls due to the act of gravitational force.

1)When a body is rotating in a circular path due to the centrifugal force which is the pseudo force. 2) When the lift is accelerating upwards, the upwards force felt by passengers a pseudo force.

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[1] Distance is a scalar quantity where as the displacement is a vector quantity.

[2] Newton's Second Law of Motion is defined by the expression $F = \frac{dp}{dT}$, where F gives the force vector acting on the system and p gives its momentum vector; in linear motion. A similar expression can be written to describe angular motion, i.e. : $\tau = \frac{dL}{dt}$, where τ is the external torque vector acting on the system, and L is the angular momentum.

If the external torque on the system is zero, then we get the expression as: dL/dt=0. This points out to the fact that, when no external torque is acting on the system, then its angular momentum is constant, no matter what changes occur in the system. This is the Law of Conservation Of Angular Momentum.

[3] The conservation of angular momentum of a system of bodies requires that the the sum of torque due to all forces be equal to zero. Now consider a situation where the forces are such that the sum of torques of external forces is zero w.r.t. some axes K. Since the value of torque depends of the choices of axes, the sum of torques due to all internal forces will depend on the choice of axes and in general it will be non zero. Therefore, for a system of several bodies, for a given choice of axes K, there will be situations when the total angular momentum may not be conserved.

[4] For the motion of earth around sun, the angular momentum of the earth about the center of mass of the sun + earth system and perpendicular to the plane of motion of earth is conserved.

[5] The z component of angular momentum of a conical pendulum is not conserved w.r.t. the origin fixed at the point of suspension; but the x and y components are conserved. SetId=35

[6] Example where law of conservation of angular momentum does not hold:If a particle undergoes conical motion and the only force acting on particle is central force like tension of the string.Then total external torque about fixed point A is zero,yet angular momentum is not conserved,as angular momentum keeps on changing direction.

[7] There are certain situations where it appears that the law of conservation of linear momentum does not hold. For example if we take some amount of a substance like construction putty, cement, cake batter, playing dough,etc and drop it on the ground, it does not bounce back like a rubber ball would and hence the momentum it had before striking the ground seems to have been lost. Hence it appears that the law of conservation of linear momentum does not hold.

[8] To apply the conservation laws of momentum, energy and angular momentum, we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *external force* acting on the system, the energy and momentum will be conserved. However, depending on the nature of the system and of the forces, the total angular momentum may not be conserved.

[9] The force whose work depends on path taken is called a non conservative force.friction for example does less work on a book dragged across a table if the book is dragged straight across than if the book is dragged in a curved path.

SetId=35

[10] When the force is kept constant as function of time, it is possible for a particle to move on a circular path in such a way that its speed remains constant, but the velocity and acceleration must always change with time.

[11] Displacements, being vector quantity can not compared with, a scalar quantity such as distance.

[12] If K is an inertial frame, any frame that moves w.r.t. the frame K with uniform speed is also an inertial frame.

[13] There is no known exception to the law of conservation of momentum in classical mechanics however when two bodies collide and their mass converts to energy, an exception in nuclear physics is observed. In real life this is observed in nuclear reactions at atomic level.

[14] The kinetic energy of a body does not change if any one of the following is true
(i)force is always perpendicular to the velocity
(ii) the force is always perpendicular to the acceleration
(iii) the object remains stationary
(iv) the object moves in such a way that the point of application of the force remains fixed. SetId=35

[15] Newton's first law defines inertial frame. An inertial frame is a frame in which the first law hold. It also makes it possible to compare and tell two force being equal or not. The second law defines the force.

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SetId=36

[1] The speed is rate of change of distance and the velocity is the rate of change of displacement.

[2] If the net external torque acting on a system is zero, the angular momentum L of the system remains constant, no matter what changes take place within the system.

$$\sum(T_{\text{ext}}) = \frac{dL}{dt}$$

The law states that when there is no net external torque, $\frac{dL}{dt}$ is zero implying that the total angular momentum of system is constant.

i.e. $L = a$ constant (isolated system)

[3] Example where law of conservation of angular momentum does not hold:
When there is external force like frictional force acting on a object when it is rotating we cannot use conservation of angular momentum as the friction force acting on the object produces an external torque.

[4] In the Sun Earth system the angular momentum of the Earth about the pole star is conserved

[5] Only the z component of angular momentum of a conical pendulum is conserved w.r.t. the origin fixed at the point of suspension. SetId=36

[6] A nonzero torque always causes the angular velocity to change, because a change in angular momentum means a change in angular velocity $L = I\omega$

[7] A tennis ball is dropped from height h and after hitting the ground and it bounces back and rises to the same height. In this case the momentum of the ball is conserved because (under ideal conditions) the momentum after it hits the ground will be equal to the momentum it had before hitting the ground.

[8] In order to apply the law of conservation of momentum we must first identify the system. If there is no *external forces* acting on the system then conservation laws of momentum always holds. And depending on the nature of the system and of the forces, the total kinetic energy and the total angular momentum may not be conserved.

SetId=36

[9] ** Nonconservative force is a force in which the amount of work done by the force is dependent of the path taken to change a state of a system.

[10] It is not possible for a particle to move on a circular path in such a way that its speed and force remains constant, and only the velocity and acceleration may (or may not) always change with time.

[11] Distance depends on the path where as the displacement depends on the end point only

[12] A frame rotating w.r.t K with uniform angular velocity is also an inertial frame.

[13] When there is no external forces act on a system of many particles, and there are only internal forces acting on the particles. The third law gives that the internal forces are pairwise equal and opposite.Thus the sum of internal forces is zero and the momentum of each particle is conserved.

[14] The total work done on a particle is always equal to the change in kinetic energy. SetId=36

[15] The magnitude of the pseudo force arising in a non-inertial frame is always equal to the mass of the body under consideration multiplied by the acceleration of the frame of reference and the direction of pseudoforce is always opposite to the direction of acceleration of the frame.

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SetId=37

[1] For any type of translational motion of a body, the displacement cannot be zero, where as the distance travelled can be zero.

[2] When the net external torque acting on a body or a system of bodies is zero about a particular axis, then the angular momentum of each body is conserved about that axis.

[3] A bob attached to a ceiling by a string moving in a horizontal circular plane is an example where the total angular momentum of the bob about the point of suspension is not conserved. This is because the the torque due to the weight of the bob about the point of suspension does not vanish and has non zero horizontal component. Only the vertical component of the angular component is conserved.

[4] For the motion of earth around sun, the angular momentum of the sun about the center of mass of the sun + earth system and perpendicular to the orbital plane of earth is conserved.

For the motion of earth around sun, the angular momentum of the sun about and axis passing through the Earth and perpendicular to the orbital plane of motion of earth is conserved.

[5] The projection of angular momentum of a conical pendulum in the horizontal plane is a constant of motion when the origin is chosen to be at fixed at the point of suspension. SetId=37

[6] A nonzero torque always implies change in angular momentum and may not give rise to a change in magnitude of angular velocity. A non zero torque may mean change only the direction of the angular momentum and not the angular velocity.

[7] Law of conservation of momentum does not hold when Newton's laws are not valid, e.g. in a non-inertial frame of reference. For example, when we consider collision between two bodies in a non-inertial frame of reference, the law of conservation of momentum cannot be applied because there will be a pseudo force acting on the frame itself.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then check if the laws is applicable or not.

So if there is no *net external force* acting on the system all the three conservation laws will hold.

[9] Nonconservative force is any force where the work done by the force on the object depends on the path of motion of the object.the work done by the frictional force results in to loss of the energy of the system in the form of heat or other form of energy.

SetId=37

[10] For a particle moving on circle the acceleration is always constant in magnitude and directed towards the centre of the circle.

[11] Distance equal to zero ⇒ displacement=0; but Displacement=0

[12] The Newton's Laws of motion will hold in all frames which are at rest w.r.t. K but do not remain valid in a frame that move with respect to K.

[13] During collision of billiard balls momentum is conserved. During explosion of a bomb also momentum is conserved and the total momentum of the fragments of bomb will be zero. This is because all the forces are only internal forces.

[14] A particle is acted upon by a force of constant magnitude which is always perpendicular to the velocity of the particle and the motion of the particle takes place in a plane, Then its kinetic energy, speed, velocity acceleration will not change. SetId=37

[15] A force is any interaction which tends to change the motion of an object. It is also *defined* as rate of change of momentum.It is a vector quantity.
A physically apparent but nonexistent force felt by an observer in a noninertial frame (that is, a frame undergoing acceleration).

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SetId=38

[1] Displacements, being vector quantity can not compared with, a scalar quantity such as distance.

[2] The law of conservation of angular momentum states that in absence of an external torque on an object or a closed system of objects the total angular momentum of the system remains constant. Thus if $\vec{\tau} = 0 => \vec{L} =$ constant where τ is the torque and $\vec{L}$ is the angular momentum of the system.

[3] Law of conservation of angular momentum holds in case of long jump. When a athlete takes off from the ground in a running long jump, the forces on the launching foot give the athlete an angular momentum with a forward rotation around a horizontal axis. Such rotation would not allow the jumper to land properly. In the landing, the legs should be together and extended forward at an angle so that the heels mark the sand at the greatest distance. Once airborne, the angular momentum cannot change (it is conserved) because no external torque acts to change it. However, the jumper can shift most of the angular momentum to the arms by rotating them in windmill fashion. Then the body remains upright in the proper orientation of landing.

[4] For the motion of earth around sun, the sum of angular momenta of the Sun and the Earth about the center of mass of the sun + earth system is conserved.

[5] The law of angular momentum of a is not applicable for the conical pendulum conserved w.r.t. the origin fixed at the point of suspension. SetId=38

[6] In the example of a rotating skew rod the torque due to the external gravitational forces is zero , but the angular momentum is not constant Therefore the law of conservation of angular momentum is violated.

[7] If I throw a ball upward, it's speed decreases as it rises upwards. There is an external force (gravity) acting on the ball, so the momentum conservation law does not apply. Momentum of the ball is not conserved, however the momentum of the Earth-ball system is conserved as gravity will become an internal force in this case.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then check we should if the laws are applicable or not.

So if there is no *external force* acting on the system all the three quantities, total momentum is conserved. The total angular momentum is also because the torque of internal forces will be zero. The conservation of energy depends on the nature of forces. will be conserved.

SetId=38

[9] nonconservative force is any force ,where the work done by the force depends on the path of motion of the body.The work done by such a force is equal to the change in mechanical energy of the system.Energy mostly observed to be lost in form of heat, by the action of non conservative force.

[10] The motion of a bomb dropped from a plane does is not a uniform motion as it follows a parabolic path and not a straight line path.

[11] If P and Q are the initial and the final points of a path of a particle, displacement is a vector whose direction is along PQ and has magnitude is equal to the length of line PQ

[12] Staying inside a bullet train moving with constant velocity (no jerks etc) an experiment can always be performed which will tell us the numerical velocity of the bullet train

[13] Give an example where law of conservation of momentum holds: A mass exploding into several pieces in a conservative field like gravitational field(if air resistance is neglected), obeys law of conservation of momentum. If air resistance cannot be neglected then the law of conservation of momentum will not hold.

[14] The kinetic energy of a particle is continuously increasing with time, then the angle bewteen the net force and the velocity cannot be greater than or equal to 90^o at any time. SetId=38

[15] Psuedo Force is defined as an apparent force that acts in only non-inertial frames. Pseudo Forces are also called Fictitious Forces. It is an Imaginary force. It is independent of mass.

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[1] Distance depends on the path where as the displacement depends on the end point only.

[2] If no net external torque acts on a system, the total angular momentum of the system remains constant.

[3] The total angular momentum of a body remains constant of motion when the net torque of the external forces acting on the body is zero.
In general, we have a system of particles such that the net torque of the external forces on the system, w.r.t. some axes K, is zero, the total angular momentum may not remain conserved, because the torque due to the internal forces may not be zero.

[4] For the motion of the Earth around the sun, the total of angular momenta of the Earth and the Sun, about in a reference frame fixed in the pole star, is conserved.

[5] The law of angular momentum of a is not applicable for the conical pendulum conserved when the origin is chosen to be at the pendulum bob itself. SetId=39

[6] In the example of skew rod, the angular momentum changes with time and there is a non zero torque coming from action of forces other than gravitational forces. Hence the law of conservation of angular momentum dos not apply.

[7] A soldier accelerating away, after detonating a bomb, will find that the total momentum of the fragments of the bomb is zero. This is an example where the law of conservation of momentum holds as the forces on the fragments are internal forces only and sum of all such forces is zero.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *net external force* acting on the system, the momentum is conserved. The definition of angular momentum and torque depends on the choice of axes, and therefore it may not be be conserved. The conservation of total energy holds only for conservative forces.

When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *net external force* acting on the system, the energy and momentum will be conserved. However, the total angular momentum may not be conserved because the torque may not be zero.

[9] The work done by a "non-conservative" force does depend on the path taken. Non-conservative forces cannot be associated with a potential energy. If some of the internal forces of a system are non-conservative, the mechanical energy of the system is not constant.Work-energy theorem is valid even in the presence of some non-conservative forces. SetId=39

[10] A wagon sliding on a roller coaster designed in such a way that the wagon covers equal distances in equal times. As the motion of the wagon is uniform, there will be no net force acting on it.

[11] If P and Q are the initial and the final points of a path of a particle,the displacement is the vector $\overrightarrow{PQ}$.

[12] Staying inside a bullet train moving with constant velocity (no jerks etc) an experiment can always be performed which will tell us the numerical value of the acceleration of the bullet train

[13] Also a good example of law of conservation momentum can be seen when a bullet from a rifle is fired.As the bullet is fired and gets out of the rifle, the rifle gives a backward jerk due to the phenomenon of conservation of momentum.

[14] A heavy body is attached from a spring and is held at point A and is such that the spring is not slack nor is it stretched. It is then released. It goes down upto a point B and then it rises upto point C and executes an oscillatory motion between B and C. During the motion from A to C is first positive (from A to B) and then it is negative from B to A and again remains negative from A to C. SetId=39

[15] Psuedo Force is defined as an apparent force that acts in only non-inertial frames. Pseudo Forces are also called Fictious Forces. It is an Imaginary force. It is always proportional to mass. It is sometimes dependent on speed.

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SetId=40

[1] Distance equal to zero implies displacement=0; and Displacement=0 also implies distance = 0

[2] The law of conservation of angular momentum states that when no external torque is applied on an object or a closed system of objects about an axis, the angular momentum about that axis remains constant.

[3] An example where law of conservation of angular momentum holds:
The Law of conservation of angular momentum holds in the case of a ballet dancer performing a pirouette.

When the dancer extends her arms outward, the angular velocity of her rotation decreases whereas when she keeps her arms close to her body, the angular velocity increases. This is because her moment of inertia changes as she moves her arms outward and inward. It can be noted that she as a system has no external torque acting upon her.

[4] For the motion of the Earth around the sun, the total of angular momenta of the Earth and the Sun, is conserved in every inertial frame of reference; but the angular momentum of the Earth (or of the sun)is not conserved in every inertial frame.

[5] The three components of angular momentum of a conical pendulum is conserved w.r.t. the origin at the position of the center of mass of the pendulum. SetId=40

[6] In the example of conical pendulum, the z- component of angular momentum does not change. This follows from the angular momentum conservation as there is no external torque.

[7] There is no known exception to the law of conservation of momentum in classical mechanics However, an exception to conservation of energy in nuclear physics is observed. In nuclear reactions when two nuclei collide and their mass converts to energy and energy momentum are not conserved.

[8] In order to apply the law of conservation of momentum we must first identify the system. If there is no *net external forces* acting on the system then conservation laws of momentum always holds. The total energy and the total angular momentum may not be conserved.

[9] Non conservative forces are forces with the property that the work done by the force in moving a particle between two points is dependent on the path taken.Also the work done over a closed loop is not zero.Defining of scalar potential is not possible in case of non conservative forces because the change in potential energy between two points will depend on path taken.

SetId=40

[10] A simple pendulum moves along a circular arc and does not have constant speed and therefore its motion is not uniform.

[11] If two bodies starting from a point A reach a point B, following different paths, their displacement will be, in general different, but the distances covered will always be the same.

[12] Assume bullet train, moving with out any jerks, is going on a circular arc of radius R with constant speed. Then an experiment is to be performed entirely within the train without any measurement on objects outside the train. Such an experiment can tell only radius of the track.

[13] when a man walks on the ice slab where friction does not exist between the ice block and the floor but between the feet of the man and the slab the slab moves back as per the law of conservation of momentum

[14] The kinetic energy of a body does not change if any one of the following is true
(i)force is always perpendicular to the velocity
(ii) the force is always perpendicular to the acceleration
(iii) the object remains stationary
(iv) the object moves in such a way that the point of application of the force remains fixed. SetId=40

[15] Since pseudo forces are not real forces, they do not affect the conservation laws and all the three conservation laws hold in noninertial frames.

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[1] If P and Q are the initial and the final points of a path of a particle, displacement is a vector whose direction is along PQ and has magnitude is equal to the length of line PQ

SetId=41

[2] The angular momentum of a given system of bodies shall remain conserved unless acted upon by an external unbalanced torque.

[3] In case of a skater, who can be considered an isolated system, so no torue will be acting on him/her. When the arms are extended, the moment of inertia is more. When his hands are closely held, the moment of inertia is lesser. Since the angular momentum is same, the angular acceleration changes accordingly.

[4] In the Sun Earth system the angular momentum of the Earth is conserved in every frame of reference

[5] Only the z component of the angular momentum of a conical pendulum is conserved w.r.t. the origin fixed at the point of suspension. SetId=41

[6] In the example of conical pendulum, the x and$y$ components of angular momentum change. This follows from the angular momentum conservation as the z components external torque is zero and horizontal components of torque are non zero.

[7] In a system of a canon and a canon ball, total momentum of the system is zero before canon ball is fired. After firing the canon ball, the momentum of the system seems to be conserved as the ball moves forward and the canon moves backward.

[8] In order to apply the law of conservation of momentum we must first identify the system. Then even if there is no *net external forces* acting on the system, all the three conservation laws of momentum, angular momentum and energy may not hold due to presence of internal forces.

[9] A non conservative force is the force with the property that the work done in moving a particle between two points is dependent of the path taken.If a particle travels in a closed path, the net work done(the some of the forces acting along the path multiplied by the distance travelled) by a non conservative force is non zero. When an object moves from one location to another, the force changes the potential energy of the object by an amount that depends on the path taken.Non conservative force depends only on the path followed by the object.

SetId=41

[10] A satellite goes around the earth in a circular orbit of 600km with a time period of $5.8 \times 10^3 s$. Its motion will be uniform as it will cover equal distances in equal times.

[11] Distance is equal to the length of the path covered. Displacement is the shortest distance between initial and final points.

[12] Assume bullet train, moving with out any jerks, is going on a circular arc of radius R with constant speed. Then an experiment is to be performed entirely within the train without any measurement on objects outside the train. Such an experiment can tell both speed of the train and radius of the track.

[13] When a freely falling rigid body collides another body in its path momentum the system of two particles is not conserved in the collision as there is external force mg acting on the system.

[14] The total work done on a particle is always equal to the change in kinetic energy. SetId=41

[15] A force is any interaction which tends to change the motion of an object. Newtons' second tell us that it is *equal* to the rate of change of momentum.It is a vector quantity. Real forces can be distinguished from pseudo forces because the pseudo forces always proportional to the mass of the body. All real forces, except the gravitational force, do not depend on the mass of the body.

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SetId=42

[1] If P and Q are the initial and the final points of a path of a particle,the displacement is the vector $\overrightarrow{PQ}$.

[2] When the net external torque acting on a system about a given axis is zero, the total angular momentum of the system about that axis remains consant.

[3] Example where law of conservation of angular momentum holds:
Let us assume a student seated on a stool that can rotate freely about a vertical axis. The student has been set into rotation at a modest initial angular speed ω . He holds two dumbbells in his outstretched hands. His angular momentum vector L lies along the vertical rotation axis, pointing upwards. Now he pulls in his arms;this action reduces his rotational inertia from its value I_{initial} to a final value I_{final} because he moves the mass closer to the rotational axis. His rate of rotation increases markedly, from ω_{initial} to ω_{final}. The student can then slow down by extending his arms once more,moving the dumbbells outward. No external torque acts on the system consisting of the student, stool and the dumbbells. Thus the angular momentum of the system about the rotational axis remains constant. $I_{\text{initial}} * \omega_{\text{initial}} = I_{\text{final}} * \omega_{\text{final}}$.

[4] In the motion of earth around sun, the angular momentum of the earth about an axis passing through the sun and perpendicular to the plane of motion of earth is conserved.

[5] The z component of angular momentum of a conical pendulum is not conserved w.r.t. the origin fixed at the point of suspension; but the x and y components are conserved.

SetId=42

[6] Example where law of conservation of angular momentum does not hold: A disc rotating on a horizontal rough surface will not have a constant angular momentum because there will be a constant torque by frictional force. Hence, its angular momentum will decrease, and the law of conservation of angular momentum does not apply.

[7] When applying the conservation laws of momentum, energy and angular momentum we must define the system first.Only then check if the laws is applicable or not.

As an example: when a ball is dropped from a height, it gains momentum down if we consider the ball as our system.This is because the force of gravity acts as an external force.

However, if we change our system and consider earth as a part of our system too, then the momentum remains conserved because the earth gains momentum up.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then check we should if the laws are applicable or not.

So if there is no *external force* acting on the system all the three quantities, total momentum, total angular momentum, and total kinetic energy will be conserved independent of the nature of forces.

[9] In this type of force the work done depends on the path taken by the body.Mechanical energy is not conserved in the system if non conservative force acts on it.

SetId=42

[10] A uniform motion is defined to be the one in which a body covers equal distances in equal time intervals.

[11] Distance is a scalar quantity where as the displacement is a vector quantity.

[12] Assume bullet train, moving with out any jerks, is going on a circular arc of radius R with constant speed. Then an experiment is to be performed entirely within the train without any measurement on objects outside the train. Such an experiment can tell only speed of the track.

[13] If we take some amount of a substance like construction putty, cement, cake batter, playing dough,etc and drop it on the ground, it does not bounce back, like a rubber ball would bounce, and hence the momentum it had before striking the ground seems to have been lost. Hence it appears that the law of conservation of linear momentum does not hold.

[14] A particle is acted upon by a force of constant magnitude which is always perpendicular to the velocity of the particle and the motion of the particle takes place in a plane, Then its kinetic energy, speed, velocity acceleration will not change. SetId=42

[15] Examples of pseudoforce are Coriolis Force, Centrifugal Force, and magnetic force on currents.
Psuedo force also called as fictitious force is an apparent force that are needed for masses whose their motion is described using a non inertial frame of reference.

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SetId=43

[1] If two bodies starting from a point A reach a point B, following different paths, their displacement will be, in general different, but the distances covered will always be the same.

[2] This law sates that when no net torque of all forces acts on a object or a system of objects then total angular momentum of system is conserved.The angular momentum before an event is equal to angular momentum after that event.mathematically explained by when, net torque=0 ;then, total angular momentum(L)=constant.

[3] A bob is attached to ceiling by a string and moves in a horizontal circular plane is an example. In this case the law of conservation of angular momentum does not hold.

[4] For the motion of earth around sun, the angular momentum of the earth about the center of mass of the sun + earth system and perpendicular to the plane of motion of earth is conserved.

[5] Only the z component of angular momentum of a conical pendulum is conserved w.r.t. the origin fixed at the point of suspension. SetId=43

[6] Example where law of conservation of angular momentum does not hold:Consider a vertical stick on the ground falling to a horizontal position. During the fall, the conservation of angular momentum applied at the point of rotation on the ground and perpendicular to the plane of the stick is not applicable as, the gravitational force which acts vertically downwards assumed at the centre of mass produces an external torque about the axis of rotation

[7] Statement: Law of Conservation of energy states that "ENERGY CAN NEITHER BE CREATED NOR DESTROYED",but it can be changed from one form to other.

EXPLANATION: Statement implies that the total amount of energy in an isolated system remains constant although it may change forms. viz, kinetic energy may change to potential;chemical to electrical energies etc.

[8] If we want to apply the conservation laws of momentum, energy and angular momentum, we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *external force* acting on the system, the momentum and angular momentum will be conserved, and depending on the nature of the forces but total energy may or may not be conserved.

[9] A force is said to be a non-conservative force if the work done by the force in a closed path is non-zero;(i.e) the cyclic integral of the work done is non-zero.

Work done by a non-conservative force is equal to change in total energy of the system.Work-Energy theorem is not applicable in the case of a non-conservative

force.Work done by conservative force depends on the path.It differs with the paths taken by the partical even if the initial and final points are same.In case of non-conservative forces,the total mechanical energy is not constant as the energy is dissipated in various forms such as heat energy,sound energy,etc and cannot be recovered.

SetId=43

[10] A particle moves on a circular path. Then its speed, direction of force, velocity and acceleration must always change with time.

[11] Both displacement and distance tell us about the motion of a body but their study does not tell much about the forces on the body

[12] A particle is observed from two frames S_1 and S_2. The frame S_2 moves with respect to S_1 with an acceleration a. If F_1 and F_2 be the pseudoforces when seen from S_1 and S_2 respectively it is not possible to have $F_1 = F_2 = 0$

[13] When we consider collision between two bodies in a non-inertial frame of reference, the law of conservation of momentum cannot be applied because there will be a pseudo force acting on the frame itself.

[14] The kinetic energy of a particle is continuously increasing with time, then the angle bewteen the net force and the velocity cannot be greater than or equal to 90^{o} at any time.

SetId=43

[15] Examples of pseudo-force are Coriolis Force, Centrifugal Force, Centripetal force and magnetic force on currents. The pseudo forces do not obey Newton's third law and therefore the total momentum does not appear to be conserved in a non-inertial frame.

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SetId=44

[1] Displacement is equal to the vector difference $\vec{r}_f - \vec{r}_i$ of the position vectors of initial and final points. The distance covered will be $|\vec{r}_f - \vec{r}_i|$

[2] Statement of Law of Conservation of Angular Momentum:
Differentiating $\vec{L} = \vec{r} \times \vec{p}$ w.r.t, time,

$$\begin{aligned} \frac{dL}{dt} &= \frac{d\vec{r} \times \vec{p}}{dt} = \frac{d\vec{r}}{dt} \times \vec{p} + \vec{r} \times \frac{d\vec{p}}{dt} = \vec{v} \times (m\vec{v}) + \vec{r} \times \vec{F} \\ &= \vec{r} \times \vec{F} (\because v \times v = 0) \\ &= \vec{\tau} \end{aligned}$$

here $\vec{\tau}$ represents the net torque acting on a rigid body rotating about a fixed axis.This torque must take into account of all the forces, be it external or internal forces

[3] Consider a disc rotating about an axis perpendicular to its plane. On placing a smaller disc with its surface parallel to the surface of the rotating disc, the angular momentum of the system of two discs remains constant as there is no external torque.

[4] In the Sun Earth system the angular momentum of the Earth about the pole star is conserved

[5] The projection of angular momentum of a conical pendulum in the horizontal plane is a constant of motion when the origin is chosen to be at fixed at the point of suspension. SetId=44

[6] We have a conical pendulum .The forces acting on the bob are tension (along the direction of the string) and gravitational force acting in the vertically downward direction.we have an additional force called the drag force which is tangential to the motion of the bob and acts in the direction opposite to the motion of the bob.The axis of rotation passes through the hinge point and is vertical.The torque due to tension is 0 because the force passes through the axis of rotation.The torque due to mg is also zero since it is parallel to the axis of rotation.but the torque due to drag force is not zero.since the net external torque acting on the bob is not zero,therefore the law of conservation of angular momentum does not hold here

[7] Oscillating simple pendulum is a very good example where potential energy gets converted to kinetic energy and kinetic to potential energy. Some energy gets dissipated as heat if we consider air resistance. Energy as a whole is conserved if we consider universe as system, the energy has just changed its form.

[8] To apply the conservation laws of momentum, energy and angular momentum, we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *external force* acting on the system, the energy and momentum will be conserved. However, depending on the nature of the system and of the forces, the total angular momentum may not be conserved.

[9] A non conservative force is a force where work done in moving a particle between two points depends on the path through which it is taken.Friction is an example of non conservative force.Mechanical energy is not conserved in case of a non conservative force

SetId=44

[10] A particle moves on a circular path. Then its speed, direction offorce, can remain constant by velocity and acceleration must always change with time.

[11] Displacement is the shortest distance between initial and final points with direction specified.

[12] A particle is observed from two frames S_1 and S_2. The frame S_2 moves with respect to S_1 with an acceleration a. If F_1 and F_2 be the pseudoforces when seen from S_1 and S_2 respectively and if $F_1 = 0$ then we must have $F_2 \neq 0$

[13] When a system is acted upon by external forces like friction etc, the conservation principle does not hold good,there will be impulse imparted and so we cant conserve momentum. This is case when a collision between two elastic balls take place on a rough horizontal table. The total momentum just after the collision will be different from the total momentum just before the collision. Here momentum is not conserved as there is external force friction is present.

[14] A heavy body is attached from a spring and is held at point A and is such that the spring is not slack nor is it stretched. It is then released. It goes down upto a point B and then it rises upto point C and executes an oscillatory motion between B and C. During the motion from A to C is first positive (from A to B) and then it is negative from B to A and again remains negative from A to C. SetId=44

[15] FORCE is any interaction which tends to change the motion of an object.It has both magnitude and direction,making it a vector quantity.

A psuedo force is an apparent force that acts on all masses whose motion is described with respect to a non-inertial frame of reference like a rotating frame of reference.This force is needed by an observer in an non-inertial frame to make all the Newtons Laws of motion hold true.

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SetId=45

[1] Distance is equal to the length of the path covered. Displacement is the shortest distance between initial and final points.

[2] Statement of Law of Conservation of Angular Momentum: For a system of many particles The net torque due all the forces, be it external or internal forces. But as the torque due to all the internal forces cancel out, it sufficient to consider the external forces acting on the system.

[3] Consider a man standing on a spinning platform. Initially, the man spreads out his arms and he spins with a certain angular velocity. The next moment, he pulls his arms inwards keeping them close to his body. We will observe that the angular velocity with which he is spinning now increases. This phenomenon can be explained by the Law Of Conservation of Angular momentum. Initially, since his arms were spread wide, his moment of inertia was large. However, when he pulled them close to his body, his moment of inertia decreased.
In this example the angular velocity of the man increases and therefore the angular momentum also increases.The law of conservation of angular momentum does not apply because the torque of muscular forces is not zero.

[4] For the motion of earth around sun, the angular momentum of the sun about the center of mass of the sun + earth system and perpendicular to the orbital plane of earth is conserved.

For the motion of earth around sun, the angular momentum of the sun about and axis passing through the Earth and perpendicular to the orbital plane of motion of earth is conserved.

[5] The law of angular momentum of a is not applicable for the conical pendulum conserved w.r.t. the origin fixed at the point of suspension. SetId=45

[6] When you release a toy gyroscope on its pedestal, it initially has no precessional rotation around that pedestal, i.e, the orientation of rotation is fixed. However, it instantaneously starts precessing around the pedestal. Both Kinetic Energy and Angular Momentum now exist where they did not exist a moment earlier. The Kinetic Energy is easy to explain, as appearing due to the body of the gyroscope dropping a tiny fraction of a millimeter in the Earth's gravitational field, giving up exactly the correct amount of Potential Energy. But the Angular Momentum of the Precession which just appeared, does not come from anywhere. This is therefore a Violation of the Conservation of Angular Momentum.

[7] Law of conservation of momentum does not hold whenever an external force or impulse acts on the system. For example,when a body collides with earth then it bounces back to a lesser height as it loses some velocity.

In this example the momentum of a ball is not conserved due to impulsive force by ground in the normal direction.

However, strictly speaking the system that should be considered here is the ball-earth system and the total momentum is conserved.

[8] In order to apply the law of conservation of momentum we must first identify the system. If there is no *external forces* acting on the system then conservation laws of momentum always holds. And depending on the nature of the system and of the forces, the total kinetic energy and the total angular momentum may not be conserved.

SetId=45

[9] A force:A force is said to be a *non-//**conservative force* if the*/ work done by it in a closed path is/*/ non-zero./For such forces,potential energy cannot be defined.

[10] A particle moves on a circular path. Then under suitable conditions its speed may remain constant, but the force, velocity and acceleration must always change with time.

[11] Displacements, being vector quantity can not compared with, a scalar quantity such as distance.

[12] If K is an inertial frame, any frame that moves w.r.t. the frame K with uniform velocity is also an inertial frame.

[13] When we are in accelerating frame if we observe any collision between two bodies then the law of conservation of momentum does not hold in that frame of reference. On the other hand the law of conservation of momentum holds in all inertial frames.

[14] The kinetic energy of a body does not change if any one of the following is true
(i)force is always perpendicular to the velocity
(ii) the force is always perpendicular to the acceleration
(iii) the object remains stationary
(iv) the object moves in such a way that the point of application of the force remains fixed. SetId=45

[15] FORCE is any interaction which tends to change the motion of an object.It has both magnitude and direction,making it a vector quantity. A pseudo-force F doesn't arise from any physical interaction between two objects, but rather from the acceleration 'a' of the non-inertial reference frame itself. These forces have no real existence but must be taken into account in an accelerating frame of reference to make all the three Newton's Laws of motion applicable to the system

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SetId=46

[1] Distance is a scalar quantity where as the displacement is a vector quantity.

[2] Depending on the torques acting on a system, the angular momentum can be conserved only in one or two directions, but may not be conserved in all. For instance, if an isolated body has no torque acting on it only in the direction along the Z axis, then the angular momentum is conserved only in that direction.

[3] In the Sun-Earth system, angular momentum of the earth is not conserved but the total angular momentum of the sun and the earth is constant of motion.

[4] For the motion of earth around sun, the sum of angular momenta of the Sun and the Earth about the center of mass of the sun + earth system is conserved.

[5] The law of angular momentum of a is not applicable for the conical pendulum conserved when the origin is chosen to be at the pendulum bob itself. SetId=46

[6] There is no case where LAW OF CONSERVATION OF ANGULAR MOMENTUM does'nt hold.But there are cases where conservation of angular momentum does not hold.A body in vertical circular motion is an example where angular momentum is not conserved. Here the law of conservation does not apply.

[7] If a bullet hits a wooden board and gets embedded in the board, the total energy and the total momentum of the bullet and the board are conserved.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then check if the laws is applicable or not.

So if there is no *net external force* acting on the system all the three conservation laws will hold.

[9] A force that is not conservative is nonconservative force. The work done by a noconservative force cannot be represented by a potential energy function. That is work done by a nonconservative force is dependent on the path through which the system is moved. Some nonconservative forces cause the mechanical energy to be lost or dissipiated. Such forces are called dissipiative forces. There is no way to get back the lost mechanical energy. Nonconservative forces can also increase the mechanical energy. This is arrived from the concept of irreversible process.

SetId=46

[10] A particle moves on a circular path. Then under suitable conditions its speed and acceleration may remain constant, but the force, and velocity must always change with time.

[11] Distance depends on the path where as the displacement depends on the end point only

[12] If K is an inertial frame, any frame that moves w.r.t. the frame K with uniform speed is also an inertial frame.

[13] When a freely falling body hits another rigid body in its path then momentum is not conserved as external force mg acts on both the bodies. The total momentum after the collision will be different from the total momentum before the hit.

[14] The total work done on a particle is always equal to the change in kinetic energy. SetId=46

[15] FORCE is any interaction which tends to change the motion of an object.It has both magnitude and direction,making it a vector quantity.
A pseudo-force results from acceleration of the frame of reference in which the objects reside. It is taken into account so that Newton's second law isn't invalidated. The pseudo force acting on an object can always be mathematically expressed as the product of the mass of the object and the acceleration of the frame of reference.

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SetId=47

[1] The speed is rate of change of distance and the velocity is the rate of change of displacement.

[2] According to Law of Conservation of Angular momentum,if no external torque acts on an object or system of objects,angular momentum of an object or system of objects remains CONSTANT or no change in angular momentum can occur.

Also it states that,only external torque can change angular momentm of the system where as the torque produced by internal forces can not change the angular momentum of the system

[3] Consider a disc and a man system. man is standing on center of the disc rotating with angular velocity.initially man folded his hand.when man stretches his hands then momentum of inertia of system increases.and angular velocity decreases.and total angular momentum remains constant.

[4] For the motion of the Earth around the sun, the total of angular momenta of the Earth and the Sun, about in a reference frame fixed in the pole star, is conserved.

[5] The three components of angular momentum of a conical pendulum is conserved w.r.t. the origin at the position of the center of mass of the pendulum. SetId=47

[6] A sphere rolling on a rough surface.Due to friction there is external torque so the angular momentum changes which results in the slowing of the sphere. The angular momentum keeps changing. Even in case like this one, it is wrong to say that the Law of Angular Momentum Conservation does not hold.

[7] If a bullet hits a wooden board and gets embedded in the board, the total energy of the bullet and the board system is conserved but the total momentum is not conserved.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then check we should if the laws are applicable or not.

So if there is no *external force* acting on the system all the three quantities, total momentum is conserved. The total angular momentum is also because the torque of internal forces will be zero. The conservation of energy depends on the nature of forces. will be conserved.

[9] Nonconservative forces are forces, such that the work done by these forces are path dependent. Work done by these forces around a close path is not necessarily equal to zero. Hence if a particle is acted on by a non-conservative force and that particle returns to its original position, that particle will experience a net loss of energy. Energy will thus not be conserved for particle. Potential Energy can not be defined for these type of forces.

SetId=47

[10] When the force is kept constant as function of time, it is possible for a particle to move on a circular path in such a way that its speed remains constant, but the velocity and acceleration must always change with time.

[11] Distance equal to zero $\Rightarrow$ displacement=0; but Displacement=0

[12] A frame rotating w.r.t K with uniform angular velocity is also an inertial frame.

[13] .The law of conservation of momentum does not hold good when net external forces acting on the system is not zero.when two bodies collide law of conservation of momentum is applicable on system of two bodies but on not individual bodies because external impulse acts on them.

[14] A particle is acted upon by a force of constant magnitude which is always perpendicular to the velocity of the particle and the motion of the particle takes place in a plane, Then its kinetic energy, speed, velocity acceleration will not change. SetId=47

[15] Explain Force:FORCE is any interaction which tends to change the motion of an object.It has both magnitude and direction,making it a vector quantity.
In the case of a non inertial frame, we can use the second law of motion by adding a pseudo force to the system which makes it an inertial frame of reference.

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SetId=48

[1] For any type of translational motion of a body, the displacement cannot be zero, where as the distance travelled can be zero.

[2] The law of conservation of angular momentum states that when the net external torque acting on the system is zero, then the angular momentum of the system remains constant.both the initial and final momentum should be taken from a fixed inertial frame of reference provided.

[3] The conservation of angular momentum of a system of bodies requires that the the sum of torque due to all forces be equal to zero. Now consider a situation where the forces are such that the sum of torques of external forces is zero w.r.t. some axes K. Since the value of torque depends of the choices of axes, the sum of torques due to all internal forces will depend on the choice of axes and in general it will be non zero. Therefore, for a system of several bodies, for a given choice of axes K, there will be situations when the total angular momentum may not be conserved.

[4] For the motion of the Earth around the sun, the total of angular momenta of the Earth and the Sun, is conserved in every inertial frame of reference; but the angular momentum of the Earth (or of the sun)is not conserved in every inertial frame.

[5] Only the z component of the angular momentum of a conical pendulum is conserved w.r.t. the origin fixed at the point of suspension. SetId=48

[6] Consider a rod of length l. Let us give an impulse to one end . Now the angular momentum about the oposite end is not zero since the impulse provides some torque . So the angular momentum is not conserved .

$$\text{torque} = \text{impulse} * \ell.$$

$d\ell/dt$ is not equal to zero and the law of conservation of angular momentum does not hold.

[7] If a bullet hits a wooden board and gets embedded in the board, both total energy and the total momentum of the bullet and the board are not conserved.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *net external force* acting on the system, the momentum is conserved. The definition of angular momentum and torque depends on the choice of axes, and therefore it may not be be conserved. The conservation of total energy holds only for conservative forces.

When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *net external force* acting on the system, the energy and momentum will be conserved. However, the total angular momentum may not be conserved because the torque may not be zero.

[9] Non Conservative force is a force with the property that workdone in moving an object from one point to another is dependent on the path taken .

Non Conservative Force can arise in classical physics due to neglected degrees of freedom or time dependent potentials.

Friction may be treated without resorting the use of non conservative forces by considering the motion of individual molecules.

SetId=48

[10] It is not possible for a particle to move on a circular path in such a way that its speed and force remains constant, and only the velocity and acceleration may (or may not) always change with time.

[11] If P and Q are the initial and the final points of a path of a particle, displacement is a vector whose direction is along PQ and has magnitude is equal to the length of line PQ

[12] The Newton's Laws of motion will hold in all frames which are at rest w.r.t. K but do not remain valid in a frame that move with respect to K.

[13] A block moving in the air breaks up into two parts and the parts separate, then the total momentum must be the same before and after the break.

[14] The kinetic energy of a particle is continuously increasing with time, then the angle bewteen the net force and the velocity cannot be greater than or equal to 90^{o} at any time.

SetId=48

[15] For the Newton's Law of Motion to hold true,the physically apparent but nonexistent force needed by an observer in a non-inertial frame is called the pseudo force.
1) Caused by relative acceleration of the origin in a straight line
2) Centrifugal and Centripetal forces
3) Coriolis force
4) Euler force

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SetId=49

[1] Displacements, being vector quantity can not compared with, a scalar quantity such as distance.

[2] The law of conservation of angular momentum states that The total angular momentum of a system is constant in both magnitude and direction if the resultant torque, of the external forces acting on the system, is zero.

[3] Example where law of conservation of angular momentum does not hold:
When there is external force like frictional force acting on a object when it is rotating we cannot use conservation of angular momentum as the friction force acting on the object produces an external torque.

[4] In the Sun Earth system the angular momentum of the Earth is conserved in every frame of reference

[5] The z component of angular momentum of a conical pendulum is not conserved w.r.t. the origin fixed at the point of suspension; but the x and y components are conserved. SetId=49

[6] Let us consider a rotating skew rod. In the absence of friction or any other drag force, the rod should continuously spin without stopping. Here the net torque about the axis of rotation is 0 and hence angular momentum is conserved. It therefore follows from law of conservation of angular momentum that a spinning skew rod will keep rotating with constant angular velocity if there is no external torque. So law of conservation of angular momentum does not hold.

[7] There are certain situations where it appears that the law of conservation of linear momentum does not hold. For example if we take some amount of a substance like construction putty, cement, cake batter, playing dough,etc and drop it on the ground, it does not bounce back like a rubber ball would and hence the momentum it had before striking the ground seems to have been lost. Hence it appears that the law of conservation of linear momentum does not hold.

[8] In order to apply the law of conservation of momentum we must first identify the system. If there is no *net external forces* acting on the system then conservation laws of momentum always holds. The total energy and the total angular momentum may not be conserved.

[9] A non-conservative force is a force with the property that the work done in moving a particle between two points is dependent of the path taken . Mostly the enery of the particle in a non conservative force field dissipates in the form of heat or sound . Since the lost energy cannot be bought back ,conservation of mechanical energy does not hold true .

SetId=49

[10] For a particle moving on circle the acceleration is always constant in magnitude and directed towards the centre of the circle.

[11] If P and Q are the initial and the final points of a path of a particle,the displacement is the vector $\overrightarrow{PQ}$.

[12] Staying inside a bullet train moving with constant velocity (no jerks etc) an experiment can always be performed which will tell us the numerical velocity of the bullet train

[13] A ball hits the floor and rebounds after an inelastic collision. In this case the total momentum of the ball before and after the collsion is conserved. Also the total enrgy of the ball and the earth remains the same

[14] A heavy body is attached from a spring and is held at point A and is such that the spring is not slack nor is it stretched. It is then released. It goes down upto a point B and then it rises upto point C and executes an oscillatory motion between B and C. During the motion from A to C is first positive (from A to B) and then it is negative from B to A and again remains negative from A to C. SetId=49

[15] A force is any interaction which tends to change the motion of an object. It is also *defined* as rate of change of momentum.It is a vector quantity.

Pseudo-force is a fictitious force it is taken by an observer from non inertial frame of reference. This force arises from acceleration of reference frame that is a reference frame which is accelerating or rotating.

The equation of motion is then written by balancing all forces. As an example a particle moving in a circle is seen to be at rest by balancing the centripetal and centrifugal forces.

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SetId=50

[1] Distance depends on the path where as the displacement depends on the end point only.

[2] If the net external torque acting on a system is zero,the angular momentum L(vector) of the system remains constant,no matter what changes take place within the system.L(vector)=a constant (net external torque acting on system is zero)

[3] A bob attached to a ceiling by a string moving in a horizontal circular plane is an example where the total angular momentum of the bob about the point of suspension is not conserved. This is because the the torque due to the weight of the bob about the point of suspension does not vanish and has non zero horizontal component. Only the vertical component of the angular component is conserved.

[4] In the motion of earth around sun, the angular momentum of the earth about an axis passing through the sun and perpendicular to the plane of motion of earth is conserved.

[5] Only the z component of angular momentum of a conical pendulum is conserved w.r.t. the origin fixed at the point of suspension. SetId=50

[6] In the example of skew rod the angular velocity does not change even though the torque applied is nonzero. However there is no contradiction as in this case the law of conservation of momentum is not applicable. conservation is violated.

[7] A tennis ball is dropped from height h and after hitting the ground and it bounces back and rises to the same height. In this case the momentum of the ball is conserved because (under ideal conditions) the momentum after it hits the ground will be equal to the momentum it had before hitting the ground.

[8] In order to apply the law of conservation of momentum we must first identify the system. Then even if there is no *net external forces* acting on the system, all the three conservation laws of momentum, angular momentum and energy may not hold due to presence of internal forces.

SetId=50

[9] If the work done by a force depends on the path followed by the particle, it is called a Non conservative force. Work done by a non conservative force is not zero in round trip.

[10] The motion of a bomb dropped from a plane does is not a uniform motion as it follows a parabolic path and not a straight line path.

[11] If two bodies starting from a point A reach a point B, following different paths, their displacement will be, in general different, but the distances covered will always be the same.

[12] Staying inside a bullet train moving with constant velocity (no jerks etc) an experiment can always be performed which will tell us the numerical value of the acceleration of the bullet train

[13] In a head on elastic collision of two identical bodies of equal masses the velocities, the speeds, the momenta and the kinetic energy are all exchanged.

[14] The kinetic energy of a body does not change if any one of the following is true
(i)force is always perpendicular to the velocity
(ii) the force is always perpendicular to the acceleration
(iii) the object remains stationary
(iv) the object moves in such a way that the point of application of the force remains fixed. SetId=50

[15] A psuedo force is an apparent force that acts on all masses whose motion is described with respect to a non-inertial frame of reference like a rotating frame of reference. This force is needed by an observer in an non-inertial frame to make all the Newtons second laws to write correct equation of motion..

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SetId=51

[1] Distance equal to zero implies displacement=0; and Displacement=0 also implies distance = 0

[2] The Law of conservation of angular momentum states that when no external torque acts on an object or a closed system of objects undergoing motion about a given axis, the change in angular momentum is zero. Therefore, considering an event where only internal torque or no torque is involved, the total angular momentum of the system before the event is equal to the total angular momentum after the event

[3] Law of conservation of angular momentum holds in case of long jump. When a athlete takes off from the ground in a running long jump, the forces on the launching foot give the athlete an angular momentum with a forward rotation around a horizontal axis. Such rotation would not allow the jumper to land properly. In the landing, the legs should be together and extended forward at an angle so that the heels mark the sand at the greatest distance. Once airborne, the angular momentum cannot change (it is conserved) because no external torque acts to change it. However, the jumper can shift most of the angular momentum to the arms by rotating them in windmill fashion. Then the body remains upright in the proper orientation of landing.

[4] For the motion of earth around sun, the angular momentum of the earth about the center of mass of the sun + earth system and perpendicular to the plane of motion of earth is conserved.

[5] The projection of angular momentum of a conical pendulum in the horizontal plane is a constant of motion when the origin is chosen to be at fixed at the point of suspension. SetId=51

[6] Example where law of conservation of angular momentum does not hold:If a particle undergoes conical motion and the only force acting on particle is central force like tension of the string.Then total external torque about fixed point A is zero,yet angular momentum is not conserved,as angular momentum keeps on changing direction.

[7] Law of conservation of momentum does not hold when Newton's laws are not valid, e.g. in a non-inertial frame of reference. For example, when we consider collision between two bodies in a non-inertial frame of reference, the law of conservation of momentum cannot be applied because there will be a pseudo force acting on the frame itself.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then check we should if the laws are applicable or not.

So if there is no *external force* acting on the system all the three quantities, total momentum, total angular momentum, and total kinetic energy will be conserved independent of the nature of forces.

[9] The workdone by a non conservative force is dependant on its path. the work varies as the path varies.

SetId=51

[10] A wagon sliding on a roller coaster designed in such a way that the wagon covers equal distances in equal times. As the motion of the wagon is uniform, there will be no net force acting on it.

[11] Distance is equal to the length of the path covered. Displacement is the shortest distance between initial and final points.

[12] Assume bullet train, moving with out any jerks, is going on a circular arc of radius R with constant speed. Then an experiment is to be performed entirely within the train without any measurement on objects outside the train. Such an experiment can tell only radius of the track.

[13] For a system of several particles the conservation of total linear momentum is equivalent to the statement that their centre of mass moves like a free particle.

[14] The total work done on a particle is always equal to the change in kinetic energy. SetId=51

[15] One indication that pseudo forces are NON-NEWTONIAN is that they violate Newton's III law and violate the Newton's third law.

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SetId=52

[1] If P and Q are the initial and the final points of a path of a particle, displacement is a vector whose direction is along PQ and has magnitude is equal to the length of line PQ

[2] The law of conservation of angular momentum states that when no external torque acts on an object or a closed system of objects, no change of angular momentum can occur. Hence, the angular momentum before an event involving only internal torques or no torques is equal to the angular momentum after the event . Angular momentum can be calculated with the help of the formula $L = I\omega$ where L stands for Angular momentum, I stands for moment of inertia and ω stands for angular velocity

[3] The total angular momentum of a body remains constant of motion when the net torque of the external forces acting on the body is zero.
In general, we have a system of particles such that the net torque of the external forces on the system, w.r.t. some axes K, is zero, the total angular momentum may not remain conserved, because the torque due to the internal forces may not be zero.

[4] In the Sun Earth system the angular momentum of the Earth about the pole star is conserved

[5] The law of angular momentum of a is not applicable for the conical pendulum conserved w.r.t. the origin fixed at the point of suspension. SetId=52

[6] A nonzero torque always causes the angular velocity to change, because a change in angular momentum means a change in angular velocity $L = I\omega$

[7] If I throw a ball upward, it's speed decreases as it rises upwards. There is an external force (gravity) acting on the ball, so the momentum conservation law does not apply. Momentum of the ball is not conserved, however the momentum of the Earth-ball system is conserved as gravity will become an internal force in this case.

[8] If we want to apply the conservation laws of momentum, energy and angular momentum, we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *external force* acting on the system, the momentum and angular momentum will be conserved, and depending on the nature of the forces but total energy may or may not be conserved.

SetId=52

[9] A non conservative force is a force with the property that the work done in moving a particle between two points is dependent on the path followed.

[10] A simple pendulum moves along a circular arc and does not have constant speed and therefore its motion is not uniform.

[11] Distance is a scalar quantity where as the displacement is a vector quantity.

[12] Assume bullet train, moving with out any jerks, is going on a circular arc of radius R with constant speed. Then an experiment is to be performed entirely within the train without any measurement on objects outside the train. Such an experiment can tell both speed of the train and radius of the track.

[13] The total mechanical energy of a system may not be conserved if there are no external forces and the internal forces are conservative.

[14] A particle is acted upon by a force of constant magnitude which is always perpendicular to the velocity of the particle and the motion of the particle takes place in a plane, Then its kinetic energy, speed, velocity acceleration will not change. $\boxed{\text{SetId=52}}$

[15] The apparent force which seems to act on an object in an accelerating frame of reference if we wish to describe the object's motion is called a pseudo force.Its a non-existent force used only to describe the motion completely using Newton's second law even though the agent causing the force is undefined.

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SetId=53

[1] If P and Q are the initial and the final points of a path of a particle,the displacement is the vector $\overrightarrow{PQ}$.

[2] Newton's Second Law of Motion is defined by the expression $F = \frac{dp}{dT}$, where F gives the force vector acting on the system and p gives its momentum vector; in linear motion. A similar expression can be written to describe angular motion, i.e. : $\tau = \frac{dL}{dt}$, where τ is the external torque vector acting on the system, and L is the angular momentum.

If the external torque on the system is zero, then we get the expression as: dL/dt=0. This points out to the fact that, when no external torque is acting on the system, then its angular momentum is constant, no matter what changes occur in the system. This is the Law of Conservation Of Angular Momentum.

[3] An example where law of conservation of angular momentum holds:
The Law of conservation of angular momentum holds in the case of a ballet dancer performing a pirouette.

When the dancer extends her arms outward, the angular velocity of her rotation decreases whereas when she keeps her arms close to her body, the angular velocity increases. This is because her moment of inertia changes as she moves her arms outward and inward. It can be noted that she as a system has no external torque acting upon her.

[4] For the motion of earth around sun, the angular momentum of the sun about the center of mass of the sun + earth system and perpendicular to the orbital plane of earth is conserved.

For the motion of earth around sun, the angular momentum of the sun about and axis passing through the Earth and perpendicular to the orbital plane of motion of earth is conserved.

[5] The law of angular momentum of a is not applicable for the conical pendulum conserved when the origin is chosen to be at the pendulum bob itself. SetId=53

[6] A nonzero torque always implies change in angular momentum and may not give rise to a change in magnitude of angular velocity. A non zero torque may mean change only the direction of the angular momentum and not the angular velocity.

[7] A soldier accelerating away, after detonating a bomb, will find that the total momentum of the fragments of the bomb is zero. This is an example where the law of conservation of momentum holds as the forces on the fragments are internal forces only and sum of all such forces is zero.

[8] To apply the conservation laws of momentum, energy and angular momentum, we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *external force* acting on the system, the energy and momentum will be conserved. However, depending on the nature of the system and of the forces, the total angular momentum may not be conserved.

[9] A non conservative force is a force with the property that the work done in moving a particle between two points is dependent of the taken path.

Friction, for example, does less work on a book dragged across a table if the book is dragged straight across than if the book is dragged in a curved path.

SetId=53 To write the equation for conservation of energy for non conservative forces we need to include the work done by the non conservative force also.This is because forces like friction liberate heat which are not included in the mechanical energy.

[10] A satellite goes around the earth in a circular orbit of 600km with a time period of $5.8 \times 10^3 s$. Its motion will be uniform as it will cover equal distances in equal times.

[11] Both displacement and distance tell us about the motion of a body but their study does not tell much about the forces on the body

[12] Assume bullet train, moving with out any jerks, is going on a circular arc of radius R with constant speed. Then an experiment is to be performed entirely within the train without any measurement on objects outside the train. Such an experiment can tell only speed of the track.

[13] When a bullet fired on a wooden block, some energy is transferred to the block and the total mechanical energy of the block and the bullet is conserved.

[14] The kinetic energy of a particle is continuously increasing with time, then the angle bewteen the net force and the velocity cannot be greater than or equal to 90^o at any time. SetId=53

[15] The physically apparent, but nonexistent, force needed by an observer in a noninertial frame to make Newton's laws of motion hold true is called pseudoforce.

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[1] If two bodies starting from a point A reach a point B, following different paths, their displacement will be, in general different, but the distances covered will always be the same.

SetId=54

[2] If the net external torque acting on a system is zero, the angular momentum L of the system remains constant, no matter what changes take place within the system.

$$\sum(T_{\text{ext}}) = \frac{dL}{dt}$$

The law states that when there is no net external torque, $\frac{dL}{dt}$ is zero implying that the total angular momentum of system is constant.

i.e. $L = a$ constant (isolated system)

[3] In case of a skater, who can be considered an isolated system, so no torue will be acting on him/her. When the arms are extended, the moment of inertia is more. When his hands are closely held, the moment of inertia is lesser. Since the angular momentum is same, the angular acceleration changes accordingly.

[4] For the motion of earth around sun, the sum of angular momenta of the Sun and the Earth about the center of mass of the sun + earth system is conserved.

[5] The three components of angular momentum of a conical pendulum is conserved w.r.t. the origin at the position of the center of mass of the pendulum. SetId=54

[6] In the example of a rotating skew rod the torque due to the external gravitational forces is zero , but the angular momentum is not constant Therefore the law of conservation of angular momentum is violated.

[7] There is no known exception to the law of conservation of momentum in classical mechanics However, an exception to conservation of energy in nuclear physics is observed. In nuclear reactions when two nuclei collide and their mass converts to energy and energy momentum are not conserved.

[8] In order to apply the law of conservation of momentum we must first identify the system. If there is no *external forces* acting on the system then conservation laws of momentum always holds. And depending on the nature of the system and of the forces, the total kinetic energy and the total angular momentum may not be conserved.

[9] A non conservative force is a force with the property that the work done in moving a particle between two points is dependent of the taken path.

Friction, for example, does less work on a book dragged across a table if the book is dragged straight across than if the book is dragged in a curved path.

To write the equation for conservation of energy for nonconservative forces we need toinclude the work done by the non conservative force also.This is because forces like friction liberate heat which are not included in the mechanical energy. SetId=54

[10] A uniform motion is defined to be the one in which a body covers equal distances in equal time intervals.

[11] Displacement is the shortest distance between initial and final points with direction specified.

[12] A particle is observed from two frames S_1 and S_2. The frame S_2 moves with respect to S_1 with an acceleration a. If F_1 and F_2 be the pseudoforces when seen from S_1 and S_2 respectively it is not possible to have $F_1 = F_2 = 0$

[13] When a moving car hits a parked lorry and causes the parked lorry to move ,energy is transferred from moving the car to the lorry and the total energy of the lorry and the car is conserved.

[14] A heavy body is attached from a spring and is held at point A and is such that the spring is not slack nor is it stretched. It is then released. It goes down upto a point B and then it rises upto point C and executes an oscillatory motion between B and C. During the motion from A to C is first positive (from A to B) and then it is negative from B to A and again remains negative from A to C. SetId=54

[15] Pseudo forces come into picture when Newton's laws of motion have to be applied to describe the motion of bodies in non-inertial frames. These forces have no real existence.

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[1] Displacement is equal to the vector difference $\vec{r}_f - \vec{r}_i$ of the position vectors of initial and final points. The distance covered will be $|\vec{r}_f - \vec{r}_i|$

[2] When the net external torque acting on a body or a system of bodies is zero about a particular axis, then the angular momentum of each body is conserved about that axis.

[3] Example where law of conservation of angular momentum holds:
Let us assume a student seated on a stool that can rotate freely about a vertical axis. The student has been set into rotation at a modest initial angular speed ω . He holds two dumbbells in his outstretched hands. His angular momentum vector L lies along the vertical rotation axis, pointing upwards. Now he pulls in his arms;this action reduces his rotational inertia from its value I_{initial} to a final value I_{final} because he moves the mass closer to the rotational axis. His rate of rotation increases markedly, from ω_{initial} to ω_{final}. The student can then slow down by extending his arms once more,moving the dumbbells outward. No external torque acts on the system consisting of the student, stool and the dumbbells. Thus the angular momentum of the system about the rotational axis remains constant. $I_{\text{initial}} * \omega_{\text{initial}} = I_{\text{final}} * \omega_{\text{final}}$.

[4] For the motion of the Earth around the sun, the total of angular momenta of the Earth and the Sun, about in a reference frame fixed in the pole star, is conserved.

[5] Only the z component of the angular momentum of a conical pendulum is conserved w.r.t. the origin fixed at the point of suspension. SetId=55

[6] In the example of skew rod, the angular momentum changes with time and there is a non zero torque coming from action of forces other than gravitational forces. Hence the law of conservation of angular momentum dos not apply.

[7] In a system of a canon and a canon ball, total momentum of the system is zero before canon ball is fired. After firing the canon ball, the momentum of the system seems to be conserved as the ball moves forward and the canon moves backward.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then check if the laws is applicable or not.

So if there is no *net external force* acting on the system all the three conservation laws will hold.

[9] The non conservative force is a force with a property thet the work done between two points depends on path taken. If a particle moves along a curve path, to know about the work done by a non conservative force we should have the equation of the path along which the particle had move.The work done would be

WORK = INTEGRAL (F.dx)

The equation of conservation of mechanical energy for a non conservative force would be

SetId=55

$KE_{\text{final}} + PE_{final} = KE_{initial} + PE_{initial} + W_{nc}$

[10] A particle moves on a circular path. Then its speed, direction of force, velocity and acceleration must always change with time.

[11] Displacements, being vector quantity can not compared with, a scalar quantity such as distance.

[12] A particle is observed from two frames S_1 and S_2. The frame S_2 moves with respect to S_1 with an acceleration a. If F_1 and F_2 be the pseudoforces when seen from S_1 and S_2 respectively and if $F_1 = 0$ then we must have $F_2 \neq 0$

[13] When a bomb explodes the total mechanical energy is not conserved. But the total chemical energy and the mechanical energy is conserved.

[14] The kinetic energy of a body does not change if any one of the following is true
(i)force is always perpendicular to the velocity
(ii) the force is always perpendicular to the acceleration
(iii) the object remains stationary
(iv) the object moves in such a way that the point of application of the force remains fixed. SetId=55

[15] In a non-inertial frame of reference the accelration of the body that we measure, is not the true acceleration, as the frame itself accelerates.Thus,force(F=ma) is also not the true force acting on the body.The extra force added to make it a true value is called pseudo force.Thus pseudo force does not really act on a body but just compensates the change produced by the non inertial frame, in true acceleration.

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SetId=56

[1] Distance is equal to the length of the path covered. Displacement is the shortest distance between initial and final points.

[2] The law of conservation of angular momentum states that in absence of an external torque on an object or a closed system of objects the total angular momentum of the system remains constant. Thus if $\vec{\tau} = 0 => \vec{L} =$ constant where τ is the torque and $\vec{L}$ is the angular momentum of the system.

[3] A bob is attached to ceiling by a string and moves in a horizontal circular plane is an example. In this case the law of conservation of angular momentum does not hold.

[4] For the motion of the Earth around the sun, the total of angular momenta of the Earth and the Sun, is conserved in every inertial frame of reference; but the angular momentum of the Earth (or of the sun)is not conserved in every inertial frame.

[5] The z component of angular momentum of a conical pendulum is not conserved w.r.t. the origin fixed at the point of suspension; but the x and y components are conserved. SetId=56

[6] In the example of conical pendulum, the z- component of angular momentum does not change. This follows from the angular momentum conservation as there is no external torque.

[7] When applying the conservation laws of momentum, energy and angular momentum we must define the system first.Only then check if the laws is applicable or not.

As an example: when a ball is dropped from a height, it gains momentum down if we consider the ball as our system.This is because the force of gravity acts as an external force.

However, if we change our system and consider earth as a part of our system too, then the momentum remains conserved because the earth gains momentum up.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then check we should if the laws are applicable or not.

So if there is no *external force* acting on the system all the three quantities, total momentum is conserved. The total angular momentum is also because the torque of internal forces will be zero. The conservation of energy depends on the nature of forces. will be conserved.

[9] Nonconservative forces arise due to neglected degrees of freedom or from time dependent potentials. The work done by a nonconservative force depends upon the path taken. It causes a change in the mechanical energy of the system. It adds or removes mechanical energy from a system.

SetId=56

[10] A particle moves on a circular path. Then its speed, direction offorce, can remain constant by velocity and acceleration must always change with time.

[11] Distance depends on the path where as the displacement depends on the end point only

[12] If K is an inertial frame, any frame that moves w.r.t. the frame K with uniform velocity is also an inertial frame.

[13] When a ball rolls over a rough surface, it comes to stop after some time. This is because transational and rotational kinetic energy initially present in the ball continuosly gets converted to heat due to friction. When all the kinetic energy changes to heat, the ball stops. The total mechanical energy of the ball is not conserved.

[14] The total work done on a particle is always equal to the change in kinetic energy. SetId=56

[15] A force is any interaction which tends to change the motion of an object. It is *equal to* the rate of change of momentum by Newton's second law.

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SetId=57 [1] Distance is a scalar quantity where as the displacement is a vector quantity.

[2] If no net external torque acts on a system, the total angular momentum of the system remains constant.

[3] Consider a disc rotating about an axis perpendicular to its plane. On placing a smaller disc with its surface parallel to the surface of the rotating disc, the angular momentum of the system of two discs remains constant as there is no external torque.

[4] In the Sun Earth system the angular momentum of the Earth is conserved in every frame of reference

[5] Only the z component of angular momentum of a conical pendulum is conserved w.r.t. the origin fixed at the point of suspension. SetId=57

[6] In the example of conical pendulum, the x and$y$ components of angular momentum change. This follows from the angular momentum conservation as the z components external torque is zero and horizontal components of torque are non zero.

[7] Statement: Law of Conservation of energy states that "ENERGY CAN NEITHER BE CREATED NOR DESTROYED",but it can be changed from one form to other.

EXPLANATION: Statement implies that the total amount of energy in an isolated system remains constant although it may change forms. viz, kinetic energy may change to potential;chemical to electrical energies etc.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *net external force* acting on the system, the momentum is conserved. The definition of angular momentum and torque depends on the choice of axes, and therefore it may not be be conserved. The conservation of total energy holds only for conservative forces.

When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *net external force* acting on the system, the energy and momentum will be conserved. However, the total angular momentum may not be conserved because the torque may not be zero.

[9] The work done by a *Nonconservative Force *is not recoverable*.*The work done by a *Non Conservative force* is usually dissipated in the form of Heat and Sound.

SetId=57 Non conservative force *cannot* be expressed in the form of *Potential Energy*.

[10] A particle moves on a circular path. Then under suitable conditions its speed may remain constant, but the force, velocity and acceleration must always change with time.

[11] Distance equal to zero $\Rightarrow$ displacement=0; but Displacement=0

[12] If K is an inertial frame, any frame that moves w.r.t. the frame K with uniform speed is also an inertial frame.

[13] Let us consider that a pendulum is oscillating moving in a vertical plane. Mean while let another bob which is attached to a spring and is executing a simple harmonic motion in horizontal direction comes and hits the pendulum. Here conservation of momentum does not hold good as tension(external force) is acting on the system.(pendulum)

[14] A particle is acted upon by a force of constant magnitude which is always perpendicular to the velocity of the particle and the motion of the particle takes place in a plane, Then its kinetic energy, speed, velocity acceleration will not change. $\boxed{\text{SetId=57}}$

[15] Newton's laws are not valid on non-inertial frame of reference. So to validate Newton's laws of motion pseudo force (fictious or virtual force) is introduced.
Pseudo force acts in non-inertial frame. Its magnitude is always mass of the body multiplied by acceleration of the frame. It is always in direction opposite to the acceleration of the frame of reference. The resultant of pseudo forces and real forces is always zero.

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SetId=58

[1] The speed is rate of change of distance and the velocity is the rate of change of displacement.

[2] The law of conservation of angular momentum states that when no external torque is applied on an object or a closed system of objects about an axis, the angular momentum about that axis remains constant.

[3] Consider a man standing on a spinning platform. Initially, the man spreads out his arms and he spins with a certain angular velocity. The next moment, he pulls his arms inwards keeping them close to his body. We will observe that the angular velocity with which he is spinning now increases. This phenomenon can be explained by the Law Of Conservation of Angular momentum. Initially, since his arms were spread wide, his moment of inertia was large. However, when he pulled them close to his body, his moment of inertia decreased.
In this example the angular velocity of the man increases and therefore the angular momentum also increases.The law of conservation of angular momentum does not apply because the torque of muscular forces is not zero.

[4] In the motion of earth around sun, the angular momentum of the earth about an axis passing through the sun and perpendicular to the plane of motion of earth is conserved.

[5] The projection of angular momentum of a conical pendulum in the horizontal plane is a constant of motion when the origin is chosen to be at fixed at the point of suspension. SetId=58

[6] Example where law of conservation of angular momentum does not hold: A disc rotating on a horizontal rough surface will not have a constant angular momentum because there will be a constant torque by frictional force. Hence, its angular momentum will decrease, and the law of conservation of angular momentum does not apply.

[7] Oscillating simple pendulum is a very good example where potential energy gets converted to kinetic energy and kinetic to potential energy. Some energy gets dissipated as heat if we consider air resistance. Energy as a whole is conserved if we consider universe as system, the energy has just changed its form.

[8] In order to apply the law of conservation of momentum we must first identify the system. If there is no *net external forces* acting on the system then conservation laws of momentum always holds. The total energy and the total angular momentum may not be conserved.

[9] * A non conservative force is a force that acts on a particle(or point), such that the work done by this force in moving this particle from one point to another is

/dependent of path taken/ that is the work done depends on the path itself. * For example frictional force is non conservative because the work done by friction always acts in the direction of travel and therefore depends on length L of the path taken.

SetId=58

[10] A particle moves on a circular path. Then under suitable conditions its speed and acceleration may remain constant, but the force, and velocity must always change with time.

[11] If P and Q are the initial and the final points of a path of a particle, displacement is a vector whose direction is along PQ and has magnitude is equal to the length of line PQ

[12] A frame rotating w.r.t K with uniform angular velocity is also an inertial frame.

[13] The law of conservation of momentum does not hold in relativistic situations, i.e., where the speeds of the masses involved are close to the speed of light.

[14] The kinetic energy of a particle is continuously increasing with time, then the angle bewteen the net force and the velocity cannot be greater than or equal to 90^{o} at any time.

SetId=58

[15] These forces are non-real forces but must be taken into account while applying Newton's Law's of Motion in accelerating frame of reference as compared to an inertial frame of reference.

The centrifugal and centripetal forces are examples of pesudo-forces.

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SetId=59

[1] For any type of translational motion of a body, the displacement cannot be zero, where as the distance travelled can be zero.

[2] The angular momentum of a given system of bodies shall remain conserved unless acted upon by an external unbalanced torque.

[3] In the Sun-Earth system, angular momentum of the earth is not conserved but the total angular momentum of the sun and the earth is constant of motion.

[4] For the motion of earth around sun, the angular momentum of the earth about the center of mass of the sun + earth system and perpendicular to the plane of motion of earth is conserved.

[5] The law of angular momentum of a is not applicable for the conical pendulum conserved w.r.t. the origin fixed at the point of suspension. SetId=59

[6] Example where law of conservation of angular momentum does not hold:Consider a vertical stick on the ground falling to a horizontal position. During the fall, the conservation of angular momentum applied at the point of rotation on the ground and perpendicular to the plane of the stick is not applicable as, the gravitational force which acts vertically downwards assumed at the centre of mass produces an external torque about the axis of rotation

[7] Law of conservation of momentum does not hold whenever an external force or impulse acts on the system. For example,when a body collides with earth then it bounces back to a lesser height as it loses some velocity.

In this example the momentum of a ball is not conserved due to impulsive force by ground in the normal direction.

However, strictly speaking the system that should be considered here is the ball-earth system and the total momentum is conserved.

[8] In order to apply the law of conservation of momentum we must first identify the system. Then even if there is no *net external forces* acting on the system, all the three conservation laws of momentum, angular momentum and energy may not hold due to presence of internal forces.

[9] A force with the property that the work done in moving a particle is dependent on the path followed. The work done by a conservative force in moving a body from an initial location to a final location is dependent on the path taken between the two points

SetId=59

[10] When the force is kept constant as function of time, it is possible for a particle to move on a circular path in such a way that its speed remains constant, but the velocity and acceleration must always change with time.

[11] If P and Q are the initial and the final points of a path of a particle,the displacement is the vector $\overrightarrow{PQ}$.

[12] The Newton's Laws of motion will hold in all frames which are at rest w.r.t. K but do not remain valid in a frame that move with respect to K.

[13] when we are in accelerating frame if we observe any collision between two bodies then the law of conservation of momentum does not hold in that frame of reference.

[14] A heavy body is attached from a spring and is held at point A and is such that the spring is not slack nor is it stretched. It is then released. It goes down upto a point B and then it rises upto point C and executes an oscillatory motion between B and C. During the motion from A to C is first positive (from A to B) and then it is negative from B to A and again remains negative from A to C. SetId=59

[15] When observing our system from a reference frame which is accelerating compared to an inertial frame,in order to make it easier to apply newtons laws, we can apply a pseudo force on all objects in the universe proportional to their mass capable of causing an acceleration equal and opposite to that of our reference frame. Hence serving to in a way "stop"(or make inertial) our reference frame, and making it easier for us to investigate the motion.

This application of pseudo force doesn't change the motion of the object because just as we can choose an arbitrary reference frame, we can choose an arbitrary force to cause the same acceleration in every object in the whole universe without changing the relative motions of objects. (as all motion is truly relative, we will still get correct answers for our investigations.

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SetId=60

[1] Displacements, being vector quantity can not compared with, a scalar quantity such as distance.

[2] When the net external torque acting on a system about a given axis is zero, the total angular momentum of the system about that axis remains consant.

[3] Consider a disc and a man system. man is standing on center of the disc rotating with angular velocity.initially man folded his hand.when man stretches his hands then momentum of inertia of system increases.and angular velocity decreases.and total angular momentum remains constant.

[4] In the Sun Earth system the angular momentum of the Earth about the pole star is conserved

[5] The law of angular momentum of a is not applicable for the conical pendulum conserved when the origin is chosen to be at the pendulum bob itself. SetId=60

[6] We have a conical pendulum .The forces acting on the bob are tension (along the direction of the string) and gravitational force acting in the vertically downward direction.we have an additional force called the drag force which is tangential to the motion of the bob and acts in the direction opposite to the motion of the bob.The axis of rotation passes through the hinge point and is vertical.The torque due to tension is 0 because the force passes through the axis of rotation.The torque due to mg is also zero since it is parallel to the axis of rotation.but the torque due to drag force is not zero.since the net external torque acting on the bob is not zero,therefore the law of conservation of angular momentum does not hold here

[7] If a bullet hits a wooden board and gets embedded in the board, the total energy and the total momentum of the bullet and the board are conserved.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then check we should if the laws are applicable or not.

So if there is no *external force* acting on the system all the three quantities, total momentum, total angular momentum, and total kinetic energy will be conserved independent of the nature of forces.

[9] The work done by non conservative force is dependent on the path taken by the particle in reaching final position from initial position. Non conservative force depends on the distance travelled by the particle

SetId=60

[10] It is not possible for a particle to move on a circular path in such a way that its speed and force remains constant, and only the velocity and acceleration may (or may not) always change with time.

[11] If two bodies starting from a point A reach a point B, following different paths, their displacement will be, in general different, but the distances covered will always be the same.

[12] Staying inside a bullet train moving with constant velocity (no jerks etc) an experiment can always be performed which will tell us the numerical velocity of the bullet train

[13] Give an example where law of conservation of momentum does not hold all cases when seen from non inertial frame of references for example when we see two cars collide from a moving bus there momentum is not conserved

[14] The kinetic energy of a body does not change if any one of the following is true
(i)force is always perpendicular to the velocity
(ii) the force is always perpendicular to the acceleration
(iii) the object remains stationary
(iv) the object moves in such a way that the point of application of the force remains fixed. SetId=60

[15] Various types of forces in nature can be grouped in four categories:
(a)Gravitational; (b)Electromagnetic; (c)Nuclear; (d)Weak
There are also some non-fundamental forces such as:
(i)Normal reaction on bodies in contact with surfaces , (ii) Friction,(iii) Tension,(iv)Elastic force.

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[1] Distance depends on the path where as the displacement depends on the end point only.

[2] This law sates that when no net torque of all forces acts on a object or a system of objects then total angular momentum of system is conserved.The angular momentum before an event is equal to angular momentum after that event.mathematically explained by when, net torque=0 ;then, total angular momentum(L)=constant.

[3] The conservation of angular momentum of a system of bodies requires that the the sum of torque due to all forces be equal to zero. Now consider a situation where the forces are such that the sum of torques of external forces is zero w.r.t. some axes K. Since the value of torque depends of the choices of axes, the sum of torques due to all internal forces will depend on the choice of axes and in general it will be non zero. Therefore, for a system of several bodies, for a given choice of axes K, there will be situations when the total angular momentum may not be conserved.

[4] For the motion of earth around sun, the angular momentum of the sun about the center of mass of the sun + earth system and perpendicular to the orbital plane of earth is conserved.

For the motion of earth around sun, the angular momentum of the sun about and axis passing through the Earth and perpendicular to the orbital plane of motion of earth is conserved.

[5] The three components of angular momentum of a conical pendulum is conserved w.r.t. the origin at the position of the center of mass of the pendulum. SetId=61

[6] When you release a toy gyroscope on its pedestal, it initially has no precessional rotation around that pedestal, i.e, the orientation of rotation is fixed. However, it instantaneously starts precessing around the pedestal. Both Kinetic Energy and Angular Momentum now exist where they did not exist a moment earlier. The Kinetic Energy is easy to explain, as appearing due to the body of the gyroscope dropping a tiny fraction of a millimeter in the Earth's gravitational field, giving up exactly the correct amount of Potential Energy. But the Angular Momentum of the Precession which just appeared, does not come from anywhere. This is therefore a Violation of the Conservation of Angular Momentum.

[7] If a bullet hits a wooden board and gets embedded in the board, the total energy of the bullet and the board system is conserved but the total momentum is not conserved.

[8] If we want to apply the conservation laws of momentum, energy and angular momentum, we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *external force* acting on the system, the momentum and angular momentum will be conserved, and depending on the nature of the forces but total energy may or may not be conserved.

[9] The work done by non conservative force is dependent on the path taken by the particle in reaching final position from initial position. Non conservative force depends on the distance travelled by the particle

SetId=61

[10] For a particle moving on circle the acceleration is always constant in magnitude and directed towards the centre of the circle.

[11] Distance is equal to the length of the path covered. Displacement is the shortest distance between initial and final points.

[12] Staying inside a bullet train moving with constant velocity (no jerks etc) an experiment can always be performed which will tell us the numerical value of the acceleration of the bullet train

[13] When a tennis ball hits the ground at an oblique angle, the angle of reflection is equal to the angle of incidence. This is a simple consequence of conservation of horizontal component of momentum.

[14] The total work done on a particle is always equal to the change in kinetic energy. SetId=61

[15] A force is agency that which changes or tends to change the state of rest or motion of a body.

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SetId=62

[1] Distance equal to zero implies displacement=0; and Displacement=0 also implies distance = 0

[2] Statement of Law of Conservation of Angular Momentum:
Differentiating $\vec{L} = \vec{r} \times \vec{p}$ w.r.t, time,

$$\begin{aligned} \frac{dL}{dt} &= \frac{d\vec{r} \times \vec{p}}{dt} = \frac{d\vec{r}}{dt} \times \vec{p} + \vec{r} \times \frac{d\vec{p}}{dt} = \vec{v} \times (m\vec{v}) + \vec{r} \times \vec{F} \\ &= \vec{r} \times \vec{F} (\because v \times v = 0) \\ &= \vec{\tau} \end{aligned}$$

here $\vec{\tau}$ represents the net torque acting on a rigid body rotating about a fixed axis.This torque must take into account of all the forces, be it external or internal forces

[3] Example where law of conservation of angular momentum does not hold:
When there is external force like frictional force acting on a object when it is rotating we cannot use conservation of angular momentum as the friction force acting on the object produces an external torque.

[4] For the motion of earth around sun, the sum of angular momenta of the Sun and the Earth about the center of mass of the sun + earth system is conserved.

[5] Only the z component of the angular momentum of a conical pendulum is conserved w.r.t. the origin fixed at the point of suspension. SetId=62

[6] There is no case where LAW OF CONSERVATION OF ANGULAR MOMENTUM does'nt hold.But there are cases where conservation of angular momentum does not hold.A body in vertical circular motion is an example where angular momentum is not conserved. Here the law of conservation does not apply.

[7] If a bullet hits a wooden board and gets embedded in the board, both total energy and the total momentum of the bullet and the board are not conserved.

[8] To apply the conservation laws of momentum, energy and angular momentum, we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *external force* acting on the system, the energy and momentum will be conserved. However, depending on the nature of the system and of the forces, the total angular momentum may not be conserved.

[9] Nonconservative forces are those forces in which the work done in moving a particle is dependant on the path taken to cover the distance. Some energy woul be lost to the environment in the form of heat, sound, etc. The energy in the final state is less
SetId=62 than that in the initial state.

[10] The motion of a bomb dropped from a plane does is not a uniform motion as it follows a parabolic path and not a straight line path.

[11] Distance is a scalar quantity where as the displacement is a vector quantity.

[12] Assume bullet train, moving with out any jerks, is going on a circular arc of radius R with constant speed. Then an experiment is to be performed entirely within the train without any measurement on objects outside the train. Such an experiment can tell only radius of the track.

[13] when a ball is dropped from a height, it gains momentum down if we consider the ball as our system.This is because the force of gravity acts as an external force.

However, if we change our system and consider earth as a part of our system too, then the momentum remains conserved because the earth gains momentum up.

[14] A particle is acted upon by a force of constant magnitude which is always perpendicular to the velocity of the particle and the motion of the particle takes place in a plane, Then its kinetic energy, speed, velocity acceleration will not change. SetId=62

[15] The forces may be of the following two types - *Contact forces* (those that act when bodies are in physical contact) eg. friction, normal reaction, bouyancy etc. and*Action-at-a-distance forces* (those that act when bodies are not in contact) eg. Gravity, electostatic forces, magnetic forces etc. There At the root level, forces are of the following fundamental types :- (a) *Gravitational forces* - weakest of all forces, always attractive
(b) *Electromagnetic forces* - stronger than gravitational forces, can be attractive or repulsive,
(c) *Nuclear forces* - exist at atomic level, have very short range,
(d) *Weak nuclear forces* associated with beta particle emission

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[1] If P and Q are the initial and the final points of a path of a particle, displacement is a vector whose direction is along PQ and has magnitude is equal to the length of line PQ

[2] Statement of Law of Conservation of Angular Momentum: For a system of many particles The net torque due all the forces, be it external or internal forces. But as the torque due to all the internal forces cancel out, it sufficient to consider the external forces acting on the system.

[3] A bob attached to a ceiling by a string moving in a horizontal circular plane is an example where the total angular momentum of the bob about the point of suspension is not conserved. This is because the the torque due to the weight of the bob about the point of suspension does not vanish and has non zero horizontal component. Only the vertical component of the angular component is conserved.

[4] For the motion of the Earth around the sun, the total of angular momenta of the Earth and the Sun, about in a reference frame fixed in the pole star, is conserved.

[5] The z component of angular momentum of a conical pendulum is not conserved w.r.t. the origin fixed at the point of suspension; but the x and y components are conserved. SetId=63

[6] A sphere rolling on a rough surface.Due to friction there is external torque so the angular momentum changes which results in the slowing of the sphere. The angular momentum keeps changing. Even in case like this one, it is wrong to say that the Law of Angular Momentum Conservation does not hold.

[7] There are certain situations where it appears that the law of conservation of linear momentum does not hold. For example if we take some amount of a substance like construction putty, cement, cake batter, playing dough,etc and drop it on the ground, it does not bounce back like a rubber ball would and hence the momentum it had before striking the ground seems to have been lost. Hence it appears that the law of conservation of linear momentum does not hold.

[8] In order to apply the law of conservation of momentum we must first identify the system. If there is no *external forces* acting on the system then conservation laws of momentum always holds. And depending on the nature of the system and of the forces, the total kinetic energy and the total angular momentum may not be conserved.

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[9] The work done by such forces depends on the path taken. The work done cannot be represented as a potential energy function.Work done by such forces is always negative.

[10] A wagon sliding on a roller coaster designed in such a way that the wagon covers equal distances in equal times. As the motion of the wagon is uniform, there will be no net force acting on it.

[11] Both displacement and distance tell us about the motion of a body but their study does not tell much about the forces on the body

[12] Assume bullet train, moving with out any jerks, is going on a circular arc of radius R with constant speed. Then an experiment is to be performed entirely within the train without any measurement on objects outside the train. Such an experiment can tell both speed of the train and radius of the track.

[13] There is no known exception to the law of conservation of momentum in classical mechanics however when two bodies collide and their mass converts to energy, an exception in nuclear physics is observed. In real life this is observed in nuclear reactions at atomic level.

[14] The kinetic energy of a particle is continuously increasing with time, then the angle bewteen the net force and the velocity cannot be greater than or equal to 90^o at any time. SetId=63

[15] The main differences between force and pseudo force are -
(1) Forces have a real presence while pseudo forces don't.
(2) Forces can be accounted for by Newton's laws.
(3) Pseudo forces are only taken into account when the reference frame is accelerated.

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[1] If P and Q are the initial and the final points of a path of a particle,the displacement is the vector $\overrightarrow{PQ}$.

[2] Depending on the torques acting on a system, the angular momentum can be conserved only in one or two directions, but may not be conserved in all. For instance, if an isolated body has no torque acting on it only in the direction along the Z axis, then the angular momentum is conserved only in that direction.

[3] Law of conservation of angular momentum holds in case of long jump. When a athlete takes off from the ground in a running long jump, the forces on the launching foot give the athlete an angular momentum with a forward rotation around a horizontal axis. Such rotation would not allow the jumper to land properly. In the landing, the legs should be together and extended forward at an angle so that the heels mark the sand at the greatest distance. Once airborne, the angular momentum cannot change (it is conserved) because no external torque acts to change it. However, the jumper can shift most of the angular momentum to the arms by rotating them in windmill fashion. Then the body remains upright in the proper orientation of landing.

[4] For the motion of the Earth around the sun, the total of angular momenta of the Earth and the Sun, is conserved in every inertial frame of reference; but the angular momentum of the Earth (or of the sun)is not conserved in every inertial frame.

[5] Only the z component of angular momentum of a conical pendulum is conserved w.r.t. the origin fixed at the point of suspension. SetId=64

[6] Consider a rod of length l. Let us give an impulse to one end . Now the angular momentum about the oposite end is not zero since the impulse provides some torque . So the angular momentum is not conserved .

$$\text{torque} = \text{impulse} * \ell.$$

$d\ell/dt$ is not equal to zero and the law of conservation of angular momentum does not hold.

[7] A tennis ball is dropped from height h and after hitting the ground and it bounces back and rises to the same height. In this case the momentum of the ball is conserved because (under ideal conditions) the momentum after it hits the ground will be equal to the momentum it had before hitting the ground.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then check if the laws is applicable or not.

So if there is no *net external force* acting on the system all the three conservation laws will hold.

SetId=64

[9] A nonconservative force is a force with the property that the work done in moving a particle depends on the path taken.Also, the net work done in a closed loop is non zero.

[10] A simple pendulum moves along a circular arc and does not have constant speed and therefore its motion is not uniform.

[11] Displacement is the shortest distance between initial and final points with direction specified.

[12] Assume bullet train, moving with out any jerks, is going on a circular arc of radius R with constant speed. Then an experiment is to be performed entirely within the train without any measurement on objects outside the train. Such an experiment can tell only speed of the track.

[13] When there is no external forces act on a system of many particles, and there are only internal forces acting on the particles. The third law gives that the internal forces are pairwise equal and opposite.Thus the sum of internal forces is zero and the momentum of each particle is conserved.

[14] A heavy body is attached from a spring and is held at point A and is such that the spring is not slack nor is it stretched. It is then released. It goes down upto a point B and then it rises upto point C and executes an oscillatory motion between B and C. During the motion from A to C is first positive (from A to B) and then it is negative from B to A and again remains negative from A to C. SetId=64

[15] A force is any interaction which tends to change the motion of an object. It is also *defined* as rate of change of momentum. It is a vector quantity.

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[1] If two bodies starting from a point A reach a point B, following different paths, their displacement will be, in general different, but the distances covered will always be the same.

[2] According to Law of Conservation of Angular momentum,if no external torque acts on an object or system of objects,angular momentum of an object or system of objects remains CONSTANT or no change in angular momentum can occur.

Also it states that,only external torque can change angular momentm of the system where as the torque produced by internal forces can not change the angular momentum of the system

[3] The total angular momentum of a body remains constant of motion when the net torque of the external forces acting on the body is zero.
In general, we have a system of particles such that the net torque of the external forces on the system, w.r.t. some axes K, is zero, the total angular momentum may not remain conserved, because the torque due to the internal forces may not be zero.

[4] In the Sun Earth system the angular momentum of the Earth is conserved in every frame of reference

[5] The projection of angular momentum of a conical pendulum in the horizontal plane is a constant of motion when the origin is chosen to be at fixed at the point of suspension. SetId=65

[6] Let us consider a rotating skew rod. In the absence of friction or any other drag force, the rod should continuously spin without stopping. Here the net torque about the axis of rotation is 0 and hence angular momentum is conserved. It therefore follows from law of conservation of angular momentum that a spinning skew rod will keep rotating with constant angular velocity if there is no external torque. So law of conservation of angular momentum does not hold.

[7] Law of conservation of momentum does not hold when Newton's laws are not valid, e.g. in a non-inertial frame of reference. For example, when we consider collision between two bodies in a non-inertial frame of reference, the law of conservation of momentum cannot be applied because there will be a pseudo force acting on the frame itself.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then check we should if the laws are applicable or not.

So if there is no *external force* acting on the system all the three quantities, total momentum is conserved. The total angular momentum is also because the torque

of internal forces will be zero. The conservation of energy depends on the nature of forces. will be conserved.

[9] A force whose work done is a path function is called a non-conservative force. All the forces which do not satisfy the definition of conservative forces are non-conservative in nature. The work done by these forces dissipates into heat energy, sound energy, light energy, etc. Therefore, law of conservation of mechanical energy cannot be applied to a system on which a non-conservative force is acting. No potential function can be defined for these forces.

SetId=65

[10] A satellite goes around the earth in a circular orbit of 600km with a time period of $5.8 \times 10^3 s$. Its motion will be uniform as it will cover equal distances in equal times.

[11] Displacements, being vector quantity can not compared with, a scalar quantity such as distance.

[12] A particle is observed from two frames S_1 and S_2. The frame S_2 moves with respect to S_1 with an acceleration a. If F_1 and F_2 be the pseudoforces when seen from S_1 and S_2 respectively it is not possible to have $F_1 = F_2 = 0$

[13] During collision of billiard balls momentum is conserved. During explosion of a bomb also momentum is conserved and the total momentum of the fragments of bomb will be zero. This is because all the forces are only internal forces.

[14] The kinetic energy of a body does not change if any one of the following is true
(i)force is always perpendicular to the velocity
(ii) the force is always perpendicular to the acceleration
(iii) the object remains stationary
(iv) the object moves in such a way that the point of application of the force remains fixed.

SetId=65

[15] Explain Pseudo Force: While applying Newton's laws of motion in non-inertial frame of reference it gives answers which contradict observations. Thus, to account for this,using Newton's Laws, we introduce a "fake" or pseudo force which gives answers that match the observations in a non-inertial frame.

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[1] Displacement is equal to the vector difference $\vec{r}_f - \vec{r}_i$ of the position vectors of initial and final points. The distance covered will be $|\vec{r}_f - \vec{r}_i|$

[2] The law of conservation of angular momentum states that when the net external torque acting on the system is zero, then the angular momentum of the system remains constant.both the initial and final momentum should be taken from a fixed inertial frame of reference provided.

[3] An example where law of conservation of angular momentum holds:
The Law of conservation of angular momentum holds in the case of a ballet dancer performing a pirouette.

When the dancer extends her arms outward, the angular velocity of her rotation decreases whereas when she keeps her arms close to her body, the angular velocity increases. This is because her moment of inertia changes as she moves her arms outward and inward. It can be noted that she as a system has no external torque acting upon her.

[4] In the motion of earth around sun, the angular momentum of the earth about an axis passing through the sun and perpendicular to the plane of motion of earth is conserved.

[5] The law of angular momentum of a is not applicable for the conical pendulum conserved w.r.t. the origin fixed at the point of suspension. SetId=66

[6] In the example of skew rod the angular velocity does not change even though the torque applied is nonzero. However there is no contradiction as in this case the law of conservation of momentum is not applicable. conservation is violated.

[7] If I throw a ball upward, it's speed decreases as it rises upwards. There is an external force (gravity) acting on the ball, so the momentum conservation law does not apply. Momentum of the ball is not conserved, however the momentum of the Earth-ball system is conserved as gravity will become an internal force in this case.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *net external force* acting on the system, the momentum is conserved. The definition of angular momentum and torque depends on the choice of axes, and therefore it may not be be conserved. The conservation of total energy holds only for conservative forces.

When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *net external force* acting on the system, the energy and momentum will be conserved. However, the total angular momentum may not be conserved because the torque may not be zero.

[9] *Non conservative forces* are the type of forces in which the work done by the forces is purely dependent on the path taken by the body.Thus the net work done by the forces in cyclic path is never equal to zero.

SetId=66

[10] A uniform motion is defined to be the one in which a body covers equal distances in equal time intervals.

[11] Distance depends on the path where as the displacement depends on the end point only

[12] A particle is observed from two frames S_1 and S_2. The frame S_2 moves with respect to S_1 with an acceleration a. If F_1 and F_2 be the pseudoforces when seen from S_1 and S_2 respectively and if $F_1 = 0$ then we must have $F_2 \neq 0$

[13] Give an example where law of conservation of momentum holds: A mass exploding into several pieces in a conservative field like gravitational field(if air resistance is neglected), obeys law of conservation of momentum. If air resistance cannot be neglected then the law of conservation of momentum will not hold.

[14] The total work done on a particle is always equal to the change in kinetic energy. SetId=66

[15] When a train is at rest and a ball is hung from the ceiling with a string, an observer in the train sees that the string is vertical. But when the train starts moving, the observer sees that the string makes an angle with the vertical and is tilted in forward direction . This means that some force other than gravity and tension must act on the ball. That force is the pseudo force.

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[1] Distance is equal to the length of the path covered. Displacement is the shortest distance between initial and final points.

SetId=67

[2] The law of conservation of angular momentum states that The total angular momentum of a system is constant in both magnitude and direction if the resultant torque, of the external forces acting on the system, is zero.

[3] In case of a skater, who can be considered an isolated system, so no torue will be acting on him/her. When the arms are extended, the moment of inertia is more. When his hands are closely held, the moment of inertia is lesser. Since the angular momentum is same, the angular acceleration changes accordingly.

[4] For the motion of earth around sun, the angular momentum of the earth about the center of mass of the sun + earth system and perpendicular to the plane of motion of earth is conserved.

[5] The law of angular momentum of a is not applicable for the conical pendulum conserved when the origin is chosen to be at the pendulum bob itself. SetId=67

[6] Example where law of conservation of angular momentum does not hold:If a particle undergoes conical motion and the only force acting on particle is central force like tension of the string.Then total external torque about fixed point A is zero,yet angular momentum is not conserved,as angular momentum keeps on changing direction.

[7] A soldier accelerating away, after detonating a bomb, will find that the total momentum of the fragments of the bomb is zero. This is an example where the law of conservation of momentum holds as the forces on the fragments are internal forces only and sum of all such forces is zero.

[8] In order to apply the law of conservation of momentum we must first identify the system. If there is no *net external forces* acting on the system then conservation laws of momentum always holds. The total energy and the total angular momentum may not be conserved.

[9] Non-conservative forces are path-dependent forces, i.e. the work done on a body by these forces depends on the path taken by the body. Mechanical energy of a system is not conserved when a conservative force acts on it but the total energy is conserved. Therefore, the mechanical energy lost by the system is liberated in some other form such as light energy, heat energy, etc.

For example, when a body is moving along a surface, frictional force acts on the body as well. Due to this frictional force, the body loses its mechanical energy, and this loss is generally released in the form of heat energy to the surroundings. Thus, the mechanical energy will not be conserved and frictional force can be classified as a non-conservative force.

SetId=67

[10] A particle moves on a circular path. Then its speed, direction of force, velocity and acceleration must always change with time.

[11] Distance equal to zero $\Rightarrow$ displacement=0; but Displacement=0

[12] If K is an inertial frame, any frame that moves w.r.t. the frame K with uniform velocity is also an inertial frame.

[13] Also a good example of law of conservation momentum can be seen when a bullet from a rifle is fired.As the bullet is fired and gets out of the rifle, the rifle gives a backward jerk due to the phenomenon of conservation of momentum.

[14] A particle is acted upon by a force of constant magnitude which is always perpendicular to the velocity of the particle and the motion of the particle takes place in a plane, Then its kinetic energy, speed, velocity acceleration will not change. SetId=67

[15] Since newton's laws are not valid in non-inertial frames, pseudoforces (which do not exist in reality) are used to help us formualate and use Newton's laws of motion in non-inertial frames.

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SetId=68

[1] Distance is a scalar quantity where as the displacement is a vector quantity.

[2] If the net external torque acting on a system is zero,the angular momentum L(vector) of the system remains constant,no matter what changes take place within the system.L(vector)=a constant (net external torque acting on system is zero)

[3] Example where law of conservation of angular momentum holds:
Let us assume a student seated on a stool that can rotate freely about a vertical axis. The student has been set into rotation at a modest initial angular speed ω . He holds two dumbbells in his outstretched hands. His angular momentum vector L lies along the vertical rotation axis, pointing upwards. Now he pulls in his arms;this action reduces his rotational inertia from its value I_{initial} to a final value I_{final} because he moves the mass closer to the rotational axis. His rate of rotation increases markedly, from ω_{initial} to ω_{final}. The student can then slow down by extending his arms once more,moving the dumbbells outward. No external torque acts on the system consisting of the student, stool and the dumbbells. Thus the angular momentum of the system about the rotational axis remains constant. $I_{\text{initial}} * \omega_{\text{initial}} = I_{\text{final}} * \omega_{\text{final}}$.

[4] In the Sun Earth system the angular momentum of the Earth about the pole star is conserved

[5] The three components of angular momentum of a conical pendulum is conserved w.r.t. the origin at the position of the center of mass of the pendulum. SetId=68

[6] A nonzero torque always causes the angular velocity to change, because a change in angular momentum means a change in angular velocity $L = I\omega$

[7] There is no known exception to the law of conservation of momentum in classical mechanics However, an exception to conservation of energy in nuclear physics is observed. In nuclear reactions when two nuclei collide and their mass converts to energy and energy momentum are not conserved.

[8] In order to apply the law of conservation of momentum we must first identify the system. Then even if there is no *net external forces* acting on the system, all the three conservation laws of momentum, angular momentum and energy may not hold due to presence of internal forces.

[9] It is a force for which the work done by that force on an object or a particle in moving it between any two points depends on its path travelled.This force doesn't conserves the mechanical energy.The work done by a non-conservative force on an object in moving it in a circular path is not equal to zero.

SetId=68

[10] A particle moves on a circular path. Then its speed, direction offorce, can remain constant by velocity and acceleration must always change with time.

[11] If P and Q are the initial and the final points of a path of a particle, displacement is a vector whose direction is along PQ and has magnitude is equal to the length of line PQ

[12] If K is an inertial frame, any frame that moves w.r.t. the frame K with uniform speed is also an inertial frame.

[13] when a man walks on the ice slab where friction does not exist between the ice block and the floor but between the feet of the man and the slab the slab moves back as per the law of conservation of momentum

[14] The kinetic energy of a particle is continuously increasing with time, then the angle bewteen the net force and the velocity cannot be greater than or equal to 90^{o} at any time. SetId=68

[15] Force is defined as the rate of change of linear momentum. In other words it is the agency which changes or tends to change the (a) State of rest; (b)State of uniform motion (c) Direction of body's motion; (d) Shape of the body

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SetId=69

[1] The speed is rate of change of distance and the velocity is the rate of change of displacement.

[2] The Law of conservation of angular momentum states that when no external torque acts on an object or a closed system of objects undergoing motion about a given axis, the change in angular momentum is zero. Therefore, considering an event where only internal torque or no torque is involved, the total angular momentum of the system before the event is equal to the total angular momentum after the event

[3] A bob is attached to ceiling by a string and moves in a horizontal circular plane is an example. In this case the law of conservation of angular momentum does not hold.

[4] For the motion of earth around sun, the angular momentum of the sun about the center of mass of the sun + earth system and perpendicular to the orbital plane of earth is conserved.

For the motion of earth around sun, the angular momentum of the sun about and axis passing through the Earth and perpendicular to the orbital plane of motion of earth is conserved.

[5] Only the z component of the angular momentum of a conical pendulum is conserved w.r.t. the origin fixed at the point of suspension. SetId=69

[6] A nonzero torque always implies change in angular momentum and may not give rise to a change in magnitude of angular velocity. A non zero torque may mean change only the direction of the angular momentum and not the angular velocity.

[7] In a system of a canon and a canon ball, total momentum of the system is zero before canon ball is fired. After firing the canon ball, the momentum of the system seems to be conserved as the ball moves forward and the canon moves backward.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then check we should if the laws are applicable or not.

So if there is no *external force* acting on the system all the three quantities, total momentum, total angular momentum, and total kinetic energy will be conserved independent of the nature of forces.

[9] Explain Nonconservative force: This force is just opposite to that of conservative force. The work done by this force depends on the path taken by the particle on which the force is applied.This force does not conserve mechanical energy.If a particle travels in a closed loop, the net work done by a non consevative force is non zero.

SetId=69

[10] A particle moves on a circular path. Then under suitable conditions its speed may remain constant, but the force, velocity and acceleration must always change with time.

[11] If P and Q are the initial and the final points of a path of a particle,the displacement is the vector $\overrightarrow{PQ}$.

[12] A frame rotating w.r.t K with uniform angular velocity is also an inertial frame.

[13] When a freely falling rigid body collides another body in its path momentum the system of two particles is not conserved in the collision as there is external force mg acting on the system.

[14] A heavy body is attached from a spring and is held at point A and is such that the spring is not slack nor is it stretched. It is then released. It goes down upto a point B and then it rises upto point C and executes an oscillatory motion between B and C. During the motion from A to C is first positive (from A to B) and then it is negative from B to A and again remains negative from A to C. SetId=69

[15] Real forces have their origin in matter such as electricity, gravitation etc., while pseudo forces are caused by inertial motion.

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ASSIGNMENT-II **Due On : Nov 18, 2014**

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SetId=70

[1] For any type of translational motion of a body, the displacement cannot be zero, where as the distance travelled can be zero.

[2] The law of conservation of angular momentum states that when no external torque acts on an object or a closed system of objects, no change of angular momentum can occur. Hence, the angular momentum before an event involving only internal torques or no torques is equal to the angular momentum after the event . Angular momentum can be calculated with the help of the formula $L = I\omega$ where L stands for Angular momentum, I stands for moment of inertia and ω stands for angular velocity

[3] Consider a disc rotating about an axis perpendicular to its plane. On placing a smaller disc with its surface parallel to the surface of the rotating disc, the angular momentum of the system of two discs remains constant as there is no external torque.

[4] For the motion of earth around sun, the sum of angular momenta of the Sun and the Earth about the center of mass of the sun + earth system is conserved.

[5] The z component of angular momentum of a conical pendulum is not conserved w.r.t. the origin fixed at the point of suspension; but the x and y components are conserved. SetId=70

[6] In the example of a rotating skew rod the torque due to the external gravitational forces is zero , but the angular momentum is not constant Therefore the law of conservation of angular momentum is violated.

[7] When applying the conservation laws of momentum, energy and angular momentum we must define the system first.Only then check if the laws is applicable or not.

As an example: when a ball is dropped from a height, it gains momentum down if we consider the ball as our system.This is because the force of gravity acts as an external force.

However, if we change our system and consider earth as a part of our system too, then the momentum remains conserved because the earth gains momentum up.

[8] If we want to apply the conservation laws of momentum, energy and angular momentum, we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *external force* acting on the system, the momentum and angular momentum will be conserved, and depending on the nature of the forces but total energy may or may not be conserved.

[9] Non conservative force is the force in which the work done by a particle in going from one point to another is path dependent.

For non conservative forces mechanical energy is not conserved,mostly lost in the form of heat and light.The work done by a non conservative force is equal to the change in mechanical energy.

SetId=70 For non conservative force $E_{\text{initial}} > E_{\text{final}}$

[10] A particle moves on a circular path. Then under suitable conditions its speed and acceleration may remain constant, but the force, and velocity must always change with time.

[11] If two bodies starting from a point A reach a point B, following different paths, their displacement will be, in general different, but the distances covered will always be the same.

[12] The Newton's Laws of motion will hold in all frames which are at rest w.r.t. K but do not remain valid in a frame that move with respect to K.

[13] If we take some amount of a substance like construction putty, cement, cake batter, playing dough,etc and drop it on the ground, it does not bounce back, like a rubber ball would bounce, and hence the momentum it had before striking the ground seems to have been lost. Hence it appears that the law of conservation of linear momentum does not hold.

[14] The kinetic energy of a body does not change if any one of the following is true
(i)force is always perpendicular to the velocity
(ii) the force is always perpendicular to the acceleration
(iii) the object remains stationary
(iv) the object moves in such a way that the point of application of the force remains fixed. SetId=70

[15] 1)When we start rolling a body on a rough ground, it stops rolling after certain period because of frictional force.
2)When we leave a body from a certain height, it falls due to the act of gravitational force.

1)When a body is rotating in a circular path due to the centrifugal force which is the pseudo force. 2) When the lift is accelerating upwards, the upwards force felt by passengers a pseudo force.

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SetId=71

[1] Displacements, being vector quantity can not compared with, a scalar quantity such as distance.

[2] Newton's Second Law of Motion is defined by the expression $F = \frac{dp}{dT}$, where F gives the force vector acting on the system and p gives its momentum vector; in linear motion. A similar expression can be written to describe angular motion, i.e. : $\tau = \frac{dL}{dt}$, where τ is the external torque vector acting on the system, and L is the angular momentum.

If the external torque on the system is zero, then we get the expression as: dL/dt=0. This points out to the fact that, when no external torque is acting on the system, then its angular momentum is constant, no matter what changes occur in the system. This is the Law of Conservation Of Angular Momentum.

[3] Consider a man standing on a spinning platform. Initially, the man spreads out his arms and he spins with a certain angular velocity. The next moment, he pulls his arms inwards keeping them close to his body. We will observe that the angular velocity with which he is spinning now increases. This phenomenon can be explained by the Law Of Conservation of Angular momentum. Initially, since his arms were spread wide, his moment of inertia was large. However, when he pulled them close to his body, his moment of inertia decreased.
In this example the angular velocity of the man increases and therefore the angular momentum also increases.The law of conservation of angular momentum does not apply because the torque of muscular forces is not zero.

[4] For the motion of the Earth around the sun, the total of angular momenta of the Earth and the Sun, about in a reference frame fixed in the pole star, is conserved.

[5] Only the z component of angular momentum of a conical pendulum is conserved w.r.t. the origin fixed at the point of suspension. SetId=71

[6] In the example of skew rod, the angular momentum changes with time and there is a non zero torque coming from action of forces other than gravitational forces. Hence the law of conservation of angular momentum dos not apply.

[7] Statement: Law of Conservation of energy states that "ENERGY CAN NEITHER BE CREATED NOR DESTROYED",but it can be changed from one form to other.

EXPLANATION: Statement implies that the total amount of energy in an isolated system remains constant although it may change forms. viz, kinetic energy may change to potential;chemical to electrical energies etc.

[8] To apply the conservation laws of momentum, energy and angular momentum, we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *external force* acting on the system, the energy and momentum will be conserved. However, depending on the nature of the system and of the forces, the total angular momentum may not be conserved.

[9] A force is said to be non-conservative, if the work done by the force is dependent on the path taken. It could also be defined as a force for which the work done during a cyclic process is non-zero.

SetId=71

[10] When the force is kept constant as function of time, it is possible for a particle to move on a circular path in such a way that its speed remains constant, but the velocity and acceleration must always change with time.

[11] Distance is equal to the length of the path covered. Displacement is the shortest distance between initial and final points.

[12] Staying inside a bullet train moving with constant velocity (no jerks etc) an experiment can always be performed which will tell us the numerical velocity of the bullet train

[13] When we consider collision between two bodies in a non-inertial frame of reference, the law of conservation of momentum cannot be applied because there will be a pseudo force acting on the frame itself.

[14] The total work done on a particle is always equal to the change in kinetic energy. SetId=71

[15] Newton's first law defines inertial frame. An inertial frame is a frame in which the first law hold. It also makes it possible to compare and tell two force being equal or not. The second law defines the force.

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SetId=72

[1] Distance depends on the path where as the displacement depends on the end point only.

[2] If the net external torque acting on a system is zero, the angular momentum L of the system remains constant, no matter what changes take place within the system.

$$\sum(T_{\text{ext}}) = \frac{dL}{dt}$$

The law states that when there is no net external torque, $\frac{dL}{dt}$ is zero implying that the total angular momentum of system is constant.

i.e. $L = a$ constant (isolated system)

[3] In the Sun-Earth system, angular momentum of the earth is not conserved but the total angular momentum of the sun and the earth is constant of motion.

[4] For the motion of the Earth around the sun, the total of angular momenta of the Earth and the Sun, is conserved in every inertial frame of reference; but the angular momentum of the Earth (or of the sun)is not conserved in every inertial frame.

[5] The projection of angular momentum of a conical pendulum in the horizontal plane is a constant of motion when the origin is chosen to be at fixed at the point of suspension. SetId=72

[6] In the example of conical pendulum, the z- component of angular momentum does not change. This follows from the angular momentum conservation as there is no external torque.

[7] Oscillating simple pendulum is a very good example where potential energy gets converted to kinetic energy and kinetic to potential energy. Some energy gets dissipated as heat if we consider air resistance. Energy as a whole is conserved if we consider universe as system, the energy has just changed its form.

[8] In order to apply the law of conservation of momentum we must first identify the system. If there is no *external forces* acting on the system then conservation laws of momentum always holds. And depending on the nature of the system and of the forces, the total kinetic energy and the total angular momentum may not be conserved.

[9] a force is said to be non conservative if work done is dependent on the path of the particle.potential cannot be defined in the case of non conservative forces.work done in closed loop is not equal to zero.

SetId=72

[10] It is not possible for a particle to move on a circular path in such a way that its speed and force remains constant, and only the velocity and acceleration may (or may not) always change with time.

[11] Distance is a scalar quantity where as the displacement is a vector quantity.

[12] Staying inside a bullet train moving with constant velocity (no jerks etc) an experiment can always be performed which will tell us the numerical value of the acceleration of the bullet train

[13] When a system is acted upon by external forces like friction etc, the conservation principle does not hold good,there will be impulse imparted and so we cant conserve momentum. This is case when a collision between two elastic balls take place on a rough horizontal table. The total momentum just after the collision will be different from the total momentum just before the collision. Here momentum is not conserved as there is external force friction is present.

[14] A particle is acted upon by a force of constant magnitude which is always perpendicular to the velocity of the particle and the motion of the particle takes place in a plane, Then its kinetic energy, speed, velocity acceleration will not change. SetId=72

[15] The magnitude of the pseudo force arising in a non-inertial frame is always equal to the mass of the body under consideration multiplied by the acceleration of the frame of reference and the direction of pseudoforce is always opposite to the direction of acceleration of the frame.

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SetId=73

[1] Distance equal to zero implies displacement=0; and Displacement=0 also implies distance = 0

[2] When the net external torque acting on a body or a system of bodies is zero about a particular axis, then the angular momentum of each body is conserved about that axis.

[3] Consider a disc and a man system. man is standing on center of the disc rotating with angular velocity.initially man folded his hand.when man stretches his hands then momentum of inertia of system increases.and angular velocity decreases.and total angular momentum remains constant.

[4] In the Sun Earth system the angular momentum of the Earth is conserved in every frame of reference

[5] The law of angular momentum of a is not applicable for the conical pendulum conserved w.r.t. the origin fixed at the point of suspension. SetId=73

[6] In the example of conical pendulum, the x and$y$ components of angular momentum change. This follows from the angular momentum conservation as the z components external torque is zero and horizontal components of torque are non zero.

[7] Law of conservation of momentum does not hold whenever an external force or impulse acts on the system. For example,when a body collides with earth then it bounces back to a lesser height as it loses some velocity.

In this example the momentum of a ball is not conserved due to impulsive force by ground in the normal direction.

However, strictly speaking the system that should be considered here is the ball-earth system and the total momentum is conserved.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then check if the laws is applicable or not.

So if there is no *net external force* acting on the system all the three conservation laws will hold.

[9] Explain Nonconservative Forces:

The forces that depend on the path taken by the particle are called non-conservative forces.

Mechanical energy is not conserved during the action of a non conservative force, instead, it is lost as other forms of enery like heat, light, etc.

Potential energy is not defined for a non-conservative force.

The initial and final kinetic energy in a closed loop is not equal.

The work done by a non conservative force in a closed loop is non zero. In practice, the net work is invariably negative.

Work done by a non conservative force cannot be completely recovered.

For a non conservative force,

$$/text(KE)//_f//+(\mathrm{PE})//_f// = (\mathrm{KE})_i+(\mathrm{PE})_i//+//\text{Work Done})//\text{non-conservative force}//$$

SetId=73

[10] For a particle moving on circle the acceleration is always constant in magnitude and directed towards the centre of the circle.

[11] Both displacement and distance tell us about the motion of a body but their study does not tell much about the forces on the body

[12] Assume bullet train, moving with out any jerks, is going on a circular arc of radius R with constant speed. Then an experiment is to be performed entirely within the train without any measurement on objects outside the train. Such an experiment can tell only radius of the track.

[13] When we are in accelerating frame if we observe any collision between two bodies then the law of conservation of momentum does not hold in that frame of reference. On the other hand the law of conservation of momentum holds in all inertial frames.

[14] The kinetic energy of a particle is continuously increasing with time, then the angle bewteen the net force and the velocity cannot be greater than or equal to 90° at any time. SetId=73

[15] A force is any interaction which tends to change the motion of an object. It is also *defined* as rate of change of momentum.It is a vector quantity.
A physically apparent but nonexistent force felt by an observer in a noninertial frame (that is, a frame undergoing acceleration).

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SetId=74

[1] If P and Q are the initial and the final points of a path of a particle, displacement is a vector whose direction is along PQ and has magnitude is equal to the length of line PQ

[2] The law of conservation of angular momentum states that in absence of an external torque on an object or a closed system of objects the total angular momentum of the system remains constant. Thus if $\vec{\tau} = 0 => \vec{L} =$ constant where τ is the torque and $\vec{L}$ is the angular momentum of the system.

[3] The conservation of angular momentum of a system of bodies requires that the the sum of torque due to <u>all forces</u> be equal to zero. Now consider a situation where the forces are such that the sum of torques of external forces is zero w.r.t. some axes K. Since the value of torque depends of the choices of axes, the sum of torques due to all <u>internal forces</u> will depend on the choice of axes and in general it will be non zero. Therefore, for a system of several bodies, for a given choice of axes K, there will be situations when the total angular momentum may not be conserved.

[4] In the motion of earth around sun, the angular momentum of the earth about an axis passing through the sun and perpendicular to the plane of motion of earth is conserved.

[5] The law of angular momentum of a is not applicable for the conical pendulum conserved when the origin is chosen to be at the pendulum bob itself. SetId=74

[6] Example where law of conservation of angular momentum does not hold: A disc rotating on a horizontal rough surface will not have a constant angular momentum because there will be a constant torque by frictional force. Hence, its angular momentum will decrease, and the law of conservation of angular momentum does not apply.

[7] If a bullet hits a wooden board and gets embedded in the board, the total energy and the total momentum of the bullet and the board are conserved.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then check we should if the laws are applicable or not.

So if there is no *external force* acting on the system all the three quantities, total momentum is conserved. The total angular momentum is also because the torque of internal forces will be zero. The conservation of energy depends on the nature of forces. will be conserved.

[9] A non conservative force is one where the mechanical energy is not conserved.Here the work done is dependent on the path taken .Different amounts of work need to

be done in different paths.Here potential energy would have no meaning as it would keep changing with the path.Here some amount of mechanical energy is lost as sound energy or heat energy and hence is not conserved.

SetId=74

[10] The motion of a bomb dropped from a plane does is not a uniform motion as it follows a parabolic path and not a straight line path.

[11] Displacement is the shortest distance between initial and final points with direction specified.

[12] Assume bullet train, moving with out any jerks, is going on a circular arc of radius R with constant speed. Then an experiment is to be performed entirely within the train without any measurement on objects outside the train. Such an experiment can tell both speed of the train and radius of the track.

[13] When a freely falling body hits another rigid body in its path then momentum is not conserved as external force mg acts on both the bodies. The total momentum after the collision will be different from the total momentum before the hit.

[14] A heavy body is attached from a spring and is held at point A and is such that the spring is not slack nor is it stretched. It is then released. It goes down upto a point B and then it rises upto point C and executes an oscillatory motion between B and C. During the motion from A to C is first positive (from A to B) and then it is negative from B to A and again remains negative from A to C. SetId=74

[15] Psuedo Force is defined as an apparent force that acts in only non-inertial frames. Pseudo Forces are also called Fictitious Forces. It is an Imaginary force. It is independent of mass.

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SetId=75

[1] If P and Q are the initial and the final points of a path of a particle,the displacement is the vector $\overrightarrow{PQ}$.

[2] If no net external torque acts on a system, the total angular momentum of the system remains constant.

[3] Example where law of conservation of angular momentum does not hold:
When there is external force like frictional force acting on a object when it is rotating we cannot use conservation of angular momentum as the friction force acting on the object produces an external torque.

[4] For the motion of earth around sun, the angular momentum of the earth about the center of mass of the sun + earth system and perpendicular to the plane of motion of earth is conserved.

[5] The three components of angular momentum of a conical pendulum is conserved w.r.t. the origin at the position of the center of mass of the pendulum. SetId=75

[6] Example where law of conservation of angular momentum does not hold:Consider a vertical stick on the ground falling to a horizontal position. During the fall, the conservation of angular momentum applied at the point of rotation on the ground and perpendicular to the plane of the stick is not applicable as, the gravitational force which acts vertically downwards assumed at the centre of mass produces an external torque about the axis of rotation

[7] If a bullet hits a wooden board and gets embedded in the board, the total energy of the bullet and the board system is conserved but the total momentum is not conserved.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *net external force* acting on the system, the momentum is conserved. The definition of angular momentum and torque depends on the choice of axes, and therefore it may not be be conserved. The conservation of total energy holds only for conservative forces.

When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *net external force* acting on the system, the energy and momentum will be conserved. However, the total angular momentum may not be conserved because the torque may not be zero.

SetId=75

[9] The force whose work depends on path taken is called a non conservative force.friction for example does less work on a book dragged across a table if the book is dragged straight across than if the book is dragged in a curved path.

[10] A wagon sliding on a roller coaster designed in such a way that the wagon covers equal distances in equal times. As the motion of the wagon is uniform, there will be no net force acting on it.

[11] Displacements, being vector quantity can not compared with, a scalar quantity such as distance.

[12] Assume bullet train, moving with out any jerks, is going on a circular arc of radius R with constant speed. Then an experiment is to be performed entirely within the train without any measurement on objects outside the train. Such an experiment can tell only speed of the track.

[13] .The law of conservation of momentum does not hold good when net external forces acting on the system is not zero.when two bodies collide law of conservation of momentum is applicable on system of two bodies but on not individual bodies because external impulse acts on them.

[14] The kinetic energy of a body does not change if any one of the following is true
(i)force is always perpendicular to the velocity
(ii) the force is always perpendicular to the acceleration
(iii) the object remains stationary
(iv) the object moves in such a way that the point of application of the force remains fixed. SetId=75

[15] Psuedo Force is defined as an apparent force that acts in only non-inertial frames. Pseudo Forces are also called Fictious Forces. It is an Imaginary force. It is always proportional to mass. It is sometimes dependent on speed.

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[1] If two bodies starting from a point A reach a point B, following different paths, their displacement will be, in general different, but the distances covered will always be the same.

SetId=76

[2] The law of conservation of angular momentum states that when no external torque is applied on an object or a closed system of objects about an axis, the angular momentum about that axis remains constant.

[3] A bob attached to a ceiling by a string moving in a horizontal circular plane is an example where the total angular momentum of the bob about the point of suspension is not conserved. This is because the the torque due to the weight of the bob about the point of suspension does not vanish and has non zero horizontal component. Only the vertical component of the angular component is conserved.

[4] In the Sun Earth system the angular momentum of the Earth about the pole star is conserved

[5] Only the z component of the angular momentum of a conical pendulum is conserved w.r.t. the origin fixed at the point of suspension.

SetId=76

[6] We have a conical pendulum .The forces acting on the bob are tension (along the direction of the string) and gravitational force acting in the vertically downward direction.we have an additional force called the drag force which is tangential to the motion of the bob and acts in the direction opposite to the motion of the bob.The axis of rotation passes through the hinge point and is vertical.The torque due to tension is 0 because the force passes through the axis of rotation.The torque due to mg is also zero since it is parallel to the axis of rotation.but the torque due to drag force is not zero.since the net external torque acting on the bob is not zero,therefore the law of conservation of angular momentum does not hold here

[7] If a bullet hits a wooden board and gets embedded in the board, both total energy and the total momentum of the bullet and the board are not conserved.

[8] In order to apply the law of conservation of momentum we must first identify the system. If there is no *net external forces* acting on the system then conservation laws of momentum always holds. The total energy and the total angular momentum may not be conserved.

[9] ** Nonconservative force is a force in which the amount of work done by the force is dependent of the path taken to change a state of a system.

SetId=76

[10] A simple pendulum moves along a circular arc and does not have constant speed and therefore its motion is not uniform.

[11] Distance depends on the path where as the displacement depends on the end point only

[12] A particle is observed from two frames S_1 and S_2. The frame S_2 moves with respect to S_1 with an acceleration a. If F_1 and F_2 be the pseudoforces when seen from S_1 and S_2 respectively it is not possible to have $F_1 = F_2 = 0$

[13] A block moving in the air breaks up into two parts and the parts separate, then the total momentum must be the same before and after the break.

[14] The total work done on a particle is always equal to the change in kinetic energy. SetId=76

[15] Since pseudo forces are not real forces, they do not affect the conservation laws and all the three conservation laws hold in noninertial frames.

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Assignment-II **Due On : Nov 18, 2014**

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SetId=77

[1] Displacement is equal to the vector difference $\vec{r}_f - \vec{r}_i$ of the position vectors of initial and final points. The distance covered will be $|\vec{r}_f - \vec{r}_i|$

[2] The angular momentum of a given system of bodies shall remain conserved unless acted upon by an external unbalanced torque.

[3] Law of conservation of angular momentum holds in case of long jump. When a athlete takes off from the ground in a running long jump, the forces on the launching foot give the athlete an angular momentum with a forward rotation around a horizontal axis. Such rotation would not allow the jumper to land properly. In the landing, the legs should be together and extended forward at an angle so that the heels mark the sand at the greatest distance. Once airborne, the angular momentum cannot change (it is conserved) because no external torque acts to change it. However, the jumper can shift most of the angular momentum to the arms by rotating them in windmill fashion. Then the body remains upright in the proper orientation of landing.

[4] For the motion of earth around sun, the angular momentum of the sun about the center of mass of the sun + earth system and perpendicular to the orbital plane of earth is conserved.

For the motion of earth around sun, the angular momentum of the sun about and axis passing through the Earth and perpendicular to the orbital plane of motion of earth is conserved.

[5] The z component of angular momentum of a conical pendulum is not conserved w.r.t. the origin fixed at the point of suspension; but the x and y components are conserved.

SetId=77

[6] When you release a toy gyroscope on its pedestal, it initially has no precessional rotation around that pedestal, i.e, the orientation of rotation is fixed. However, it instantaneously starts precessing around the pedestal. Both Kinetic Energy and Angular Momentum now exist where they did not exist a moment earlier. The Kinetic Energy is easy to explain, as appearing due to the body of the gyroscope dropping a tiny fraction of a millimeter in the Earth's gravitational field, giving up exactly the correct amount of Potential Energy. But the Angular Momentum of the Precession which just appeared, does not come from anywhere. This is therefore a Violation of the Conservation of Angular Momentum.

[7] There are certain situations where it appears that the law of conservation of linear momentum does not hold. For example if we take some amount of a substance like construction putty, cement, cake batter, playing dough,etc and drop it on the ground, it does not bounce back like a rubber ball would and hence the momentum

it had before striking the ground seems to have been lost. Hence it appears that the law of conservation of linear momentum does not hold.

[8] In order to apply the law of conservation of momentum we must first identify the system. Then even if there is no *net external forces* acting on the system, all the three conservation laws of momentum, angular momentum and energy may not hold due to presence of internal forces.

[9] Nonconservative force is any force where the work done by the force on the object depends on the path of motion of the object.the work done by the frictional force results in to loss of the energy of the system in the form of heat or other form of energy.

SetId=77

[10] A satellite goes around the earth in a circular orbit of 600km with a time period of $5.8 \times 10^3 s$. Its motion will be uniform as it will cover equal distances in equal times.

[11] Distance equal to zero $\Rightarrow$ displacement=0; but Displacement=0

[12] A particle is observed from two frames S_1 and S_2. The frame S_2 moves with respect to S_1 with an acceleration a. If F_1 and F_2 be the pseudoforces when seen from S_1 and S_2 respectively and if $F_1 = 0$ then we must have $F_2 \neq 0$

[13] A ball hits the floor and rebounds after an inelastic collision. In this case the total momentum of the ball before and after the collsion is conserved. Also the total enrgy of the ball and the earth remains the same

[14] A particle is acted upon by a force of constant magnitude which is always perpendicular to the velocity of the particle and the motion of the particle takes place in a plane, Then its kinetic energy, speed, velocity acceleration will not change. SetId=77

[15] A force is any interaction which tends to change the motion of an object. Newtons' second tell us that it is *equal* to the rate of change of momentum.It is a vector quantity. Real forces can be distinguished from pseudo forces because the pseudo forces always proportional to the mass of the body. All real forces, except the gravitational force, do not depend on the mass of the body.

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SetId=78

[1] Distance is equal to the length of the path covered. Displacement is the shortest distance between initial and final points.

[2] When the net external torque acting on a system about a given axis is zero, the total angular momentum of the system about that axis remains consant.

[3] The total angular momentum of a body remains constant of motion when the net torque of the external forces acting on the body is zero.
In general, we have a system of particles such that the net torque of the external forces on the system, w.r.t. some axes K, is zero, the total angular momentum may not remain conserved, because the torque due to the internal forces may not be zero.

[4] For the motion of earth around sun, the sum of angular momenta of the Sun and the Earth about the center of mass of the sun + earth system is conserved.

[5] Only the z component of angular momentum of a conical pendulum is conserved w.r.t. the origin fixed at the point of suspension. SetId=78

[6] There is no case where LAW OF CONSERVATION OF ANGULAR MOMENTUM does'nt hold.But there are cases where conservation of angular momentum does not hold.A body in vertical circular motion is an example where angular momentum is not conserved. Here the law of conservation does not apply.

[7] A tennis ball is dropped from height h and after hitting the ground and it bounces back and rises to the same height. In this case the momentum of the ball is conserved because (under ideal conditions) the momentum after it hits the ground will be equal to the momentum it had before hitting the ground.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then check we should if the laws are applicable or not.

So if there is no *external force* acting on the system all the three quantities, total momentum, total angular momentum, and total kinetic energy will be conserved independent of the nature of forces.

[9] nonconservative force is any force ,where the work done by the force depends on the path of motion of the body.The work done by such a force is equal to the change in mechanical energy of the system.Energy mostly observed to be lost in form of heat, by the action of non conservative force.

SetId=78

[10] A uniform motion is defined to be the one in which a body covers equal distances in equal time intervals.

[11] If P and Q are the initial and the final points of a path of a particle, displacement is a vector whose direction is along PQ and has magnitude is equal to the length of line PQ

[12] If K is an inertial frame, any frame that moves w.r.t. the frame K with uniform velocity is also an inertial frame.

[13] In a head on elastic collision of two identical bodies of equal masses the velocities, the speeds, the momenta and the kinetic energy are all exchanged.

[14] The kinetic energy of a particle is continuously increasing with time, then the angle bewteen the net force and the velocity cannot be greater than or equal to 90^o at any time.

SetId=78

[15] Examples of pseudoforce are Coriolis Force, Centrifugal Force, and magnetic force on currents.
Psuedo force also called as fictitious force is an apparent force that are needed for masses whose their motion is described using a non inertial frame of reference.

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SetId=79

[1] Distance is a scalar quantity where as the displacement is a vector quantity.

[2] This law sates that when no net torque of all forces acts on a object or a system of objects then total angular momentum of system is conserved.The angular momentum before an event is equal to angular momentum after that event.mathematically explained by when, net torque=0 ;then, total angular momentum(L)=constant.

[3] An example where law of conservation of angular momentum holds:
The Law of conservation of angular momentum holds in the case of a ballet dancer performing a pirouette.

When the dancer extends her arms outward, the angular velocity of her rotation decreases whereas when she keeps her arms close to her body, the angular velocity increases. This is because her moment of inertia changes as she moves her arms outward and inward. It can be noted that she as a system has no external torque acting upon her.

[4] For the motion of the Earth around the sun, the total of angular momenta of the Earth and the Sun, about in a reference frame fixed in the pole star, is conserved.

[5] The projection of angular momentum of a conical pendulum in the horizontal plane is a constant of motion when the origin is chosen to be at fixed at the point of suspension. SetId=79

[6] A sphere rolling on a rough surface.Due to friction there is external torque so the angular momentum changes which results in the slowing of the sphere. The angular momentum keeps changing. Even in case like this one, it is wrong to say that the Law of Angular Momentum Conservation does not hold.

[7] Law of conservation of momentum does not hold when Newton's laws are not valid, e.g. in a non-inertial frame of reference. For example, when we consider collision between two bodies in a non-inertial frame of reference, the law of conservation of momentum cannot be applied because there will be a pseudo force acting on the frame itself.

[8] If we want to apply the conservation laws of momentum, energy and angular momentum, we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *external force* acting on the system, the momentum and angular momentum will be conserved, and depending on the nature of the forces but total energy may or may not be conserved.

[9] The work done by a "non-conservative" force does depend on the path taken. Non-conservative forces cannot be associated with a potential energy. If some of the

internal forces of a system are non-conservative, the mechanical energy of the system is not constant.Work-energy theorem is valid even in the presence of some non-conservative forces.

SetId=79

[10] A particle moves on a circular path. Then its speed, direction of force, velocity and acceleration must always change with time.

[11] If P and Q are the initial and the final points of a path of a particle,the displacement is the vector $\overrightarrow{PQ}$.

[12] If K is an inertial frame, any frame that moves w.r.t. the frame K with uniform speed is also an inertial frame.

[13] For a system of several particles the conservation of total linear momentum is equivalent to the statement that their centre of mass moves like a free particle.

[14] A heavy body is attached from a spring and is held at point A and is such that the spring is not slack nor is it stretched. It is then released. It goes down upto a point B and then it rises upto point C and executes an oscillatory motion between B and C. During the motion from A to C is first positive (from A to B) and then it is negative from B to A and again remains negative from A to C.

SetId=79

[15] Examples of pseudo-force are Coriolis Force, Centrifugal Force, Centripetal force and magnetic force on currents. The pseudo forces do not obey Newton's third law and therefore the total momentum does not appear to be conserved in a non-inertial frame.

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SetId=80

[1] The speed is rate of change of distance and the velocity is the rate of change of displacement.

[2] Statement of Law of Conservation of Angular Momentum:
Differentiating $\vec{L} = \vec{r} \times \vec{p}$ w.r.t, time,

$$\begin{aligned} \frac{dL}{dt} &= \frac{d\vec{r} \times \vec{p}}{dt} = \frac{d\vec{r}}{dt} \times \vec{p} + \vec{r} \times \frac{d\vec{p}}{dt} = \vec{v} \times (m\vec{v}) + \vec{r} \times \vec{F} \\ &= \vec{r} \times \vec{F}(\because v \times v = 0) \\ &= \vec{\tau} \end{aligned}$$

here $\vec{\tau}$ represents the net torque acting on a rigid body rotating about a fixed axis.This torque must take into account of all the forces, be it external or internal forces

[3] In case of a skater, who can be considered an isolated system, so no torue will be acting on him/her. When the arms are extended, the moment of inertia is more. When his hands are closely held, the moment of inertia is lesser. Since the angular momentum is same, the angular acceleration changes accordingly.

[4] For the motion of the Earth around the sun, the total of angular momenta of the Earth and the Sun, is conserved in every inertial frame of reference; but the angular momentum of the Earth (or of the sun)is not conserved in every inertial frame.

[5] The law of angular momentum of a is not applicable for the conical pendulum conserved w.r.t. the origin fixed at the point of suspension. SetId=80

[6] Consider a rod of length l. Let us give an impulse to one end . Now the angular momentum about the oposite end is not zero since the impulse provides some torque . So the angular momentum is not conserved .

$$\text{torque} = \text{impulse} * \ell.$$

$d\ell/dt$ is not equal to zero and the law of conservation of angular momentum does not hold.

[7] If I throw a ball upward, it's speed decreases as it rises upwards. There is an external force (gravity) acting on the ball, so the momentum conservation law does not apply. Momentum of the ball is not conserved, however the momentum of the Earth-ball system is conserved as gravity will become an internal force in this case.

[8] To apply the conservation laws of momentum, energy and angular momentum, we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *external force* acting on the system, the energy and momentum will be conserved. However, depending on the nature of the system and of the forces, the total angular momentum may not be conserved.

[9] Non conservative forces are forces with the property that the work done by the force in moving a particle between two points is dependent on the path taken.Also the work done over a closed loop is not zero.Defining of scalar potential is not possible in case of non conservative forces because the change in potential energy between two points will depend on path taken.

SetId=80

[10] A particle moves on a circular path. Then its speed, direction offorce, can remain constant by velocity and acceleration must always change with time.

[11] If two bodies starting from a point A reach a point B, following different paths, their displacement will be, in general different, but the distances covered will always be the same.

[12] A frame rotating w.r.t K with uniform angular velocity is also an inertial frame.

[13] The total mechanical energy of a system may not be conserved if there are no external forces and the internal forces are conservative.

[14] The kinetic energy of a body does not change if any one of the following is true
(i)force is always perpendicular to the velocity
(ii) the force is always perpendicular to the acceleration
(iii) the object remains stationary
(iv) the object moves in such a way that the point of application of the force remains fixed.

SetId=80

[15] FORCE is any interaction which tends to change the motion of an object.It has both magnitude and direction,making it a vector quantity.

A psuedo force is an apparent force that acts on all masses whose motion is described with respect to a non-inertial frame of reference like a rotating frame of reference.This force is needed by an observer in an non-inertial frame to make all the Newtons Laws of motion hold true.

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ASSIGNMENT-II **Due On : Nov 18, 2014**

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SetId=81

[1] For any type of translational motion of a body, the displacement cannot be zero, where as the distance travelled can be zero.

[2] Statement of Law of Conservation of Angular Momentum: For a system of many particles The net torque due all the forces, be it external or internal forces. But as the torque due to all the internal forces cancel out, it sufficient to consider the external forces acting on the system.

[3] Example where law of conservation of angular momentum holds:
Let us assume a student seated on a stool that can rotate freely about a vertical axis. The student has been set into rotation at a modest initial angular speed ω . He holds two dumbbells in his outstretched hands. His angular momentum vector L lies along the vertical rotation axis, pointing upwards. Now he pulls in his arms;this action reduces his rotational inertia from its value I_{initial} to a final value I_{final} because he moves the mass closer to the rotational axis. His rate of rotation increases markedly, from ω_{initial} to ω_{final}. The student can then slow down by extending his arms once more,moving the dumbbells outward. No external torque acts on the system consisting of the student, stool and the dumbbells. Thus the angular momentum of the system about the rotational axis remains constant. $I_{\text{initial}} * \omega_{\text{initial}} = I_{\text{final}} * \omega_{\text{final}}$.

[4] In the Sun Earth system the angular momentum of the Earth is conserved in every frame of reference

[5] The law of angular momentum of a is not applicable for the conical pendulum conserved when the origin is chosen to be at the pendulum bob itself. SetId=81

[6] Let us consider a rotating skew rod. In the absence of friction or any other drag force, the rod should continuously spin without stopping. Here the net torque about the axis of rotation is 0 and hence angular momentum is conserved. It therefore follows from law of conservation of angular momentum that a spinning skew rod will keep rotating with constant angular velocity if there is no external torque. So law of conservation of angular momentum does not hold.

[7] A soldier accelerating away, after detonating a bomb, will find that the total momentum of the fragments of the bomb is zero. This is an example where the law of conservation of momentum holds as the forces on the fragments are internal forces only and sum of all such forces is zero.

[8] In order to apply the law of conservation of momentum we must first identify the system. If there is no *external forces* acting on the system then conservation laws of momentum always holds. And depending on the nature of the system and of the forces, the total kinetic energy and the total angular momentum may not be conserved.

[9] A non conservative force is the force with the property that the work done in moving a particle between two points is dependent of the path taken.If a particle travels in a closed path, the net work done(the some of the forces acting along the path multiplied by the distance travelled) by a non conservative force is non zero. When an object moves from one location to another, the force changes the potential energy of the object by an amount that depends on the path taken.Non conservative force depends only on the path followed by the object.

SetId=81

[10] A particle moves on a circular path. Then under suitable conditions its speed may remain constant, but the force, velocity and acceleration must always change with time.

[11] Distance is equal to the length of the path covered. Displacement is the shortest distance between initial and final points.

[12] The Newton's Laws of motion will hold in all frames which are at rest w.r.t. K but do not remain valid in a frame that move with respect to K.

[13] When a bullet fired on a wooden block, some energy is transferred to the block and the total mechanical energy of the block and the bullet is conserved.

[14] The total work done on a particle is always equal to the change in kinetic energy.

SetId=81

[15] FORCE is any interaction which tends to change the motion of an object.It has both magnitude and direction,making it a vector quantity. A pseudo-force F doesn't arise from any physical interaction between two objects, but rather from the acceleration 'a' of the non-inertial reference frame itself. These forces have no real existence but must be taken into account in an accelerating frame of reference to make all the three Newton's Laws of motion applicable to the system

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SetId=82

[1] Displacements, being vector quantity can not compared with, a scalar quantity such as distance.

[2] Depending on the torques acting on a system, the angular momentum can be conserved only in one or two directions, but may not be conserved in all. For instance, if an isolated body has no torque acting on it only in the direction along the Z axis, then the angular momentum is conserved only in that direction.

[3] A bob is attached to ceiling by a string and moves in a horizontal circular plane is an example. In this case the law of conservation of angular momentum does not hold.

[4] In the motion of earth around sun, the angular momentum of the earth about an axis passing through the sun and perpendicular to the plane of motion of earth is conserved.

[5] The three components of angular momentum of a conical pendulum is conserved w.r.t. the origin at the position of the center of mass of the pendulum. SetId=82

[6] In the example of skew rod the angular velocity does not change even though the torque applied is nonzero. However there is no contradiction as in this case the law of conservation of momentum is not applicable. conservation is violated.

[7] There is no known exception to the law of conservation of momentum in classical mechanics However, an exception to conservation of energy in nuclear physics is observed. In nuclear reactions when two nuclei collide and their mass converts to energy and energy momentum are not conserved.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then check if the laws is applicable or not.

So if there is no *net external force* acting on the system all the three conservation laws will hold.

SetId=82

[9] In this type of force the work done depends on the path taken by the body.Mechanical energy is not conserved in the system if non conservative force acts on it.

[10] A particle moves on a circular path. Then under suitable conditions its speed and acceleration may remain constant, but the force, and velocity must always change with time.

[11] Distance is a scalar quantity where as the displacement is a vector quantity.

[12] Staying inside a bullet train moving with constant velocity (no jerks etc) an experiment can always be performed which will tell us the numerical velocity of the bullet train

[13] When a moving car hits a parked lorry and causes the parked lorry to move ,energy is transferred from moving the car to the lorry and the total energy of the lorry and the car is conserved.

[14] A particle is acted upon by a force of constant magnitude which is always perpendicular to the velocity of the particle and the motion of the particle takes place in a plane, Then its kinetic energy, speed, velocity acceleration will not change. SetId=82

[15] FORCE is any interaction which tends to change the motion of an object.It has both magnitude and direction,making it a vector quantity.
A pseudo-force results from acceleration of the frame of reference in which the objects reside. It is taken into account so that Newton's second law isn't invalidated. The pseudo force acting on an object can always be mathematically expressed as the product of the mass of the object and the acceleration of the frame of reference.

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SetId=83

[1] Distance depends on the path where as the displacement depends on the end point only.

[2] According to Law of Conservation of Angular momentum,if no external torque acts on an object or system of objects,angular momentum of an object or system of objects remains CONSTANT or no change in angular momentum can occur.

Also it states that,only external torque can change angular momentm of the system where as the torque produced by internal forces can not change the angular momentum of the system

[3] Consider a disc rotating about an axis perpendicular to its plane. On placing a smaller disc with its surface parallel to the surface of the rotating disc, the angular momentum of the system of two discs remains constant as there is no external torque.

[4] For the motion of earth around sun, the angular momentum of the earth about the center of mass of the sun + earth system and perpendicular to the plane of motion of earth is conserved.

[5] Only the z component of the angular momentum of a conical pendulum is conserved w.r.t. the origin fixed at the point of suspension. SetId=83

[6] Example where law of conservation of angular momentum does not hold:If a particle undergoes conical motion and the only force acting on particle is central force like tension of the string.Then total external torque about fixed point A is zero,yet angular momentum is not conserved,as angular momentum keeps on changing direction.

[7] In a system of a canon and a canon ball, total momentum of the system is zero before canon ball is fired. After firing the canon ball, the momentum of the system seems to be conserved as the ball moves forward and the canon moves backward.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then check we should if the laws are applicable or not.

So if there is no *external force* acting on the system all the three quantities, total momentum is conserved. The total angular momentum is also because the torque of internal forces will be zero. The conservation of energy depends on the nature of forces. will be conserved.

[9] A force is said to be a non-conservative force if the work done by the force in a closed path is non-zero;(i.e) the cyclic integral of the work done is non-zero.

Work done by a non-conservative force is equal to change in total energy of the system.Work-Energy theorem is not applicable in the case of a non-conservative

force.Work done by conservative force depends on the path.It differs with the paths taken by the partical even if the initial and final points are same.In case of non-conservative forces,the total mechanical energy is not constant as the energy is dissipated in various forms such as heat energy,sound energy,etc and cannot be recovered.

SetId=83

[10] When the force is kept constant as function of time, it is possible for a particle to move on a circular path in such a way that its speed remains constant, but the velocity and acceleration must always change with time.

[11] Both displacement and distance tell us about the motion of a body but their study does not tell much about the forces on the body

[12] Staying inside a bullet train moving with constant velocity (no jerks etc) an experiment can always be performed which will tell us the numerical value of the acceleration of the bullet train

[13] When a bomb explodes the total mechanical energy is not conserved. But the total chemical energy and the mechanical energy is conserved.

[14] The kinetic energy of a particle is continuously increasing with time, then the angle bewteen the net force and the velocity cannot be greater than or equal to 90^{o} at any time.

SetId=83

[15] Explain Force:FORCE is any interaction which tends to change the motion of an object.It has both magnitude and direction,making it a vector quantity.
In the case of a non inertial frame, we can use the second law of motion by adding a pseudo force to the system which makes it an inertial frame of reference.

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SetId=84

[1] Distance equal to zero implies displacement=0; and Displacement=0 also implies distance = 0

[2] The law of conservation of angular momentum states that when the net external torque acting on the system is zero, then the angular momentum of the system remains constant.both the initial and final momentum should be taken from a fixed inertial frame of reference provided.

[3] Consider a man standing on a spinning platform. Initially, the man spreads out his arms and he spins with a certain angular velocity. The next moment, he pulls his arms inwards keeping them close to his body. We will observe that the angular velocity with which he is spinning now increases. This phenomenon can be explained by the Law Of Conservation of Angular momentum. Initially, since his arms were spread wide, his moment of inertia was large. However, when he pulled them close to his body, his moment of inertia decreased.
In this example the angular velocity of the man increases and therefore the angular momentum also increases.The law of conservation of angular momentum does not apply because the torque of muscular forces is not zero.

[4] In the Sun Earth system the angular momentum of the Earth about the pole star is conserved

[5] The z component of angular momentum of a conical pendulum is not conserved w.r.t. the origin fixed at the point of suspension; but the x and y components are conserved. SetId=84

[6] A nonzero torque always causes the angular velocity to change, because a change in angular momentum means a change in angular velocity $L = I\omega$

[7] When applying the conservation laws of momentum, energy and angular momentum we must define the system first.Only then check if the laws is applicable or not.

As an example: when a ball is dropped from a height, it gains momentum down if we consider the ball as our system.This is because the force of gravity acts as an external force.

However, if we change our system and consider earth as a part of our system too, then the momentum remains conserved because the earth gains momentum up.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *net external force* acting on the system, the momentum is conserved. The definition of angular momentum and torque depends on the choice of axes, and

therefore it may not be be conserved. The conservation of total energy holds only for conservative forces.

When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *net external force* acting on the system, the energy and momentum will be conserved. However, the total angular momentum may not be conserved because the torque may not be zero.

[9] A non conservative force is a force where work done in moving a particle between two points depends on the path through which it is taken.Friction is an example of non conservative force.Mechanical energy is not conserved in case of a non conservative force

SetId=84

[10] It is not possible for a particle to move on a circular path in such a way that its speed and force remains constant, and only the velocity and acceleration may (or may not) always change with time.

[11] Displacement is the shortest distance between initial and final points with direction specified.

[12] Assume bullet train, moving with out any jerks, is going on a circular arc of radius R with constant speed. Then an experiment is to be performed entirely within the train without any measurement on objects outside the train. Such an experiment can tell only radius of the track.

[13] When a ball rolls over a rough surface, it comes to stop after some time. This is because transational and rotational kinetic energy initially present in the ball continuosly gets converted to heat due to friction. When all the kinetic energy changes to heat, the ball stops. The total mechanical energy of the ball is not conserved.

[14] A heavy body is attached from a spring and is held at point A and is such that the spring is not slack nor is it stretched. It is then released. It goes down upto a point B and then it rises upto point C and executes an oscillatory motion between B and C. During the motion from A to C is first positive (from A to B) and then it is negative from B to A and again remains negative from A to C. SetId=84

[15] For the Newton's Law of Motion to hold true,the physically apparent but nonexistent force needed by an observer in a non-inertial frame is called the pseudo force.
1) Caused by relative acceleration of the origin in a straight line
2) Centrifugal and Centripetal forces
3) Coriolis force
4) Euler force

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Sem-I 2014-15 Mechanics Waves and Oscillations MM:15

ASSIGNMENT-II **Due On : Nov 18, 2014**

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[1] If P and Q are the initial and the final points of a path of a particle, displacement is a vector whose direction is along PQ and has magnitude is equal to the length of line PQ

SetId=85

[2] The law of conservation of angular momentum states that The total angular momentum of a system is constant in both magnitude and direction if the resultant torque, of the external forces acting on the system, is zero.

[3] In the Sun-Earth system, angular momentum of the earth is not conserved but the total angular momentum of the sun and the earth is constant of motion.

[4] For the motion of earth around sun, the angular momentum of the sun about the center of mass of the sun + earth system and perpendicular to the orbital plane of earth is conserved.

For the motion of earth around sun, the angular momentum of the sun about and axis passing through the Earth and perpendicular to the orbital plane of motion of earth is conserved.

[5] Only the z component of angular momentum of a conical pendulum is conserved w.r.t. the origin fixed at the point of suspension. SetId=85

[6] A nonzero torque always implies change in angular momentum and may not give rise to a change in magnitude of angular velocity. A non zero torque may mean change only the direction of the angular momentum and not the angular velocity.

[7] Statement: Law of Conservation of energy states that "ENERGY CAN NEITHER BE CREATED NOR DESTROYED",but it can be changed from one form to other.

EXPLANATION: Statement implies that the total amount of energy in an isolated system remains constant although it may change forms. viz, kinetic energy may change to potential;chemical to electrical energies etc.

[8] In order to apply the law of conservation of momentum we must first identify the system. If there is no *net external forces* acting on the system then conservation laws of momentum always holds. The total energy and the total angular momentum may not be conserved.

SetId=85

[9] A force:A force is said to be a *non-//**conservative force* if the*/ work done by it in a closed path is/*/ non-zero./For such forces,potential energy cannot be defined.

[10] For a particle moving on circle the acceleration is always constant in magnitude and directed towards the centre of the circle.

[11] Displacements, being vector quantity can not compared with, a scalar quantity such as distance.

[12] Assume bullet train, moving with out any jerks, is going on a circular arc of radius R with constant speed. Then an experiment is to be performed entirely within the train without any measurement on objects outside the train. Such an experiment can tell both speed of the train and radius of the track.

[13] Let us consider that a pendulum is oscillating moving in a vertical plane. Mean while let another bob which is attached to a spring and is executing a simple harmonic motion in horizontal direction comes and hits the pendulum. Here conservation of momentum does not hold good as tension(external force) is acting on the system.(pendulum)

[14] The kinetic energy of a body does not change if any one of the following is true
(i)force is always perpendicular to the velocity
(ii) the force is always perpendicular to the acceleration
(iii) the object remains stationary
(iv) the object moves in such a way that the point of application of the force remains fixed. SetId=85

[15] A force is any interaction which tends to change the motion of an object. It is also *defined* as rate of change of momentum.It is a vector quantity.

Pseudo-force is a fictitious force it is taken by an observer from non inertial frame of reference. This force arises from acceleration of reference frame that is a reference frame which is accelerating or rotating.

The equation of motion is then written by balancing all forces. As an example a particle moving in a circle is seen to be at rest by balancing the centripetal and centrifugal forces.

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SetId=86

[1] If P and Q are the initial and the final points of a path of a particle,the displacement is the vector $\overrightarrow{PQ}$.

[2] If the net external torque acting on a system is zero,the angular momentum L(vector) of the system remains constant,no matter what changes take place within the system.L(vector)=a constant (net external torque acting on system is zero)

[3] Consider a disc and a man system. man is standing on center of the disc rotating with angular velocity.initially man folded his hand.when man stretches his hands then momentum of inertia of system increases.and angular velocity decreases.and total angular momentum remains constant.

[4] For the motion of earth around sun, the sum of angular momenta of the Sun and the Earth about the center of mass of the sun + earth system is conserved.

[5] The projection of angular momentum of a conical pendulum in the horizontal plane is a constant of motion when the origin is chosen to be at fixed at the point of suspension. SetId=86

[6] In the example of a rotating skew rod the torque due to the external gravitational forces is zero , but the angular momentum is not constant Therefore the law of conservation of angular momentum is violated.

[7] Oscillating simple pendulum is a very good example where potential energy gets converted to kinetic energy and kinetic to potential energy. Some energy gets dissipated as heat if we consider air resistance. Energy as a whole is conserved if we consider universe as system, the energy has just changed its form.

[8] In order to apply the law of conservation of momentum we must first identify the system. Then even if there is no *net external forces* acting on the system, all the three conservation laws of momentum, angular momentum and energy may not hold due to presence of internal forces.

[9] A force that is not conservative is nonconservative force. The work done by a noconservative force cannot be represented by a potential energy function. That is work done by a nonconservative force is dependent on the path through which the system is moved. Some nonconservative forces cause the mechanical energy to be lost or dissipiated. Such forces are called dissipiative forces. There is no way to get back the lost mechanical energy. Nonconservative forces can also increase the mechanical energy. This is arrived from the concept of irreversible process.

SetId=86

[10] The motion of a bomb dropped from a plane does is not a uniform motion as it follows a parabolic path and not a straight line path.

[11] Distance depends on the path where as the displacement depends on the end point only

[12] Assume bullet train, moving with out any jerks, is going on a circular arc of radius R with constant speed. Then an experiment is to be performed entirely within the train without any measurement on objects outside the train. Such an experiment can tell only speed of the track.

[13] The law of conservation of momentum does not hold in relativistic situations, i.e., where the speeds of the masses involved are close to the speed of light.

[14] The total work done on a particle is always equal to the change in kinetic energy. SetId=86

[15] A psuedo force is an apparent force that acts on all masses whose motion is described with respect to a non-inertial frame of reference like a rotating frame of reference. This force is needed by an observer in an non-inertial frame to make all the Newtons second laws to write correct equation of motion..

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[1] If two bodies starting from a point A reach a point B, following different paths, their displacement will be, in general different, but the distances covered will always be the same.

SetId=87

[2] The Law of conservation of angular momentum states that when no external torque acts on an object or a closed system of objects undergoing motion about a given axis, the change in angular momentum is zero. Therefore, considering an event where only internal torque or no torque is involved, the total angular momentum of the system before the event is equal to the total angular momentum after the event

[3] The conservation of angular momentum of a system of bodies requires that the the sum of torque due to all forces be equal to zero. Now consider a situation where the forces are such that the sum of torques of external forces is zero w.r.t. some axes K. Since the value of torque depends of the choices of axes, the sum of torques due to all internal forces will depend on the choice of axes and in general it will be non zero. Therefore, for a system of several bodies, for a given choice of axes K, there will be situations when the total angular momentum may not be conserved.

[4] For the motion of the Earth around the sun, the total of angular momenta of the Earth and the Sun, about in a reference frame fixed in the pole star, is conserved.

[5] The law of angular momentum of a is not applicable for the conical pendulum conserved w.r.t. the origin fixed at the point of suspension. SetId=87

[6] In the example of skew rod, the angular momentum changes with time and there is a non zero torque coming from action of forces other than gravitational forces. Hence the law of conservation of angular momentum dos not apply.

[7] Law of conservation of momentum does not hold whenever an external force or impulse acts on the system. For example,when a body collides with earth then it bounces back to a lesser height as it loses some velocity.

In this example the momentum of a ball is not conserved due to impulsive force by ground in the normal direction.

However, strictly speaking the system that should be considered here is the ball-earth system and the total momentum is conserved.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then check we should if the laws are applicable or not.

So if there is no *external force* acting on the system all the three quantities, total momentum, total angular momentum, and total kinetic energy will be conserved independent of the nature of forces.

[9] Nonconservative forces are forces, such that the work done by these forces are path dependent. Work done by these forces around a close path is not necessarily equal to zero. Hence if a particle is acted on by a non-conservative force and that particle returns to its original position, that particle will experience a net loss of energy. Energy will thus not be conserved for particle. Potential Energy can not be defined for these type of forces.

SetId=87

[10] A wagon sliding on a roller coaster designed in such a way that the wagon covers equal distances in equal times. As the motion of the wagon is uniform, there will be no net force acting on it.

[11] Distance equal to zero $\Rightarrow$ displacement=0; but Displacement=0

[12] A particle is observed from two frames S_1 and S_2. The frame S_2 moves with respect to S_1 with an acceleration a. If F_1 and F_2 be the pseudoforces when seen from S_1 and S_2 respectively it is not possible to have $F_1 = F_2 = 0$

[13] when we are in accelerating frame if we observe any collision between two bodies then the law of conservation of momentum does not hold in that frame of reference.

[14] A particle is acted upon by a force of constant magnitude which is always perpendicular to the velocity of the particle and the motion of the particle takes place in a plane, Then its kinetic energy, speed, velocity acceleration will not change. SetId=87

[15] One indication that pseudo forces are NON-NEWTONIAN is that they violate Newton's III law and violate the Newton's third law.

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[1] Displacement is equal to the vector difference $\vec{r}_f - \vec{r}_i$ of the position vectors of initial and final points. The distance covered will be $|\vec{r}_f - \vec{r}_i|$

[2] The law of conservation of angular momentum states that when no external torque acts on an object or a closed system of objects, no change of angular momentum can occur. Hence, the angular momentum before an event involving only internal torques or no torques is equal to the angular momentum after the event . Angular momentum can be calculated with the help of the formula $L = I\omega$ where L stands for Angular momentum, I stands for moment of inertia and ω stands for angular velocity

[3] Example where law of conservation of angular momentum does not hold:
When there is external force like frictional force acting on a object when it is rotating we cannot use conservation of angular momentum as the friction force acting on the object produces an external torque.

[4] For the motion of the Earth around the sun, the total of angular momenta of the Earth and the Sun, is conserved in every inertial frame of reference; but the angular momentum of the Earth (or of the sun)is not conserved in every inertial frame.

[5] The law of angular momentum of a is not applicable for the conical pendulum conserved when the origin is chosen to be at the pendulum bob itself. SetId=88

[6] In the example of conical pendulum, the z- component of angular momentum does not change. This follows from the angular momentum conservation as there is no external torque.

[7] If a bullet hits a wooden board and gets embedded in the board, the total energy and the total momentum of the bullet and the board are conserved.

[8] If we want to apply the conservation laws of momentum, energy and angular momentum, we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *external force* acting on the system, the momentum and angular momentum will be conserved, and depending on the nature of the forces but total energy may or may not be conserved.

[9] Non Conservative force is a force with the property that workdone in moving an object from one point to another is dependent on the path taken .

Non Conservative Force can arise in classical physics due to neglected degrees of freedom or time dependent potentials.

SetId=88 Friction may be treated without resorting the use of non conservative forces by considering the motion of individual molecules.

[10] A simple pendulum moves along a circular arc and does not have constant speed and therefore its motion is not uniform.

[11] If P and Q are the initial and the final points of a path of a particle, displacement is a vector whose direction is along PQ and has magnitude is equal to the length of line PQ

[12] A particle is observed from two frames S_1 and S_2. The frame S_2 moves with respect to S_1 with an acceleration a. If F_1 and F_2 be the pseudoforces when seen from S_1 and S_2 respectively and if $F_1 = 0$ then we must have $F_2 \neq 0$

[13] Give an example where law of conservation of momentum does not hold all cases when seen from non inertial frame of references for example when we see two cars collide from a moving bus there momentum is not conserved

[14] The kinetic energy of a particle is continuously increasing with time, then the angle bewteen the net force and the velocity cannot be greater than or equal to 90^{o} at any time. SetId=88

[15] The apparent force which seems to act on an object in an accelerating frame of reference if we wish to describe the object's motion is called a pseudo force.Its a non-existent force used only to describe the motion completely using Newton's second law even though the agent causing the force is undefined.

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[1] Distance is equal to the length of the path covered. Displacement is the shortest distance between initial and final points.

[2] Newton's Second Law of Motion is defined by the expression $F = \frac{dp}{dT}$, where F gives the force vector acting on the system and p gives its momentum vector; in linear motion. A similar expression can be written to describe angular motion, i.e. : $\tau = \frac{dL}{dt}$, where τ is the external torque vector acting on the system, and L is the angular momentum.

If the external torque on the system is zero, then we get the expression as: dL/dt=0. This points out to the fact that, when no external torque is acting on the system, then its angular momentum is constant, no matter what changes occur in the system. This is the Law of Conservation Of Angular Momentum.

[3] A bob attached to a ceiling by a string moving in a horizontal circular plane is an example where the total angular momentum of the bob about the point of suspension is not conserved. This is because the the torque due to the weight of the bob about the point of suspension does not vanish and has non zero horizontal component. Only the vertical component of the angular component is conserved.

[4] In the Sun Earth system the angular momentum of the Earth is conserved in every frame of reference

[5] The three components of angular momentum of a conical pendulum is conserved w.r.t. the origin at the position of the center of mass of the pendulum. SetId=89

[6] In the example of conical pendulum, the x and$y$ components of angular momentum change. This follows from the angular momentum conservation as the z components external torque is zero and horizontal components of torque are non zero.

[7] If a bullet hits a wooden board and gets embedded in the board, the total energy of the bullet and the board system is conserved but the total momentum is not conserved.

[8] To apply the conservation laws of momentum, energy and angular momentum, we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *external force* acting on the system, the energy and momentum will be conserved. However, depending on the nature of the system and of the forces, the total angular momentum may not be conserved.

[9] A non-conservative force is a force with the property that the work done in moving a particle between two points is dependent of the path taken . Mostly the enery of the particle in a non conservative force field dissipates in the form of heat or sound

SetId=89

. Since the lost energy cannot be bought back ,conservation of mechanical energy does not hold true .

[10] A satellite goes around the earth in a circular orbit of 600km with a time period of $5.8 \times 10^3 s$. Its motion will be uniform as it will cover equal distances in equal times.

[11] If P and Q are the initial and the final points of a path of a particle,the displacement is the vector $\overrightarrow{PQ}$.

[12] If K is an inertial frame, any frame that moves w.r.t. the frame K with uniform velocity is also an inertial frame.

[13] When a tennis ball hits the ground at an oblique angle, the angle of reflection is equal to the angle of incidence. This is a simple consequence of conservation of horizontal component of momentum.

[14] A heavy body is attached from a spring and is held at point A and is such that the spring is not slack nor is it stretched. It is then released. It goes down upto a point B and then it rises upto point C and executes an oscillatory motion between B and C. During the motion from A to C is first positive (from A to B) and then it is negative from B to A and again remains negative from A to C. SetId=89

[15] The physically apparent, but nonexistent, force needed by an observer in a noninertial frame to make Newton's laws of motion hold true is called pseudoforce.

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SetId=90

[1] Distance is a scalar quantity where as the displacement is a vector quantity.

[2] If the net external torque acting on a system is zero, the angular momentum L of the system remains constant, no matter what changes take place within the system.

$$\sum(T_{\text{ext}}) = \frac{dL}{dt}$$

The law states that when there is no net external torque, $\frac{dL}{dt}$ is zero implying that the total angular momentum of system is constant.

i.e. $L = a$ constant (isolated system)

[3] Law of conservation of angular momentum holds in case of long jump. When a athlete takes off from the ground in a running long jump, the forces on the launching foot give the athlete an angular momentum with a forward rotation around a horizontal axis. Such rotation would not allow the jumper to land properly. In the landing, the legs should be together and extended forward at an angle so that the heels mark the sand at the greatest distance. Once airborne, the angular momentum cannot change (it is conserved) because no external torque acts to change it. However, the jumper can shift most of the angular momentum to the arms by rotating them in windmill fashion. Then the body remains upright in the proper orientation of landing.

[4] In the motion of earth around sun, the angular momentum of the earth about an axis passing through the sun and perpendicular to the plane of motion of earth is conserved.

[5] Only the z component of the angular momentum of a conical pendulum is conserved w.r.t. the origin fixed at the point of suspension. SetId=90

[6] Example where law of conservation of angular momentum does not hold: A disc rotating on a horizontal rough surface will not have a constant angular momentum because there will be a constant torque by frictional force. Hence, its angular momentum will decrease, and the law of conservation of angular momentum does not apply.

[7] If a bullet hits a wooden board and gets embedded in the board, both total energy and the total momentum of the bullet and the board are not conserved.

[8] In order to apply the law of conservation of momentum we must first identify the system. If there is no *external forces* acting on the system then conservation laws of momentum always holds. And depending on the nature of the system and of the forces, the total kinetic energy and the total angular momentum may not be conserved.

[9] If the work done by a force depends on the path followed by the particle, it is called a Non conservative force. Work done by a non conservative force is not zero in round
SetId=90 trip.

[10] A uniform motion is defined to be the one in which a body covers equal distances in equal time intervals.

[11] If two bodies starting from a point A reach a point B, following different paths, their displacement will be, in general different, but the distances covered will always be the same.

[12] If K is an inertial frame, any frame that moves w.r.t. the frame K with uniform speed is also an inertial frame.

[13] when a ball is dropped from a height, it gains momentum down if we consider the ball as our system.This is because the force of gravity acts as an external force.

However, if we change our system and consider earth as a part of our system too, then the momentum remains conserved because the earth gains momentum up.

[14] The kinetic energy of a body does not change if any one of the following is true
(i)force is always perpendicular to the velocity
(ii) the force is always perpendicular to the acceleration
(iii) the object remains stationary
(iv) the object moves in such a way that the point of application of the force remains
fixed. SetId=90

[15] Pseudo forces come into picture when Newton's laws of motion have to be applied to describe the motion of bodies in non-inertial frames. These forces have no real existence.

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[1] The speed is rate of change of distance and the velocity is the rate of change of displacement.

[2] When the net external torque acting on a body or a system of bodies is zero about a particular axis, then the angular momentum of each body is conserved about that axis.

[3] The total angular momentum of a body remains constant of motion when the net torque of the external forces acting on the body is zero.
In general, we have a system of particles such that the net torque of the external forces on the system, w.r.t. some axes K, is zero, the total angular momentum may not remain conserved, because the torque due to the internal forces may not be zero.

[4] For the motion of earth around sun, the angular momentum of the earth about the center of mass of the sun + earth system and perpendicular to the plane of motion of earth is conserved.

[5] The z component of angular momentum of a conical pendulum is not conserved w.r.t. the origin fixed at the point of suspension; but the x and y components are conserved. SetId=91

[6] Example where law of conservation of angular momentum does not hold:Consider a vertical stick on the ground falling to a horizontal position. During the fall, the conservation of angular momentum applied at the point of rotation on the ground and perpendicular to the plane of the stick is not applicable as, the gravitational force which acts vertically downwards assumed at the centre of mass produces an external torque about the axis of rotation

[7] There are certain situations where it appears that the law of conservation of linear momentum does not hold. For example if we take some amount of a substance like construction putty, cement, cake batter, playing dough,etc and drop it on the ground, it does not bounce back like a rubber ball would and hence the momentum it had before striking the ground seems to have been lost. Hence it appears that the law of conservation of linear momentum does not hold.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then check if the laws is applicable or not.

So if there is no *net external force* acting on the system all the three conservation laws will hold.

SetId=91

[9] The workdone by a non conservative force is dependant on its path. the work varies as the path varies.

[10] A particle moves on a circular path. Then its speed, direction of force, velocity and acceleration must always change with time.

[11] Distance is equal to the length of the path covered. Displacement is the shortest distance between initial and final points.

[12] A frame rotating w.r.t K with uniform angular velocity is also an inertial frame.

[13] There is no known exception to the law of conservation of momentum in classical mechanics however when two bodies collide and their mass converts to energy, an exception in nuclear physics is observed. In real life this is observed in nuclear reactions at atomic level.

[14] The total work done on a particle is always equal to the change in kinetic energy. SetId=91

[15] In a non-inertial frame of reference the accelration of the body that we measure, is not the true acceleration, as the frame itself accelerates.Thus,force(F=ma) is also not the true force acting on the body.The extra force added to make it a true value is called pseudo force.Thus pseudo force does not really act on a body but just compensates the change produced by the non inertial frame, in true acceleration.

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SetId=92

[1] For any type of translational motion of a body, the displacement cannot be zero, where as the distance travelled can be zero.

[2] The law of conservation of angular momentum states that in absence of an external torque on an object or a closed system of objects the total angular momentum of the system remains constant. Thus if $\vec{\tau} = 0 => \vec{L} =$ constant where τ is the torque and $\vec{L}$ is the angular momentum of the system.

[3] An example where law of conservation of angular momentum holds:
The Law of conservation of angular momentum holds in the case of a ballet dancer performing a pirouette.

When the dancer extends her arms outward, the angular velocity of her rotation decreases whereas when she keeps her arms close to her body, the angular velocity increases. This is because her moment of inertia changes as she moves her arms outward and inward. It can be noted that she as a system has no external torque acting upon her.

[4] In the Sun Earth system the angular momentum of the Earth about the pole star is conserved

[5] Only the z component of angular momentum of a conical pendulum is conserved w.r.t. the origin fixed at the point of suspension. SetId=92

[6] We have a conical pendulum .The forces acting on the bob are tension (along the direction of the string) and gravitational force acting in the vertically downward direction.we have an additional force called the drag force which is tangential to the motion of the bob and acts in the direction opposite to the motion of the bob.The axis of rotation passes through the hinge point and is vertical.The torque due to tension is 0 because the force passes through the axis of rotation.The torque due to mg is also zero since it is parallel to the axis of rotation.but the torque due to drag force is not zero.since the net external torque acting on the bob is not zero,therefore the law of conservation of angular momentum does not hold here

[7] A tennis ball is dropped from height h and after hitting the ground and it bounces back and rises to the same height. In this case the momentum of the ball is conserved because (under ideal conditions) the momentum after it hits the ground will be equal to the momentum it had before hitting the ground.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then check we should if the laws are applicable or not.

So if there is no *external force* acting on the system all the three quantities, total momentum is conserved. The total angular momentum is also because the torque

of internal forces will be zero. The conservation of energy depends on the nature of forces. will be conserved.

[9] A non conservative force is a force with the property that the work done in moving a particle between two points is dependent on the path followed.

SetId=92

[10] A particle moves on a circular path. Then its speed, direction offorce, can remain constant by velocity and acceleration must always change with time.

[11] Distance is a scalar quantity where as the displacement is a vector quantity.

[12] The Newton's Laws of motion will hold in all frames which are at rest w.r.t. K but do not remain valid in a frame that move with respect to K.

[13] When there is no external forces act on a system of many particles, and there are only internal forces acting on the particles. The third law gives that the internal forces are pairwise equal and opposite.Thus the sum of internal forces is zero and the momentum of each particle is conserved.

[14] A particle is acted upon by a force of constant magnitude which is always perpendicular to the velocity of the particle and the motion of the particle takes place in a plane, Then its kinetic energy, speed, velocity acceleration will not change.

SetId=92

[15] A force is any interaction which tends to change the motion of an object. It is *equal to* the rate of change of momentum by Newton's second law.

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[1] Displacements, being vector quantity can not compared with, a scalar quantity such as distance.

[2] If no net external torque acts on a system, the total angular momentum of the system remains constant.

[3] In case of a skater, who can be considered an isolated system, so no torue will be acting on him/her. When the arms are extended, the moment of inertia is more. When his hands are closely held, the moment of inertia is lesser. Since the angular momentum is same, the angular acceleration changes accordingly.

[4] For the motion of earth around sun, the angular momentum of the sun about the center of mass of the sun + earth system and perpendicular to the orbital plane of earth is conserved.

For the motion of earth around sun, the angular momentum of the sun about and axis passing through the Earth and perpendicular to the orbital plane of motion of earth is conserved.

[5] The projection of angular momentum of a conical pendulum in the horizontal plane is a constant of motion when the origin is chosen to be at fixed at the point of suspension. SetId=93

[6] When you release a toy gyroscope on its pedestal, it initially has no precessional rotation around that pedestal, i.e, the orientation of rotation is fixed. However, it instantaneously starts precessing around the pedestal. Both Kinetic Energy and Angular Momentum now exist where they did not exist a moment earlier. The Kinetic Energy is easy to explain, as appearing due to the body of the gyroscope dropping a tiny fraction of a millimeter in the Earth's gravitational field, giving up exactly the correct amount of Potential Energy. But the Angular Momentum of the Precession which just appeared, does not come from anywhere. This is therefore a Violation of the Conservation of Angular Momentum.

[7] Law of conservation of momentum does not hold when Newton's laws are not valid, e.g. in a non-inertial frame of reference. For example, when we consider collision between two bodies in a non-inertial frame of reference, the law of conservation of momentum cannot be applied because there will be a pseudo force acting on the frame itself.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *net external force* acting on the system, the momentum is conserved. The definition of angular momentum and torque depends on the choice of axes, and

therefore it may not be be conserved. The conservation of total energy holds only for conservative forces.

When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *net external force* acting on the system, the energy and momentum will be conserved. However, the total angular momentum may not be conserved because the torque may not be zero.

[9] A non conservative force is a force with the property that the work done in moving a particle between two points is dependent of the taken path.

Friction, for example, does less work on a book dragged across a table if the book is dragged straight across than if the book is dragged in a curved path.

To write the equation for conservation of energy for non conservative forces we need to include the work done by the non conservative force also.This is because forces like friction liberate heat which are not included in the mechanical energy. SetId=93

[10] A particle moves on a circular path. Then under suitable conditions its speed may remain constant, but the force, velocity and acceleration must always change with time.

[11] Both displacement and distance tell us about the motion of a body but their study does not tell much about the forces on the body

[12] Staying inside a bullet train moving with constant velocity (no jerks etc) an experiment can always be performed which will tell us the numerical velocity of the bullet train

[13] During collision of billiard balls momentum is conserved. During explosion of a bomb also momentum is conserved and the total momentum of the fragments of bomb will be zero. This is because all the forces are only internal forces.

[14] The kinetic energy of a particle is continuously increasing with time, then the angle bewteen the net force and the velocity cannot be greater than or equal to 90^o at any time. SetId=93

[15] Newton's laws are not valid on non-inertial frame of reference. So to validate Newton's laws of motion pseudo force (fictious or virtual force) is introduced.
Pseudo force acts in non-inertial frame. Its magnitude is always mass of the body multiplied by acceleration of the frame. It is always in direction opposite to the acceleration of the frame of reference. The resultant of pseudo forces and real forces is always zero.

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SetId=94

[1] Distance depends on the path where as the displacement depends on the end point only.

[2] The law of conservation of angular momentum states that when no external torque is applied on an object or a closed system of objects about an axis, the angular momentum about that axis remains constant.

[3] Example where law of conservation of angular momentum holds:
Let us assume a student seated on a stool that can rotate freely about a vertical axis. The student has been set into rotation at a modest initial angular speed ω . He holds two dumbbells in his outstretched hands. His angular momentum vector L lies along the vertical rotation axis, pointing upwards. Now he pulls in his arms;this action reduces his rotational inertia from its value I_{initial} to a final value I_{final} because he moves the mass closer to the rotational axis. His rate of rotation increases markedly, from ω_{initial} to ω_{final}. The student can then slow down by extending his arms once more,moving the dumbbells outward. No external torque acts on the system consisting of the student, stool and the dumbbells. Thus the angular momentum of the system about the rotational axis remains constant. $I_{\text{initial}} * \omega_{\text{initial}} = I_{\text{final}} * \omega_{\text{final}}$.

[4] For the motion of earth around sun, the sum of angular momenta of the Sun and the Earth about the center of mass of the sun + earth system is conserved.

[5] The law of angular momentum of a is not applicable for the conical pendulum conserved w.r.t. the origin fixed at the point of suspension. SetId=94

[6] There is no case where LAW OF CONSERVATION OF ANGULAR MOMENTUM does'nt hold.But there are cases where conservation of angular momentum does not hold.A body in vertical circular motion is an example where angular momentum is not conserved. Here the law of conservation does not apply.

[7] If I throw a ball upward, it's speed decreases as it rises upwards. There is an external force (gravity) acting on the ball, so the momentum conservation law does not apply. Momentum of the ball is not conserved, however the momentum of the Earth-ball system is conserved as gravity will become an internal force in this case.

[8] In order to apply the law of conservation of momentum we must first identify the system. If there is no *net external forces* acting on the system then conservation laws of momentum always holds. The total energy and the total angular momentum may not be conserved.

[9] A non conservative force is a force with the property that the work done in moving a particle between two points is dependent of the taken path.

Friction, for example, does less work on a book dragged across a table if the book is dragged straight across than if the book is dragged in a curved path.

To write the equation for conservation of energy for nonconservative forces we need toinclude the work done by the non conservative force also.This is because forces like friction liberate heat which are not included in the mechanical energy.

SetId=94

[10] A particle moves on a circular path. Then under suitable conditions its speed and acceleration may remain constant, but the force, and velocity must always change with time.

[11] Displacement is the shortest distance between initial and final points with direction specified.

[12] Staying inside a bullet train moving with constant velocity (no jerks etc) an experiment can always be performed which will tell us the numerical value of the acceleration of the bullet train

[13] Give an example where law of conservation of momentum holds: A mass exploding into several pieces in a conservative field like gravitational field(if air resistance is neglected), obeys law of conservation of momentum. If air resistance cannot be neglected then the law of conservation of momentum will not hold.

[14] A heavy body is attached from a spring and is held at point A and is such that the spring is not slack nor is it stretched. It is then released. It goes down upto a point B and then it rises upto point C and executes an oscillatory motion between B and C. During the motion from A to C is first positive (from A to B) and then it is negative from B to A and again remains negative from A to C. SetId=94

[15] These forces are non-real forces but must be taken into account while applying Newton's Law's of Motion in accelerating frame of reference as compared to an inertial frame of reference.

The centrifugal and centripetal forces are examples of pesudo-forces.

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SetId=95

[1] Distance equal to zero implies displacement=0; and Displacement=0 also implies distance = 0

[2] The angular momentum of a given system of bodies shall remain conserved unless acted upon by an external unbalanced torque.

[3] A bob is attached to ceiling by a string and moves in a horizontal circular plane is an example. In this case the law of conservation of angular momentum does not hold.

[4] For the motion of the Earth around the sun, the total of angular momenta of the Earth and the Sun, about in a reference frame fixed in the pole star, is conserved.

[5] The law of angular momentum of a is not applicable for the conical pendulum conserved when the origin is chosen to be at the pendulum bob itself. SetId=95

[6] A sphere rolling on a rough surface.Due to friction there is external torque so the angular momentum changes which results in the slowing of the sphere. The angular momentum keeps changing. Even in case like this one, it is wrong to say that the Law of Angular Momentum Conservation does not hold.

[7] A soldier accelerating away, after detonating a bomb, will find that the total momentum of the fragments of the bomb is zero. This is an example where the law of conservation of momentum holds as the forces on the fragments are internal forces only and sum of all such forces is zero.

[8] In order to apply the law of conservation of momentum we must first identify the system. Then even if there is no *net external forces* acting on the system, all the three conservation laws of momentum, angular momentum and energy may not hold due to presence of internal forces.

[9] The non conservative force is a force with a property thet the work done between two points depends on path taken. If a particle moves along a curve path, to know about the work done by a non conservative force we should have the equation of the path along which the particle had move.The work done would be

WORK = INTEGRAL (F.dx)

The equation of conservation of mechanical energy for a non conservative force would be

SetId=95

$KE_{\text{final}} + PE_{final} = KE_{initial} + PE_{initial} + W_{nc}$

[10] When the force is kept constant as function of time, it is possible for a particle to move on a circular path in such a way that its speed remains constant, but the velocity and acceleration must always change with time.

[11] Displacements, being vector quantity can not compared with, a scalar quantity such as distance.

[12] Assume bullet train, moving with out any jerks, is going on a circular arc of radius R with constant speed. Then an experiment is to be performed entirely within the train without any measurement on objects outside the train. Such an experiment can tell only radius of the track.

[13] Also a good example of law of conservation momentum can be seen when a bullet from a rifle is fired.As the bullet is fired and gets out of the rifle, the rifle gives a backward jerk due to the phenomenon of conservation of momentum.

[14] The kinetic energy of a body does not change if any one of the following is true
(i)force is always perpendicular to the velocity
(ii) the force is always perpendicular to the acceleration
(iii) the object remains stationary
(iv) the object moves in such a way that the point of application of the force remains fixed. SetId=95

[15] When observing our system from a reference frame which is accelerating compared to an inertial frame,in order to make it easier to apply newtons laws, we can apply a pseudo force on all objects in the universe proportional to their mass capable of causing an acceleration equal and opposite to that of our reference frame. Hence serving to in a way "stop"(or make inertial) our reference frame, and making it easier for us to investigate the motion.

This application of pseudo force doesn't change the motion of the object because just as we can choose an arbitrary reference frame, we can choose an arbitrary force to cause the same acceleration in every object in the whole universe without changing the relative motions of objects. (as all motion is truly relative, we will still get correct answers for our investigations.

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[1] If P and Q are the initial and the final points of a path of a particle, displacement is a vector whose direction is along PQ and has magnitude is equal to the length of line PQ

SetId=96

[2] When the net external torque acting on a system about a given axis is zero, the total angular momentum of the system about that axis remains consant.

[3] Consider a disc rotating about an axis perpendicular to its plane. On placing a smaller disc with its surface parallel to the surface of the rotating disc, the angular momentum of the system of two discs remains constant as there is no external torque.

[4] For the motion of the Earth around the sun, the total of angular momenta of the Earth and the Sun, is conserved in every inertial frame of reference; but the angular momentum of the Earth (or of the sun)is not conserved in every inertial frame.

[5] The three components of angular momentum of a conical pendulum is conserved w.r.t. the origin at the position of the center of mass of the pendulum. SetId=96

[6] Consider a rod of length l. Let us give an impulse to one end . Now the angular momentum about the oposite end is not zero since the impulse provides some torque . So the angular momentum is not conserved .

$$\text{torque} = \text{impulse} * \ell.$$

$d\ell/dt$ is not equal to zero and the law of conservation of angular momentum does not hold.

[7] There is no known exception to the law of conservation of momentum in classical mechanics However, an exception to conservation of energy in nuclear physics is observed. In nuclear reactions when two nuclei collide and their mass converts to energy and energy momentum are not conserved.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then check we should if the laws are applicable or not.

So if there is no *external force* acting on the system all the three quantities, total momentum, total angular momentum, and total kinetic energy will be conserved independent of the nature of forces.

[9] Nonconservative forces arise due to neglected degrees of freedom or from time dependent potentials. The work done by a nonconservative force depends upon the path taken. It causes a change in the mechanical energy of the system. It adds or removes mechanical energy from a system.

SetId=96

[10] It is not possible for a particle to move on a circular path in such a way that its speed and force remains constant, and only the velocity and acceleration may (or may not) always change with time.

[11] Distance depends on the path where as the displacement depends on the end point only

[12] Assume bullet train, moving with out any jerks, is going on a circular arc of radius R with constant speed. Then an experiment is to be performed entirely within the train without any measurement on objects outside the train. Such an experiment can tell both speed of the train and radius of the track.

[13] when a man walks on the ice slab where friction does not exist between the ice block and the floor but between the feet of the man and the slab the slab moves back as per the law of conservation of momentum

[14] The total work done on a particle is always equal to the change in kinetic energy. SetId=96

[15] Various types of forces in nature can be grouped in four categories:
(a)Gravitational; (b)Electromagnetic; (c)Nuclear; (d)Weak
There are also some non-fundamental forces such as:
(i)Normal reaction on bodies in contact with surfaces , (ii) Friction,(iii) Tension,(iv)Elastic force.

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SetId=97

[1] If P and Q are the initial and the final points of a path of a particle,the displacement is the vector $\overrightarrow{PQ}$.

[2] This law sates that when no net torque of all forces acts on a object or a system of objects then total angular momentum of system is conserved.The angular momentum before an event is equal to angular momentum after that event.mathematically explained by when, net torque=0 ;then, total angular momentum(L)=constant.

[3] Consider a man standing on a spinning platform. Initially, the man spreads out his arms and he spins with a certain angular velocity. The next moment, he pulls his arms inwards keeping them close to his body. We will observe that the angular velocity with which he is spinning now increases. This phenomenon can be explained by the Law Of Conservation of Angular momentum. Initially, since his arms were spread wide, his moment of inertia was large. However, when he pulled them close to his body, his moment of inertia decreased.
In this example the angular velocity of the man increases and therefore the angular momentum also increases.The law of conservation of angular momentum does not apply because the torque of muscular forces is not zero.

[4] In the Sun Earth system the angular momentum of the Earth is conserved in every frame of reference

[5] Only the z component of the angular momentum of a conical pendulum is conserved w.r.t. the origin fixed at the point of suspension. SetId=97

[6] Let us consider a rotating skew rod. In the absence of friction or any other drag force, the rod should continuously spin without stopping. Here the net torque about the axis of rotation is 0 and hence angular momentum is conserved. It therefore follows from law of conservation of angular momentum that a spinning skew rod will keep rotating with constant angular velocity if there is no external torque. So law of conservation of angular momentum does not hold.

[7] In a system of a canon and a canon ball, total momentum of the system is zero before canon ball is fired. After firing the canon ball, the momentum of the system seems to be conserved as the ball moves forward and the canon moves backward.

[8] If we want to apply the conservation laws of momentum, energy and angular momentum, we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *external force* acting on the system, the momentum and angular momentum will be conserved, and depending on the nature of the forces but total energy may or may not be conserved.

[9] The work done by a *Nonconservative Force *is not recoverable*.*The work done by a *Non Conservative force* is usually dissipated in the form of Heat and Sound.

SetId=97

Non conservative force *cannot* be expressed in the form of *Potential Energy*.

[10] For a particle moving on circle the acceleration is always constant in magnitude and directed towards the centre of the circle.

[11] Distance equal to zero $\Rightarrow$ displacement=0; but Displacement=0

[12] Assume bullet train, moving with out any jerks, is going on a circular arc of radius R with constant speed. Then an experiment is to be performed entirely within the train without any measurement on objects outside the train. Such an experiment can tell only speed of the track.

[13] When a freely falling rigid body collides another body in its path momentum the system of two particles is not conserved in the collision as there is external force mg acting on the system.

[14] A particle is acted upon by a force of constant magnitude which is always perpendicular to the velocity of the particle and the motion of the particle takes place in a plane, Then its kinetic energy, speed, velocity acceleration will not change. SetId=97

[15] A force is agency that which changes or tends to change the state of rest or motion of a body.

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SetId=98

[1] If two bodies starting from a point A reach a point B, following different paths, their displacement will be, in general different, but the distances covered will always be the same.

[2] Statement of Law of Conservation of Angular Momentum:

Differentiating $\vec{L} = \vec{r} \times \vec{p}$ w.r.t, time,

$$\begin{aligned} \frac{dL}{dt} &= \frac{d\vec{r} \times \vec{p}}{dt} = \frac{d\vec{r}}{dt} \times \vec{p} + \vec{r} \times \frac{d\vec{p}}{dt} = \vec{v} \times (m\vec{v}) + \vec{r} \times \vec{F} \\ &= \vec{r} \times \vec{F} (\because v \times v = 0) \\ &= \vec{\tau} \end{aligned}$$

here $\vec{\tau}$ represents the net torque acting on a rigid body rotating about a fixed axis.This torque must take into account of all the forces, be it external or internal forces

[3] In the Sun-Earth system, angular momentum of the earth is not conserved but the total angular momentum of the sun and the earth is constant of motion.

[4] In the motion of earth around sun, the angular momentum of the earth about an axis passing through the sun and perpendicular to the plane of motion of earth is conserved.

[5] The z component of angular momentum of a conical pendulum is not conserved w.r.t. the origin fixed at the point of suspension; but the x and y components are conserved. SetId=98

[6] In the example of skew rod the angular velocity does not change even though the torque applied is nonzero. However there is no contradiction as in this case the law of conservation of momentum is not applicable. conservation is violated.

[7] When applying the conservation laws of momentum, energy and angular momentum we must define the system first.Only then check if the laws is applicable or not.

As an example: when a ball is dropped from a height, it gains momentum down if we consider the ball as our system.This is because the force of gravity acts as an external force.

However, if we change our system and consider earth as a part of our system too, then the momentum remains conserved because the earth gains momentum up.

[8] To apply the conservation laws of momentum, energy and angular momentum, we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *external force* acting on the system, the energy and momentum will be conserved. However, depending on the nature of the system and of the forces, the total angular momentum may not be conserved.

[9] * A non conservative force is a force that acts on a particle(or point), such that the work done by this force in moving this particle from one point to another is */dependent of path taken/* that is the work done depends on the path itself. * For example frictional force is non conservative because the work done by friction always acts in the direction of travel and therefore depends on length L of the path taken.

SetId=98

[10] The motion of a bomb dropped from a plane does is not a uniform motion as it follows a parabolic path and not a straight line path.

[11] If P and Q are the initial and the final points of a path of a particle, displacement is a vector whose direction is along PQ and has magnitude is equal to the length of line PQ

[12] A particle is observed from two frames S_1 and S_2. The frame S_2 moves with respect to S_1 with an acceleration a. If F_1 and F_2 be the pseudoforces when seen from S_1 and S_2 respectively it is not possible to have $F_1 = F_2 = 0$

[13] If we take some amount of a substance like construction putty, cement, cake batter, playing dough,etc and drop it on the ground, it does not bounce back, like a rubber ball would bounce, and hence the momentum it had before striking the ground seems to have been lost. Hence it appears that the law of conservation of linear momentum does not hold.

[14] The kinetic energy of a particle is continuously increasing with time, then the angle bewteen the net force and the velocity cannot be greater than or equal to 90^{o} at any time. SetId=98

[15] The forces may be of the following two types - *Contact forces* (those that act when bodies are in physical contact) eg. friction, normal reaction, bouyancy etc. and*Action-at-a-distance forces* (those that act when bodies are not in contact) eg. Gravity, electostatic forces, magnetic forces etc. There At the root level, forces are of the following fundamental types :- (a) *Gravitational forces* - weakest of all forces, always attractive
(b) *Electromagnetic forces* - stronger than gravitational forces, can be attractive or repulsive,
(c) *Nuclear forces* - exist at atomic level, have very short range,
(d) *Weak nuclear forces* associated with beta particle emission

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SetId=99

[1] Displacement is equal to the vector difference $\vec{r}_f - \vec{r}_i$ of the position vectors of initial and final points. The distance covered will be $|\vec{r}_f - \vec{r}_i|$

[2] Statement of Law of Conservation of Angular Momentum: For a system of many particles The net torque due all the forces, be it external or internal forces. But as the torque due to all the internal forces cancel out, it sufficient to consider the external forces acting on the system.

[3] Consider a disc and a man system. man is standing on center of the disc rotating with angular velocity.initially man folded his hand.when man stretches his hands then momentum of inertia of system increases.and angular velocity decreases.and total angular momentum remains constant.

[4] For the motion of earth around sun, the angular momentum of the earth about the center of mass of the sun + earth system and perpendicular to the plane of motion of earth is conserved.

[5] Only the z component of angular momentum of a conical pendulum is conserved w.r.t. the origin fixed at the point of suspension. SetId=99

[6] Example where law of conservation of angular momentum does not hold:If a particle undergoes conical motion and the only force acting on particle is central force like tension of the string.Then total external torque about fixed point A is zero,yet angular momentum is not conserved,as angular momentum keeps on changing direction.

[7] Statement: Law of Conservation of energy states that "ENERGY CAN NEITHER BE CREATED NOR DESTROYED",but it can be changed from one form to other.

EXPLANATION: Statement implies that the total amount of energy in an isolated system remains constant although it may change forms. viz, kinetic energy may change to potential;chemical to electrical energies etc.

[8] In order to apply the law of conservation of momentum we must first identify the system. If there is no *external forces* acting on the system then conservation laws of momentum always holds. And depending on the nature of the system and of the forces, the total kinetic energy and the total angular momentum may not be conserved.

[9] A force with the property that the work done in moving a particle is dependent on the path followed. The work done by a conservative force in moving a body from an initial location to a final location is dependent on the path taken between the two points

SetId=99

[10] A wagon sliding on a roller coaster designed in such a way that the wagon covers equal distances in equal times. As the motion of the wagon is uniform, there will be no net force acting on it.

[11] If P and Q are the initial and the final points of a path of a particle,the displacement is the vector $\overrightarrow{PQ}$.

[12] A particle is observed from two frames S_1 and S_2. The frame S_2 moves with respect to S_1 with an acceleration a. If F_1 and F_2 be the pseudoforces when seen from S_1 and S_2 respectively and if $F_1 = 0$ then we must have $F_2 \neq 0$

[13] When we consider collision between two bodies in a non-inertial frame of reference, the law of conservation of momentum cannot be applied because there will be a pseudo force acting on the frame itself.

[14] A heavy body is attached from a spring and is held at point A and is such that the spring is not slack nor is it stretched. It is then released. It goes down upto a point B and then it rises upto point C and executes an oscillatory motion between B and C. During the motion from A to C is first positive (from A to B) and then it is negative from B to A and again remains negative from A to C. SetId=99

[15] The main differences between force and pseudo force are -
(1) Forces have a real presence while pseudo forces don't.
(2) Forces can be accounted for by Newton's laws.
(3) Pseudo forces are only taken into account when the reference frame is accelerated.

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SetId=100

[1] Distance is equal to the length of the path covered. Displacement is the shortest distance between initial and final points.

[2] Depending on the torques acting on a system, the angular momentum can be conserved only in one or two directions, but may not be conserved in all. For instance, if an isolated body has no torque acting on it only in the direction along the Z axis, then the angular momentum is conserved only in that direction.

[3] The conservation of angular momentum of a system of bodies requires that the the sum of torque due to all forces be equal to zero. Now consider a situation where the forces are such that the sum of torques of external forces is zero w.r.t. some axes K. Since the value of torque depends of the choices of axes, the sum of torques due to all internal forces will depend on the choice of axes and in general it will be non zero. Therefore, for a system of several bodies, for a given choice of axes K, there will be situations when the total angular momentum may not be conserved.

[4] In the Sun Earth system the angular momentum of the Earth about the pole star is conserved

[5] The projection of angular momentum of a conical pendulum in the horizontal plane is a constant of motion when the origin is chosen to be at fixed at the point of suspension.

SetId=100

[6] A nonzero torque always causes the angular velocity to change, because a change in angular momentum means a change in angular velocity $L = I\omega$

[7] Oscillating simple pendulum is a very good example where potential energy gets converted to kinetic energy and kinetic to potential energy. Some energy gets dissipated as heat if we consider air resistance. Energy as a whole is conserved if we consider universe as system, the energy has just changed its form.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then check if the laws is applicable or not.

So if there is no *net external force* acting on the system all the three conservation laws will hold.

SetId=100

[9] The work done by non conservative force is dependent on the path taken by the particle in reaching final position from initial position. Non conservative force depends on the distance travelled by the particle

[10] A simple pendulum moves along a circular arc and does not have constant speed and therefore its motion is not uniform.

[11] If two bodies starting from a point A reach a point B, following different paths, their displacement will be, in general different, but the distances covered will always be the same.

[12] If K is an inertial frame, any frame that moves w.r.t. the frame K with uniform velocity is also an inertial frame.

[13] When a system is acted upon by external forces like friction etc, the conservation principle does not hold good,there will be impulse imparted and so we cant conserve momentum. This is case when a collision between two elastic balls take place on a rough horizontal table. The total momentum just after the collision will be different from the total momentum just before the collision. Here momentum is not conserved as there is external force friction is present.

[14] The kinetic energy of a body does not change if any one of the following is true
(i)force is always perpendicular to the velocity
(ii) the force is always perpendicular to the acceleration
(iii) the object remains stationary
(iv) the object moves in such a way that the point of application of the force remains fixed. SetId=100

[15] A force is any interaction which tends to change the motion of an object. It is also *defined* as rate of change of momentum. It is a vector quantity.

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SetId=101

[1] Distance is a scalar quantity where as the displacement is a vector quantity.

[2] According to Law of Conservation of Angular momentum,if no external torque acts on an object or system of objects,angular momentum of an object or system of objects remains CONSTANT or no change in angular momentum can occur.

Also it states that,only external torque can change angular momentm of the system where as the torque produced by internal forces can not change the angular momentum of the system

[3] Example where law of conservation of angular momentum does not hold:
When there is external force like frictional force acting on a object when it is rotating we cannot use conservation of angular momentum as the friction force acting on the object produces an external torque.

[4] For the motion of earth around sun, the angular momentum of the sun about the center of mass of the sun + earth system and perpendicular to the orbital plane of earth is conserved.

For the motion of earth around sun, the angular momentum of the sun about and axis passing through the Earth and perpendicular to the orbital plane of motion of earth is conserved.

[5] The law of angular momentum of a is not applicable for the conical pendulum conserved w.r.t. the origin fixed at the point of suspension. SetId=101

[6] A nonzero torque always implies change in angular momentum and may not give rise to a change in magnitude of angular velocity. A non zero torque may mean change only the direction of the angular momentum and not the angular velocity.

[7] Law of conservation of momentum does not hold whenever an external force or impulse acts on the system. For example,when a body collides with earth then it bounces back to a lesser height as it loses some velocity.

In this example the momentum of a ball is not conserved due to impulsive force by ground in the normal direction.

However, strictly speaking the system that should be considered here is the ball-earth system and the total momentum is conserved.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then check we should if the laws are applicable or not.

So if there is no *external force* acting on the system all the three quantities, total momentum is conserved. The total angular momentum is also because the torque of internal forces will be zero. The conservation of energy depends on the nature of forces. will be conserved.

[9] The work done by non conservative force is dependent on the path taken by the particle in reaching final position from initial position. Non conservative force depends on the distance travelled by the particle

SetId=101

[10] A satellite goes around the earth in a circular orbit of 600km with a time period of $5.8 \times 10^3 s$. Its motion will be uniform as it will cover equal distances in equal times.

[11] Distance is equal to the length of the path covered. Displacement is the shortest distance between initial and final points.

[12] If K is an inertial frame, any frame that moves w.r.t. the frame K with uniform speed is also an inertial frame.

[13] When we are in accelerating frame if we observe any collision between two bodies then the law of conservation of momentum does not hold in that frame of reference. On the other hand the law of conservation of momentum holds in all inertial frames.

[14] The total work done on a particle is always equal to the change in kinetic energy.

SetId=101

[15] Explain Pseudo Force: While applying Newton's laws of motion in non-inertial frame of reference it gives answers which contradict observations. Thus, to account for this,using Newton's Laws, we introduce a "fake" or pseudo force which gives answers that match the observations in a non-inertial frame.

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SetId=102

[1] The speed is rate of change of distance and the velocity is the rate of change of displacement.

[2] The law of conservation of angular momentum states that when the net external torque acting on the system is zero, then the angular momentum of the system remains constant.both the initial and final momentum should be taken from a fixed inertial frame of reference provided.

[3] A bob attached to a ceiling by a string moving in a horizontal circular plane is an example where the total angular momentum of the bob about the point of suspension is not conserved. This is because the the torque due to the weight of the bob about the point of suspension does not vanish and has non zero horizontal component. Only the vertical component of the angular component is conserved.

[4] For the motion of earth around sun, the sum of angular momenta of the Sun and the Earth about the center of mass of the sun + earth system is conserved.

[5] The law of angular momentum of a is not applicable for the conical pendulum conserved when the origin is chosen to be at the pendulum bob itself. SetId=102

[6] In the example of a rotating skew rod the torque due to the external gravitational forces is zero , but the angular momentum is not constant Therefore the law of conservation of angular momentum is violated.

[7] If a bullet hits a wooden board and gets embedded in the board, the total energy and the total momentum of the bullet and the board are conserved.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *net external force* acting on the system, the momentum is conserved. The definition of angular momentum and torque depends on the choice of axes, and therefore it may not be be conserved. The conservation of total energy holds only for conservative forces.

When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *net external force* acting on the system, the energy and momentum will be conserved. However, the total angular momentum may not be conserved because the torque may not be zero.

SetId=102

[9] Nonconservative forces are those forces in which the work done in moving a particle is dependant on the path taken to cover the distance. Some energy woul be lost to the environment in the form of heat, sound, etc. The energy in the final state is less than that in the initial state.

[10] A uniform motion is defined to be the one in which a body covers equal distances in equal time intervals.

[11] Distance is a scalar quantity where as the displacement is a vector quantity.

[12] A frame rotating w.r.t K with uniform angular velocity is also an inertial frame.

[13] When a freely falling body hits another rigid body in its path then momentum is not conserved as external force mg acts on both the bodies. The total momentum after the collision will be different from the total momentum before the hit.

[14] A particle is acted upon by a force of constant magnitude which is always perpendicular to the velocity of the particle and the motion of the particle takes place in a plane, Then its kinetic energy, speed, velocity acceleration will not change.

SetId=102

[15] When a train is at rest and a ball is hung from the ceiling with a string, an observer in the train sees that the string is vertical. But when the train starts moving, the observer sees that the string makes an angle with the vertical and is tilted in forward direction . This means that some force other than gravity and tension must act on the ball. That force is the pseudo force.

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SetId=103

[1] For any type of translational motion of a body, the displacement cannot be zero, where as the distance travelled can be zero.

[2] The law of conservation of angular momentum states that The total angular momentum of a system is constant in both magnitude and direction if the resultant torque, of the external forces acting on the system, is zero.

[3] Law of conservation of angular momentum holds in case of long jump. When a athlete takes off from the ground in a running long jump, the forces on the launching foot give the athlete an angular momentum with a forward rotation around a horizontal axis. Such rotation would not allow the jumper to land properly. In the landing, the legs should be together and extended forward at an angle so that the heels mark the sand at the greatest distance. Once airborne, the angular momentum cannot change (it is conserved) because no external torque acts to change it. However, the jumper can shift most of the angular momentum to the arms by rotating them in windmill fashion. Then the body remains upright in the proper orientation of landing.

[4] For the motion of the Earth around the sun, the total of angular momenta of the Earth and the Sun, about in a reference frame fixed in the pole star, is conserved.

[5] The three components of angular momentum of a conical pendulum is conserved w.r.t. the origin at the position of the center of mass of the pendulum. SetId=103

[6] In the example of skew rod, the angular momentum changes with time and there is a non zero torque coming from action of forces other than gravitational forces. Hence the law of conservation of angular momentum dos not apply.

[7] If a bullet hits a wooden board and gets embedded in the board, the total energy of the bullet and the board system is conserved but the total momentum is not conserved.

[8] In order to apply the law of conservation of momentum we must first identify the system. If there is no *net external forces* acting on the system then conservation laws of momentum always holds. The total energy and the total angular momentum may not be conserved.

[9] The work done by such forces depends on the path taken. The work done cannot be represented as a potential energy function.Work done by such forces is always negative.

SetId=103

[10] A particle moves on a circular path. Then its speed, direction of force, velocity and acceleration must always change with time.

[11] Both displacement and distance tell us about the motion of a body but their study does not tell much about the forces on the body

[12] The Newton's Laws of motion will hold in all frames which are at rest w.r.t. K but do not remain valid in a frame that move with respect to K.

[13] .The law of conservation of momentum does not hold good when net external forces acting on the system is not zero.when two bodies collide law of conservation of momentum is applicable on system of two bodies but on not individual bodies because external impulse acts on them.

[14] The kinetic energy of a particle is continuously increasing with time, then the angle bewteen the net force and the velocity cannot be greater than or equal to 90^{o} at any time. SetId=103

[15] Since newton's laws are not valid in non-inertial frames, pseudoforces (which do not exist in reality) are used to help us formualate and use Newton's laws of motion in non-inertial frames.

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SetId=104

[1] Displacements, being vector quantity can not compared with, a scalar quantity such as distance.

[2] If the net external torque acting on a system is zero,the angular momentum L(vector) of the system remains constant,no matter what changes take place within the system.L(vector)=a constant (net external torque acting on system is zero)

[3] The total angular momentum of a body remains constant of motion when the net torque of the external forces acting on the body is zero.
In general, we have a system of particles such that the net torque of the external forces on the system, w.r.t. some axes K, is zero, the total angular momentum may not remain conserved, because the torque due to the internal forces may not be zero.

[4] For the motion of the Earth around the sun, the total of angular momenta of the Earth and the Sun, is conserved in every inertial frame of reference; but the angular momentum of the Earth (or of the sun)is not conserved in every inertial frame.

[5] Only the z component of the angular momentum of a conical pendulum is conserved w.r.t. the origin fixed at the point of suspension. SetId=104

[6] In the example of conical pendulum, the z- component of angular momentum does not change. This follows from the angular momentum conservation as there is no external torque.

[7] If a bullet hits a wooden board and gets embedded in the board, both total energy and the total momentum of the bullet and the board are not conserved.

[8] In order to apply the law of conservation of momentum we must first identify the system. Then even if there is no *net external forces* acting on the system, all the three conservation laws of momentum, angular momentum and energy may not hold due to presence of internal forces.

[9] A nonconservative force is a force with the property that the work done in moving a particle depends on the path taken.Also, the net work done in a closed loop is non zero.

SetId=104

[10] A particle moves on a circular path. Then its speed, direction offorce, can remain constant by velocity and acceleration must always change with time.

[11] Displacement is the shortest distance between initial and final points with direction specified.

[12] Staying inside a bullet train moving with constant velocity (no jerks etc) an experiment can always be performed which will tell us the numerical velocity of the bullet train

[13] A block moving in the air breaks up into two parts and the parts separate, then the total momentum must be the same before and after the break.

[14] A heavy body is attached from a spring and is held at point A and is such that the spring is not slack nor is it stretched. It is then released. It goes down upto a point B and then it rises upto point C and executes an oscillatory motion between B and C. During the motion from A to C is first positive (from A to B) and then it is negative from B to A and again remains negative from A to C. SetId=104

[15] Force is defined as the rate of change of linear momentum. In other words it is the agency which changes or tends to change the (a) State of rest; (b)State of uniform motion (c) Direction of body's motion; (d) Shape of the body

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SetId=105

[1] Distance depends on the path where as the displacement depends on the end point only.

[2] The Law of conservation of angular momentum states that when no external torque acts on an object or a closed system of objects undergoing motion about a given axis, the change in angular momentum is zero. Therefore, considering an event where only internal torque or no torque is involved, the total angular momentum of the system before the event is equal to the total angular momentum after the event

[3] An example where law of conservation of angular momentum holds:
The Law of conservation of angular momentum holds in the case of a ballet dancer performing a pirouette.

When the dancer extends her arms outward, the angular velocity of her rotation decreases whereas when she keeps her arms close to her body, the angular velocity increases. This is because her moment of inertia changes as she moves her arms outward and inward. It can be noted that she as a system has no external torque acting upon her.

[4] In the Sun Earth system the angular momentum of the Earth is conserved in every frame of reference

[5] The z component of angular momentum of a conical pendulum is not conserved w.r.t. the origin fixed at the point of suspension; but the x and y components are conserved.

SetId=105

[6] In the example of conical pendulum, the x and$y$ components of angular momentum change. This follows from the angular momentum conservation as the z components external torque is zero and horizontal components of torque are non zero.

[7] There are certain situations where it appears that the law of conservation of linear momentum does not hold. For example if we take some amount of a substance like construction putty, cement, cake batter, playing dough,etc and drop it on the ground, it does not bounce back like a rubber ball would and hence the momentum it had before striking the ground seems to have been lost. Hence it appears that the law of conservation of linear momentum does not hold.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then check we should if the laws are applicable or not.

So if there is no *external force* acting on the system all the three quantities, total momentum, total angular momentum, and total kinetic energy will be conserved independent of the nature of forces.

SetId=105

[9] A force whose work done is a path function is called a non-conservative force. All the forces which do not satisfy the definition of conservative forces are non-conservative in nature. The work done by these forces dissipates into heat energy, sound energy, light energy, etc. Therefore, law of conservation of mechanical energy cannot be applied to a system on which a non-conservative force is acting. No potential function can be defined for these forces.

[10] A particle moves on a circular path. Then under suitable conditions its speed may remain constant, but the force, velocity and acceleration must always change with time.

[11] Displacements, being vector quantity can not compared with, a scalar quantity such as distance.

[12] Staying inside a bullet train moving with constant velocity (no jerks etc) an experiment can always be performed which will tell us the numerical value of the acceleration of the bullet train

[13] A ball hits the floor and rebounds after an inelastic collision. In this case the total momentum of the ball before and after the collsion is conserved. Also the total enrgy of the ball and the earth remains the same

[14] The kinetic energy of a body does not change if any one of the following is true
(i)force is always perpendicular to the velocity
(ii) the force is always perpendicular to the acceleration
(iii) the object remains stationary
(iv) the object moves in such a way that the point of application of the force remains fixed. SetId=105

[15] Real forces have their origin in matter such as electricity, gravitation etc., while pseudo forces are caused by inertial motion.

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SetId=106

[1] Distance equal to zero implies displacement=0; and Displacement=0 also implies distance = 0

[2] The law of conservation of angular momentum states that when no external torque acts on an object or a closed system of objects, no change of angular momentum can occur. Hence, the angular momentum before an event involving only internal torques or no torques is equal to the angular momentum after the event . Angular momentum can be calculated with the help of the formula $L = I\omega$ where L stands for Angular momentum, I stands for moment of inertia and ω stands for angular velocity

[3] In case of a skater, who can be considered an isolated system, so no torue will be acting on him/her. When the arms are extended, the moment of inertia is more. When his hands are closely held, the moment of inertia is lesser. Since the angular momentum is same, the angular acceleration changes accordingly.

[4] In the motion of earth around sun, the angular momentum of the earth about an axis passing through the sun and perpendicular to the plane of motion of earth is conserved.

[5] Only the z component of angular momentum of a conical pendulum is conserved w.r.t. the origin fixed at the point of suspension. SetId=106

[6] Example where law of conservation of angular momentum does not hold: A disc rotating on a horizontal rough surface will not have a constant angular momentum because there will be a constant torque by frictional force. Hence, its angular momentum will decrease, and the law of conservation of angular momentum does not apply.

[7] A tennis ball is dropped from height h and after hitting the ground and it bounces back and rises to the same height. In this case the momentum of the ball is conserved because (under ideal conditions) the momentum after it hits the ground will be equal to the momentum it had before hitting the ground.

[8] If we want to apply the conservation laws of momentum, energy and angular momentum, we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *external force* acting on the system, the momentum and angular momentum will be conserved, and depending on the nature of the forces but total energy may or may not be conserved.

[9] *Non conservative forces* are the type of forces in which the work done by the forces is purely dependent on the path taken by the body.Thus the net work done by the forces in cyclic path is never equal to zero.

SetId=106

[10] A particle moves on a circular path. Then under suitable conditions its speed and acceleration may remain constant, but the force, and velocity must always change with time.

[11] Distance depends on the path where as the displacement depends on the end point only

[12] Assume bullet train, moving with out any jerks, is going on a circular arc of radius R with constant speed. Then an experiment is to be performed entirely within the train without any measurement on objects outside the train. Such an experiment can tell only radius of the track.

[13] In a head on elastic collision of two identical bodies of equal masses the velocities, the speeds, the momenta and the kinetic energy are all exchanged.

[14] The total work done on a particle is always equal to the change in kinetic energy. SetId=106

[15] 1)When we start rolling a body on a rough ground, it stops rolling after certain period because of frictional force.
2)When we leave a body from a certain height, it falls due to the act of gravitational force.

1)When a body is rotating in a circular path due to the centrifugal force which is the pseudo force. 2) When the lift is accelerating upwards, the upwards force felt by passengers a pseudo force.

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SetId=107

[1] If P and Q are the initial and the final points of a path of a particle, displacement is a vector whose direction is along PQ and has magnitude is equal to the length of line PQ

[2] Newton's Second Law of Motion is defined by the expression $F = \frac{dp}{dT}$, where F gives the force vector acting on the system and p gives its momentum vector; in linear motion. A similar expression can be written to describe angular motion, i.e. : $\tau = \frac{dL}{dt}$, where τ is the external torque vector acting on the system, and L is the angular momentum.

If the external torque on the system is zero, then we get the expression as: dL/dt=0. This points out to the fact that, when no external torque is acting on the system, then its angular momentum is constant, no matter what changes occur in the system. This is the Law of Conservation Of Angular Momentum.

[3] Example where law of conservation of angular momentum holds:
Let us assume a student seated on a stool that can rotate freely about a vertical axis. The student has been set into rotation at a modest initial angular speed ω . He holds two dumbbells in his outstretched hands. His angular momentum vector L lies along the vertical rotation axis, pointing upwards. Now he pulls in his arms;this action reduces his rotational inertia from its value I_{initial} to a final value I_{final} because he moves the mass closer to the rotational axis. His rate of rotation increases markedly, from ω_{initial} to ω_{final}. The student can then slow down by extending his arms once more,moving the dumbbells outward. No external torque acts on the system consisting of the student, stool and the dumbbells. Thus the angular momentum of the system about the rotational axis remains constant. $I_{\text{initial}} * \omega_{\text{initial}} = I_{\text{final}} * \omega_{\text{final}}$.

[4] For the motion of earth around sun, the angular momentum of the earth about the center of mass of the sun + earth system and perpendicular to the plane of motion of earth is conserved.

[5] The projection of angular momentum of a conical pendulum in the horizontal plane is a constant of motion when the origin is chosen to be at fixed at the point of suspension.

SetId=107

[6] Example where law of conservation of angular momentum does not hold:Consider a vertical stick on the ground falling to a horizontal position. During the fall, the conservation of angular momentum applied at the point of rotation on the ground and perpendicular to the plane of the stick is not applicable as, the gravitational force which acts vertically downwards assumed at the centre of mass produces an external torque about the axis of rotation

[7] Law of conservation of momentum does not hold when Newton's laws are not valid, e.g. in a non-inertial frame of reference. For example, when we consider collision between two bodies in a non-inertial frame of reference, the law of conservation of momentum cannot be applied because there will be a pseudo force acting on the frame itself.

[8] To apply the conservation laws of momentum, energy and angular momentum, we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *external force* acting on the system, the energy and momentum will be conserved. However, depending on the nature of the system and of the forces, the total angular momentum may not be conserved.

[9] Non-conservative forces are path-dependent forces, i.e. the work done on a body by these forces depends on the path taken by the body. Mechanical energy of a system is not conserved when a conservative force acts on it but the total energy is conserved. Therefore, the mechanical energy lost by the system is liberated in some other form such as light energy, heat energy, etc.

For example, when a body is moving along a surface, frictional force acts on the body as well. Due to this frictional force, the body loses its mechanical energy, and this loss is generally released in the form of heat energy to the surroundings. Thus, the mechanical energy will not be conserved and frictional force can be classified as
SetId=107 a non-conservative force.

[10] When the force is kept constant as function of time, it is possible for a particle to move on a circular path in such a way that its speed remains constant, but the velocity and acceleration must always change with time.

[11] Distance equal to zero $\Rightarrow$ displacement=0; but Displacement=0

[12] Assume bullet train, moving with out any jerks, is going on a circular arc of radius R with constant speed. Then an experiment is to be performed entirely within the train without any measurement on objects outside the train. Such an experiment can tell both speed of the train and radius of the track.

[13] For a system of several particles the conservation of total linear momentum is equivalent to the statement that their centre of mass moves like a free particle.

[14] A particle is acted upon by a force of constant magnitude which is always perpendicular to the velocity of the particle and the motion of the particle takes place in a plane, Then its kinetic energy, speed, velocity acceleration will not change. SetId=107

[15] Newton's first law defines inertial frame. An inertial frame is a frame in which the first law hold. It also makes it possible to compare and tell two force being equal or not. The second law defines the force.

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SetId=108

[1] If P and Q are the initial and the final points of a path of a particle,the displacement is the vector $\overrightarrow{PQ}$.

[2] If the net external torque acting on a system is zero, the angular momentum L of the system remains constant, no matter what changes take place within the system.

$$\sum(T_{\text{ext}}) = \frac{dL}{dt}$$

The law states that when there is no net external torque, $\frac{dL}{dt}$ is zero implying that the total angular momentum of system is constant.

i.e. $L = a$ constant (isolated system)

[3] A bob is attached to ceiling by a string and moves in a horizontal circular plane is an example. In this case the law of conservation of angular momentum does not hold.

[4] In the Sun Earth system the angular momentum of the Earth about the pole star is conserved

[5] The law of angular momentum of a is not applicable for the conical pendulum conserved w.r.t. the origin fixed at the point of suspension. SetId=108

[6] We have a conical pendulum .The forces acting on the bob are tension (along the direction of the string) and gravitational force acting in the vertically downward direction.we have an additional force called the drag force which is tangential to the motion of the bob and acts in the direction opposite to the motion of the bob.The axis of rotation passes through the hinge point and is vertical.The torque due to tension is 0 because the force passes through the axis of rotation.The torque due to mg is also zero since it is parallel to the axis of rotation.but the torque due to drag force is not zero.since the net external torque acting on the bob is not zero,therefore the law of conservation of angular momentum does not hold here

[7] If I throw a ball upward, it's speed decreases as it rises upwards. There is an external force (gravity) acting on the ball, so the momentum conservation law does not apply. Momentum of the ball is not conserved, however the momentum of the Earth-ball system is conserved as gravity will become an internal force in this case.

[8] In order to apply the law of conservation of momentum we must first identify the system. If there is no *external forces* acting on the system then conservation laws of momentum always holds. And depending on the nature of the system and of the forces, the total kinetic energy and the total angular momentum may not be conserved.

[9] It is a force for which the work done by that force on an object or a particle in moving it between any two points depends on its path travelled.This force doesn't conserves the mechanical energy.The work done by a non-conservative force on an object in moving it in a circular path is not equal to zero. SetId=108

[10] It is not possible for a particle to move on a circular path in such a way that its speed and force remains constant, and only the velocity and acceleration may (or may not) always change with time.

[11] If P and Q are the initial and the final points of a path of a particle, displacement is a vector whose direction is along PQ and has magnitude is equal to the length of line PQ

[12] Assume bullet train, moving with out any jerks, is going on a circular arc of radius R with constant speed. Then an experiment is to be performed entirely within the train without any measurement on objects outside the train. Such an experiment can tell only speed of the track.

[13] The total mechanical energy of a system may not be conserved if there are no external forces and the internal forces are conservative.

[14] The kinetic energy of a particle is continuously increasing with time, then the angle bewteen the net force and the velocity cannot be greater than or equal to 90^o at any time. SetId=108

[15] The magnitude of the pseudo force arising in a non-inertial frame is always equal to the mass of the body under consideration multiplied by the acceleration of the frame of reference and the direction of pseudoforce is always opposite to the direction of acceleration of the frame.

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SetId=109

[1] If two bodies starting from a point A reach a point B, following different paths, their displacement will be, in general different, but the distances covered will always be the same.

[2] When the net external torque acting on a body or a system of bodies is zero about a particular axis, then the angular momentum of each body is conserved about that axis.

[3] Consider a disc rotating about an axis perpendicular to its plane. On placing a smaller disc with its surface parallel to the surface of the rotating disc, the angular momentum of the system of two discs remains constant as there is no external torque.

[4] For the motion of earth around sun, the angular momentum of the sun about the center of mass of the sun + earth system and perpendicular to the orbital plane of earth is conserved.

For the motion of earth around sun, the angular momentum of the sun about and axis passing through the Earth and perpendicular to the orbital plane of motion of earth is conserved.

[5] The law of angular momentum of a is not applicable for the conical pendulum conserved when the origin is chosen to be at the pendulum bob itself. SetId=109

[6] When you release a toy gyroscope on its pedestal, it initially has no precessional rotation around that pedestal, i.e, the orientation of rotation is fixed. However, it instantaneously starts precessing around the pedestal. Both Kinetic Energy and Angular Momentum now exist where they did not exist a moment earlier. The Kinetic Energy is easy to explain, as appearing due to the body of the gyroscope dropping a tiny fraction of a millimeter in the Earth's gravitational field, giving up exactly the correct amount of Potential Energy. But the Angular Momentum of the Precession which just appeared, does not come from anywhere. This is therefore a Violation of the Conservation of Angular Momentum.

[7] A soldier accelerating away, after detonating a bomb, will find that the total momentum of the fragments of the bomb is zero. This is an example where the law of conservation of momentum holds as the forces on the fragments are internal forces only and sum of all such forces is zero.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then check if the laws is applicable or not.

So if there is no *net external force* acting on the system all the three conservation laws will hold.

[9] Explain Nonconservative force: This force is just opposite to that of conservative force. The work done by this force depends on the path taken by the particle on which the force is applied.This force does not conserve mechanical energy.If a particle travels in a closed loop, the net work done by a non consevative force is non zero.

SetId=109

[10] For a particle moving on circle the acceleration is always constant in magnitude and directed towards the centre of the circle.

[11] If P and Q are the initial and the final points of a path of a particle,the displacement is the vector $\overrightarrow{PQ}$.

[12] A particle is observed from two frames S_1 and S_2. The frame S_2 moves with respect to S_1 with an acceleration a. If F_1 and F_2 be the pseudoforces when seen from S_1 and S_2 respectively it is not possible to have $F_1 = F_2 = 0$

[13] When a bullet fired on a wooden block, some energy is transferred to the block and the total mechanical energy of the block and the bullet is conserved.

[14] A heavy body is attached from a spring and is held at point A and is such that the spring is not slack nor is it stretched. It is then released. It goes down upto a point B and then it rises upto point C and executes an oscillatory motion between B and C. During the motion from A to C is first positive (from A to B) and then it is negative from B to A and again remains negative from A to C.

SetId=109

[15] A force is any interaction which tends to change the motion of an object. It is also *defined* as rate of change of momentum.It is a vector quantity.
A physically apparent but nonexistent force felt by an observer in a noninertial frame (that is, a frame undergoing acceleration).

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Sem-I 2014-15 Mechanics Waves and Oscillations MM:15

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SetId=110

[1] Displacement is equal to the vector difference $\vec{r}_f - \vec{r}_i$ of the position vectors of initial and final points. The distance covered will be $|\vec{r}_f - \vec{r}_i|$

[2] The law of conservation of angular momentum states that in absence of an external torque on an object or a closed system of objects the total angular momentum of the system remains constant. Thus if $\vec{\tau} = 0 => \vec{L} =$ constant where τ is the torque and $\vec{L}$ is the angular momentum of the system.

[3] Consider a man standing on a spinning platform. Initially, the man spreads out his arms and he spins with a certain angular velocity. The next moment, he pulls his arms inwards keeping them close to his body. We will observe that the angular velocity with which he is spinning now increases. This phenomenon can be explained by the Law Of Conservation of Angular momentum. Initially, since his arms were spread wide, his moment of inertia was large. However, when he pulled them close to his body, his moment of inertia decreased.
In this example the angular velocity of the man increases and therefore the angular momentum also increases.The law of conservation of angular momentum does not apply because the torque of muscular forces is not zero.

[4] For the motion of earth around sun, the sum of angular momenta of the Sun and the Earth about the center of mass of the sun + earth system is conserved.

[5] The three components of angular momentum of a conical pendulum is conserved w.r.t. the origin at the position of the center of mass of the pendulum.

SetId=110

[6] There is no case where LAW OF CONSERVATION OF ANGULAR MOMENTUM does'nt hold.But there are cases where conservation of angular momentum does not hold.A body in vertical circular motion is an example where angular momentum is not conserved. Here the law of conservation does not apply.

[7] There is no known exception to the law of conservation of momentum in classical mechanics However, an exception to conservation of energy in nuclear physics is observed. In nuclear reactions when two nuclei collide and their mass converts to energy and energy momentum are not conserved.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then check we should if the laws are applicable or not.

So if there is no *external force* acting on the system all the three quantities, total momentum is conserved. The total angular momentum is also because the torque of internal forces will be zero. The conservation of energy depends on the nature of forces. will be conserved.

[9] Non conservative force is the force in which the work done by a particle in going from one point to another is path dependent.

For non conservative forces mechanical energy is not conserved,mostly lost in the form of heat and light.The work done by a non conservative force is equal to the change in mechanical energy.

SetId=110 For non conservative force $E_{\text{initial}} > E_{\text{final}}$

[10] The motion of a bomb dropped from a plane does is not a uniform motion as it follows a parabolic path and not a straight line path.

[11] If two bodies starting from a point A reach a point B, following different paths, their displacement will be, in general different, but the distances covered will always be the same.

[12] A particle is observed from two frames S_1 and S_2. The frame S_2 moves with respect to S_1 with an acceleration a. If F_1 and F_2 be the pseudoforces when seen from S_1 and S_2 respectively and if $F_1 = 0$ then we must have $F_2 \neq 0$

[13] When a moving car hits a parked lorry and causes the parked lorry to move ,energy is transferred from moving the car to the lorry and the total energy of the lorry and the car is conserved.

[14] The kinetic energy of a body does not change if any one of the following is true
(i)force is always perpendicular to the velocity
(ii) the force is always perpendicular to the acceleration
(iii) the object remains stationary
(iv) the object moves in such a way that the point of application of the force remains fixed. SetId=110

[15] Psuedo Force is defined as an apparent force that acts in only non-inertial frames. Pseudo Forces are also called Fictitious Forces. It is an Imaginary force. It is independent of mass.

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SetId=111

[1] Distance is equal to the length of the path covered. Displacement is the shortest distance between initial and final points.

[2] If no net external torque acts on a system, the total angular momentum of the system remains constant.

[3] In the Sun-Earth system, angular momentum of the earth is not conserved but the total angular momentum of the sun and the earth is constant of motion.

[4] For the motion of the Earth around the sun, the total of angular momenta of the Earth and the Sun, about in a reference frame fixed in the pole star, is conserved.

[5] Only the z component of the angular momentum of a conical pendulum is conserved w.r.t. the origin fixed at the point of suspension. SetId=111

[6] A sphere rolling on a rough surface.Due to friction there is external torque so the angular momentum changes which results in the slowing of the sphere. The angular momentum keeps changing. Even in case like this one, it is wrong to say that the Law of Angular Momentum Conservation does not hold.

[7] In a system of a canon and a canon ball, total momentum of the system is zero before canon ball is fired. After firing the canon ball, the momentum of the system seems to be conserved as the ball moves forward and the canon moves backward.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *net external force* acting on the system, the momentum is conserved. The definition of angular momentum and torque depends on the choice of axes, and therefore it may not be be conserved. The conservation of total energy holds only for conservative forces.

When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *net external force* acting on the system, the energy and momentum will be conserved. However, the total angular momentum may not be conserved because the torque may not be zero.

[9] A force is said to be non-conservative, if the work done by the force is dependent on the path taken. It could also be defined as a force for which the work done during a cyclic process is non-zero.

SetId=111

[10] A wagon sliding on a roller coaster designed in such a way that the wagon covers equal distances in equal times. As the motion of the wagon is uniform, there will be no net force acting on it.

[11] Distance is equal to the length of the path covered. Displacement is the shortest distance between initial and final points.

[12] If K is an inertial frame, any frame that moves w.r.t. the frame K with uniform velocity is also an inertial frame.

[13] When a bomb explodes the total mechanical energy is not conserved. But the total chemical energy and the mechanical energy is conserved.

[14] The total work done on a particle is always equal to the change in kinetic energy. SetId=111

[15] Psuedo Force is defined as an apparent force that acts in only non-inertial frames. Pseudo Forces are also called Fictious Forces. It is an Imaginary force. It is always proportional to mass. It is sometimes dependent on speed.

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SetId=112

[1] Distance is a scalar quantity where as the displacement is a vector quantity.

[2] The law of conservation of angular momentum states that when no external torque is applied on an object or a closed system of objects about an axis, the angular momentum about that axis remains constant.

[3] Consider a disc and a man system. man is standing on center of the disc rotating with angular velocity.initially man folded his hand.when man stretches his hands then momentum of inertia of system increases.and angular velocity decreases.and total angular momentum remains constant.

[4] For the motion of the Earth around the sun, the total of angular momenta of the Earth and the Sun, is conserved in every inertial frame of reference; but the angular momentum of the Earth (or of the sun)is not conserved in every inertial frame.

[5] The z component of angular momentum of a conical pendulum is not conserved w.r.t. the origin fixed at the point of suspension; but the x and y components are conserved. SetId=112

[6] Consider a rod of length l. Let us give an impulse to one end . Now the angular momentum about the oposite end is not zero since the impulse provides some torque . So the angular momentum is not conserved .

$$\text{torque} = \text{impulse} * \ell.$$

$d\ell/dt$ is not equal to zero and the law of conservation of angular momentum does not hold.

[7] When applying the conservation laws of momentum, energy and angular momentum we must define the system first.Only then check if the laws is applicable or not.

As an example: when a ball is dropped from a height, it gains momentum down if we consider the ball as our system.This is because the force of gravity acts as an external force.

However, if we change our system and consider earth as a part of our system too, then the momentum remains conserved because the earth gains momentum up.

[8] In order to apply the law of conservation of momentum we must first identify the system. If there is no *net external forces* acting on the system then conservation laws of momentum always holds. The total energy and the total angular momentum may not be conserved.

[9] a force is said to be non conservative if work done is dependent on the path of the particle.potential cannot be defined in the case of non conservative forces.work done in closed loop is not equal to zero.

SetId=112

[10] A simple pendulum moves along a circular arc and does not have constant speed and therefore its motion is not uniform.

[11] Distance is a scalar quantity where as the displacement is a vector quantity.

[12] If K is an inertial frame, any frame that moves w.r.t. the frame K with uniform speed is also an inertial frame.

[13] When a ball rolls over a rough surface, it comes to stop after some time. This is because transational and rotational kinetic energy initially present in the ball continuosly gets converted to heat due to friction. When all the kinetic energy changes to heat, the ball stops. The total mechanical energy of the ball is not conserved.

[14] A particle is acted upon by a force of constant magnitude which is always perpendicular to the velocity of the particle and the motion of the particle takes place in a plane, Then its kinetic energy, speed, velocity acceleration will not change. $\boxed{\text{SetId=112}}$

[15] Since pseudo forces are not real forces, they do not affect the conservation laws and all the three conservation laws hold in noninertial frames.

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SetId=113

[1] The speed is rate of change of distance and the velocity is the rate of change of displacement.

[2] The angular momentum of a given system of bodies shall remain conserved unless acted upon by an external unbalanced torque.

[3] The conservation of angular momentum of a system of bodies requires that the the sum of torque due to all forces be equal to zero. Now consider a situation where the forces are such that the sum of torques of external forces is zero w.r.t. some axes K. Since the value of torque depends of the choices of axes, the sum of torques due to all internal forces will depend on the choice of axes and in general it will be non zero. Therefore, for a system of several bodies, for a given choice of axes K, there will be situations when the total angular momentum may not be conserved.

[4] In the Sun Earth system the angular momentum of the Earth is conserved in every frame of reference

[5] Only the z component of angular momentum of a conical pendulum is conserved w.r.t. the origin fixed at the point of suspension. SetId=113

[6] Let us consider a rotating skew rod. In the absence of friction or any other drag force, the rod should continuously spin without stopping. Here the net torque about the axis of rotation is 0 and hence angular momentum is conserved. It therefore follows from law of conservation of angular momentum that a spinning skew rod will keep rotating with constant angular velocity if there is no external torque. So law of conservation of angular momentum does not hold.

[7] Statement: Law of Conservation of energy states that "ENERGY CAN NEITHER BE CREATED NOR DESTROYED",but it can be changed from one form to other.

EXPLANATION: Statement implies that the total amount of energy in an isolated system remains constant although it may change forms. viz, kinetic energy may change to potential;chemical to electrical energies etc.

[8] In order to apply the law of conservation of momentum we must first identify the system. Then even if there is no *net external forces* acting on the system, all the three conservation laws of momentum, angular momentum and energy may not hold due to presence of internal forces.

[9] Explain Nonconservative Forces:

The forces that depend on the path taken by the particle are called non-conservative forces.

Mechanical energy is not conserved during the action of a non conservative force, instead, it is lost as other forms of enery like heat, light, etc.

Potential energy is not defined for a non-conservative force.

The initial and final kinetic energy in a closed loop is not equal.

The work done by a non conservative force in a closed loop is non zero. In practice, the net work is invariably negative.

Work done by a non conservative force cannot be completely recovered.

For a non conservative force,

$/text(KE)//_f//$+(PE)$//_f// =$ (KE)$_i$+(PE)$_i$//+//Work Done)//non-conservative force//

SetId=113

[10] A satellite goes around the earth in a circular orbit of 600km with a time period of $5.8 \times 10^3 s$. Its motion will be uniform as it will cover equal distances in equal times.

[11] Both displacement and distance tell us about the motion of a body but their study does not tell much about the forces on the body

[12] A frame rotating w.r.t K with uniform angular velocity is also an inertial frame.

[13] Let us consider that a pendulum is oscillating moving in a vertical plane. Mean while let another bob which is attached to a spring and is executing a simple harmonic motion in horizontal direction comes and hits the pendulum. Here conservation of momentum does not hold good as tension(external force) is acting on the system.(pendulum)

[14] The kinetic energy of a particle is continuously increasing with time, then the angle bewteen the net force and the velocity cannot be greater than or equal to 90^o at any time. SetId=113

[15] A force is any interaction which tends to change the motion of an object. Newtons' second tell us that it is *equal* to the rate of change of momentum.It is a vector quantity. Real forces can be distinguished from pseudo forces because the pseudo forces always proportional to the mass of the body. All real forces, except the gravitational force, do not depend on the mass of the body.

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SetId=114

[1] For any type of translational motion of a body, the displacement cannot be zero, where as the distance travelled can be zero.

[2] When the net external torque acting on a system about a given axis is zero, the total angular momentum of the system about that axis remains consant.

[3] Example where law of conservation of angular momentum does not hold:
When there is external force like frictional force acting on a object when it is rotating we cannot use conservation of angular momentum as the friction force acting on the object produces an external torque.

[4] In the motion of earth around sun, the angular momentum of the earth about an axis passing through the sun and perpendicular to the plane of motion of earth is conserved.

[5] The projection of angular momentum of a conical pendulum in the horizontal plane is a constant of motion when the origin is chosen to be at fixed at the point of suspension.

SetId=114

[6] In the example of skew rod the angular velocity does not change even though the torque applied is nonzero. However there is no contradiction as in this case the law of conservation of momentum is not applicable. conservation is violated.

[7] Oscillating simple pendulum is a very good example where potential energy gets converted to kinetic energy and kinetic to potential energy. Some energy gets dissipated as heat if we consider air resistance. Energy as a whole is conserved if we consider universe as system, the energy has just changed its form.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then check we should if the laws are applicable or not.

So if there is no *external force* acting on the system all the three quantities, total momentum, total angular momentum, and total kinetic energy will be conserved independent of the nature of forces.

[9] A non conservative force is one where the mechanical energy is not conserved.Here the work done is dependent on the path taken .Different amounts of work need to be done in different paths.Here potential energy would have no meaning as it would keep changing with the path.Here some amount of mechanical energy is lost as sound energy or heat energy and hence is not conserved.

SetId=114

[10] A uniform motion is defined to be the one in which a body covers equal distances in equal time intervals.

[11] Displacement is the shortest distance between initial and final points with direction specified.

[12] The Newton's Laws of motion will hold in all frames which are at rest w.r.t. K but do not remain valid in a frame that move with respect to K.

[13] The law of conservation of momentum does not hold in relativistic situations, i.e., where the speeds of the masses involved are close to the speed of light.

[14] A heavy body is attached from a spring and is held at point A and is such that the spring is not slack nor is it stretched. It is then released. It goes down upto a point B and then it rises upto point C and executes an oscillatory motion between B and C. During the motion from A to C is first positive (from A to B) and then it is negative from B to A and again remains negative from A to C. SetId=114

[15] Examples of pseudoforce are Coriolis Force, Centrifugal Force, and magnetic force on currents.
Psuedo force also called as fictitious force is an apparent force that are needed for masses whose their motion is described using a non inertial frame of reference.

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SetId=115

[1] Displacements, being vector quantity can not compared with, a scalar quantity such as distance.

[2] This law sates that when no net torque of all forces acts on a object or a system of objects then total angular momentum of system is conserved.The angular momentum before an event is equal to angular momentum after that event.mathematically explained by when, net torque=0 ;then, total angular momentum(L)=constant.

[3] A bob attached to a ceiling by a string moving in a horizontal circular plane is an example where the total angular momentum of the bob about the point of suspension is not conserved. This is because the the torque due to the weight of the bob about the point of suspension does not vanish and has non zero horizontal component. Only the vertical component of the angular component is conserved.

[4] For the motion of earth around sun, the angular momentum of the earth about the center of mass of the sun + earth system and perpendicular to the plane of motion of earth is conserved.

[5] The law of angular momentum of a is not applicable for the conical pendulum conserved w.r.t. the origin fixed at the point of suspension. SetId=115

[6] Example where law of conservation of angular momentum does not hold:If a particle undergoes conical motion and the only force acting on particle is central force like tension of the string.Then total external torque about fixed point A is zero,yet angular momentum is not conserved,as angular momentum keeps on changing direction.

[7] Law of conservation of momentum does not hold whenever an external force or impulse acts on the system. For example,when a body collides with earth then it bounces back to a lesser height as it loses some velocity.

In this example the momentum of a ball is not conserved due to impulsive force by ground in the normal direction.

However, strictly speaking the system that should be considered here is the ball-earth system and the total momentum is conserved.

[8] If we want to apply the conservation laws of momentum, energy and angular momentum, we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *external force* acting on the system, the momentum and angular momentum will be conserved, and depending on the nature of the forces but total energy may or may not be conserved.

[9] The force whose work depends on path taken is called a non conservative force.friction for example does less work on a book dragged across a table if the book is dragged straight across than if the book is dragged in a curved path.

SetId=115

[10] A particle moves on a circular path. Then its speed, direction of force, velocity and acceleration must always change with time.

[11] Displacements, being vector quantity can not compared with, a scalar quantity such as distance.

[12] Staying inside a bullet train moving with constant velocity (no jerks etc) an experiment can always be performed which will tell us the numerical velocity of the bullet train

[13] when we are in accelerating frame if we observe any collision between two bodies then the law of conservation of momentum does not hold in that frame of reference.

[14] The kinetic energy of a body does not change if any one of the following is true
(i)force is always perpendicular to the velocity
(ii) the force is always perpendicular to the acceleration
(iii) the object remains stationary
(iv) the object moves in such a way that the point of application of the force remains fixed.

SetId=115

[15] Examples of pseudo-force are Coriolis Force, Centrifugal Force, Centripetal force and magnetic force on currents. The pseudo forces do not obey Newton's third law and therefore the total momentum does not appear to be conserved in a non-inertial frame.

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SetId=116

[1] Distance depends on the path where as the displacement depends on the end point only.

[2] Statement of Law of Conservation of Angular Momentum:
Differentiating $\vec{L} = \vec{r} \times \vec{p}$ w.r.t, time,

$$\begin{aligned} \frac{dL}{dt} &= \frac{d\vec{r} \times \vec{p}}{dt} = \frac{d\vec{r}}{dt} \times \vec{p} + \vec{r} \times \frac{d\vec{p}}{dt} = \vec{v} \times (m\vec{v}) + \vec{r} \times \vec{F} \\ &= \vec{r} \times \vec{F} (\because v \times v = 0) \\ &= \vec{\tau} \end{aligned}$$

here $\vec{\tau}$ represents the net torque acting on a rigid body rotating about a fixed axis.This torque must take into account of all the forces, be it external or internal forces

[3] Law of conservation of angular momentum holds in case of long jump. When a athlete takes off from the ground in a running long jump, the forces on the launching foot give the athlete an angular momentum with a forward rotation around a horizontal axis. Such rotation would not allow the jumper to land properly. In the landing, the legs should be together and extended forward at an angle so that the heels mark the sand at the greatest distance. Once airborne, the angular momentum cannot change (it is conserved) because no external torque acts to change it. However, the jumper can shift most of the angular momentum to the arms by rotating them in windmill fashion. Then the body remains upright in the proper orientation of landing.

[4] In the Sun Earth system the angular momentum of the Earth about the pole star is conserved

[5] The law of angular momentum of a is not applicable for the conical pendulum conserved when the origin is chosen to be at the pendulum bob itself. SetId=116

[6] A nonzero torque always causes the angular velocity to change, because a change in angular momentum means a change in angular velocity $L = I\omega$

[7] If a bullet hits a wooden board and gets embedded in the board, the total energy and the total momentum of the bullet and the board are conserved.

[8] To apply the conservation laws of momentum, energy and angular momentum, we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *external force* acting on the system, the energy and momentum will be conserved. However, depending on the nature of the system and of the forces, the total angular momentum may not be conserved.

[9] ** Nonconservative force is a force in which the amount of work done by the force is dependent of the path taken to change a state of a system.

SetId=116

[10] A particle moves on a circular path. Then its speed, direction offorce, can remain constant by velocity and acceleration must always change with time.

[11] Distance depends on the path where as the displacement depends on the end point only

[12] Staying inside a bullet train moving with constant velocity (no jerks etc) an experiment can always be performed which will tell us the numerical value of the acceleration of the bullet train

[13] Give an example where law of conservation of momentum does not hold all cases when seen from non inertial frame of references for example when we see two cars collide from a moving bus there momentum is not conserved

[14] The total work done on a particle is always equal to the change in kinetic energy.

SetId=116

[15] FORCE is any interaction which tends to change the motion of an object.It has both magnitude and direction,making it a vector quantity.

A psuedo force is an apparent force that acts on all masses whose motion is described with respect to a non-inertial frame of reference like a rotating frame of reference.This force is needed by an observer in an non-inertial frame to make all the Newtons Laws of motion hold true.

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SetId=117

[1] Distance equal to zero implies displacement=0; and Displacement=0 also implies distance = 0

[2] Statement of Law of Conservation of Angular Momentum: For a system of many particles The net torque due all the forces, be it external or internal forces. But as the torque due to all the internal forces cancel out, it sufficient to consider the external forces acting on the system.

[3] The total angular momentum of a body remains constant of motion when the net torque of the external forces acting on the body is zero.
In general, we have a system of particles such that the net torque of the external forces on the system, w.r.t. some axes K, is zero, the total angular momentum may not remain conserved, because the torque due to the internal forces may not be zero.

[4] For the motion of earth around sun, the angular momentum of the sun about the center of mass of the sun + earth system and perpendicular to the orbital plane of earth is conserved.

For the motion of earth around sun, the angular momentum of the sun about and axis passing through the Earth and perpendicular to the orbital plane of motion of earth is conserved.

[5] The three components of angular momentum of a conical pendulum is conserved w.r.t. the origin at the position of the center of mass of the pendulum. SetId=117

[6] A nonzero torque always implies change in angular momentum and may not give rise to a change in magnitude of angular velocity. A non zero torque may mean change only the direction of the angular momentum and not the angular velocity.

[7] If a bullet hits a wooden board and gets embedded in the board, the total energy of the bullet and the board system is conserved but the total momentum is not conserved.

[8] In order to apply the law of conservation of momentum we must first identify the system. If there is no *external forces* acting on the system then conservation laws of momentum always holds. And depending on the nature of the system and of the forces, the total kinetic energy and the total angular momentum may not be conserved.

[9] Nonconservative force is any force where the work done by the force on the object depends on the path of motion of the object.the work done by the frictional force results in to loss of the energy of the system in the form of heat or other form of energy.

SetId=117

[10] A particle moves on a circular path. Then under suitable conditions its speed may remain constant, but the force, velocity and acceleration must always change with time.

[11] Distance equal to zero $\Rightarrow$ displacement=0; but Displacement=0

[12] Assume bullet train, moving with out any jerks, is going on a circular arc of radius R with constant speed. Then an experiment is to be performed entirely within the train without any measurement on objects outside the train. Such an experiment can tell only radius of the track.

[13] When a tennis ball hits the ground at an oblique angle, the angle of reflection is equal to the angle of incidence. This is a simple consequence of conservation of horizontal component of momentum.

[14] A particle is acted upon by a force of constant magnitude which is always perpendicular to the velocity of the particle and the motion of the particle takes place in a plane, Then its kinetic energy, speed, velocity acceleration will not change. SetId=117

[15] FORCE is any interaction which tends to change the motion of an object.It has both magnitude and direction,making it a vector quantity. A pseudo-force F doesn't arise from any physical interaction between two objects, but rather from the acceleration 'a' of the non-inertial reference frame itself. These forces have no real existence but must be taken into account in an accelerating frame of reference to make all the three Newton's Laws of motion applicable to the system

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[1] If P and Q are the initial and the final points of a path of a particle, displacement is a vector whose direction is along PQ and has magnitude is equal to the length of line PQ

SetId=118

[2] Depending on the torques acting on a system, the angular momentum can be conserved only in one or two directions, but may not be conserved in all. For instance, if an isolated body has no torque acting on it only in the direction along the Z axis, then the angular momentum is conserved only in that direction.

[3] An example where law of conservation of angular momentum holds:
The Law of conservation of angular momentum holds in the case of a ballet dancer performing a pirouette.

When the dancer extends her arms outward, the angular velocity of her rotation decreases whereas when she keeps her arms close to her body, the angular velocity increases. This is because her moment of inertia changes as she moves her arms outward and inward. It can be noted that she as a system has no external torque acting upon her.

[4] For the motion of earth around sun, the sum of angular momenta of the Sun and the Earth about the center of mass of the sun + earth system is conserved.

[5] Only the z component of the angular momentum of a conical pendulum is conserved w.r.t. the origin fixed at the point of suspension. SetId=118

[6] In the example of a rotating skew rod the torque due to the external gravitational forces is zero , but the angular momentum is not constant Therefore the law of conservation of angular momentum is violated.

[7] If a bullet hits a wooden board and gets embedded in the board, both total energy and the total momentum of the bullet and the board are not conserved.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then check if the laws is applicable or not.

So if there is no *net external force* acting on the system all the three conservation laws will hold.

[9] nonconservative force is any force ,where the work done by the force depends on the path of motion of the body.The work done by such a force is equal to the change in mechanical energy of the system.Energy mostly observed to be lost in form of heat, by the action of non conservative force.

SetId=118

[10] A particle moves on a circular path. Then under suitable conditions its speed and acceleration may remain constant, but the force, and velocity must always change with time.

[11] If P and Q are the initial and the final points of a path of a particle, displacement is a vector whose direction is along PQ and has magnitude is equal to the length of line PQ

[12] Assume bullet train, moving with out any jerks, is going on a circular arc of radius R with constant speed. Then an experiment is to be performed entirely within the train without any measurement on objects outside the train. Such an experiment can tell both speed of the train and radius of the track.

[13] when a ball is dropped from a height, it gains momentum down if we consider the ball as our system.This is because the force of gravity acts as an external force.

However, if we change our system and consider earth as a part of our system too, then the momentum remains conserved because the earth gains momentum up.

[14] The kinetic energy of a particle is continuously increasing with time, then the angle bewteen the net force and the velocity cannot be greater than or equal to 90^o at any time.

SetId=118

[15] FORCE is any interaction which tends to change the motion of an object.It has both magnitude and direction,making it a vector quantity.
A pseudo-force results from acceleration of the frame of reference in which the objects reside. It is taken into account so that Newton's second law isn't invalidated. The pseudo force acting on an object can always be mathematically expressed as the product of the mass of the object and the acceleration of the frame of reference.

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SetId=119

[1] If P and Q are the initial and the final points of a path of a particle,the displacement is the vector $\overrightarrow{PQ}$.

[2] According to Law of Conservation of Angular momentum,if no external torque acts on an object or system of objects,angular momentum of an object or system of objects remains CONSTANT or no change in angular momentum can occur.

Also it states that,only external torque can change angular momentm of the system where as the torque produced by internal forces can not change the angular momentum of the system

[3] In case of a skater, who can be considered an isolated system, so no torue will be acting on him/her. When the arms are extended, the moment of inertia is more. When his hands are closely held, the moment of inertia is lesser. Since the angular momentum is same, the angular acceleration changes accordingly.

[4] For the motion of the Earth around the sun, the total of angular momenta of the Earth and the Sun, about in a reference frame fixed in the pole star, is conserved.

[5] The z component of angular momentum of a conical pendulum is not conserved w.r.t. the origin fixed at the point of suspension; but the x and y components are conserved.

SetId=119

[6] In the example of skew rod, the angular momentum changes with time and there is a non zero torque coming from action of forces other than gravitational forces. Hence the law of conservation of angular momentum dos not apply.

[7] There are certain situations where it appears that the law of conservation of linear momentum does not hold. For example if we take some amount of a substance like construction putty, cement, cake batter, playing dough,etc and drop it on the ground, it does not bounce back like a rubber ball would and hence the momentum it had before striking the ground seems to have been lost. Hence it appears that the law of conservation of linear momentum does not hold.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then check we should if the laws are applicable or not.

So if there is no *external force* acting on the system all the three quantities, total momentum is conserved. The total angular momentum is also because the torque of internal forces will be zero. The conservation of energy depends on the nature of forces. will be conserved.

[9] The work done by a "non-conservative" force does depend on the path taken. Non-conservative forces cannot be associated with a potential energy. If some of the

internal forces of a system are non-conservative, the mechanical energy of the system is not constant.Work-energy theorem is valid even in the presence of some non-conservative forces.

SetId=119

[10] When the force is kept constant as function of time, it is possible for a particle to move on a circular path in such a way that its speed remains constant, but the velocity and acceleration must always change with time.

[11] If P and Q are the initial and the final points of a path of a particle,the displacement is the vector $\overrightarrow{PQ}$.

[12] Assume bullet train, moving with out any jerks, is going on a circular arc of radius R with constant speed. Then an experiment is to be performed entirely within the train without any measurement on objects outside the train. Such an experiment can tell only speed of the track.

[13] There is no known exception to the law of conservation of momentum in classical mechanics however when two bodies collide and their mass converts to energy, an exception in nuclear physics is observed. In real life this is observed in nuclear reactions at atomic level.

[14] A heavy body is attached from a spring and is held at point A and is such that the spring is not slack nor is it stretched. It is then released. It goes down upto a point B and then it rises upto point C and executes an oscillatory motion between B and C. During the motion from A to C is first positive (from A to B) and then it is negative from B to A and again remains negative from A to C.

SetId=119

[15] Explain Force:FORCE is any interaction which tends to change the motion of an object.It has both magnitude and direction,making it a vector quantity.
In the case of a non inertial frame, we can use the second law of motion by adding a pseudo force to the system which makes it an inertial frame of reference.

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SetId=120

[1] If two bodies starting from a point A reach a point B, following different paths, their displacement will be, in general different, but the distances covered will always be the same.

[2] The law of conservation of angular momentum states that when the net external torque acting on the system is zero, then the angular momentum of the system remains constant.both the initial and final momentum should be taken from a fixed inertial frame of reference provided.

[3] Example where law of conservation of angular momentum holds:
Let us assume a student seated on a stool that can rotate freely about a vertical axis. The student has been set into rotation at a modest initial angular speed ω . He holds two dumbbells in his outstretched hands. His angular momentum vector L lies along the vertical rotation axis, pointing upwards. Now he pulls in his arms;this action reduces his rotational inertia from its value I_{initial} to a final value I_{final} because he moves the mass closer to the rotational axis. His rate of rotation increases markedly, from ω_{initial} to ω_{final}. The student can then slow down by extending his arms once more,moving the dumbbells outward. No external torque acts on the system consisting of the student, stool and the dumbbells. Thus the angular momentum of the system about the rotational axis remains constant. $I_{\text{initial}} * \omega_{\text{initial}} = I_{\text{final}} * \omega_{\text{final}}$.

[4] For the motion of the Earth around the sun, the total of angular momenta of the Earth and the Sun, is conserved in every inertial frame of reference; but the angular momentum of the Earth (or of the sun)is not conserved in every inertial frame.

[5] Only the z component of angular momentum of a conical pendulum is conserved w.r.t. the origin fixed at the point of suspension. SetId=120

[6] In the example of conical pendulum, the z- component of angular momentum does not change. This follows from the angular momentum conservation as there is no external torque.

[7] A tennis ball is dropped from height h and after hitting the ground and it bounces back and rises to the same height. In this case the momentum of the ball is conserved because (under ideal conditions) the momentum after it hits the ground will be equal to the momentum it had before hitting the ground.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *net external force* acting on the system, the momentum is conserved. The definition of angular momentum and torque depends on the choice of axes, and

therefore it may not be be conserved. The conservation of total energy holds only for conservative forces.

When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *net external force* acting on the system, the energy and momentum will be conserved. However, the total angular momentum may not be conserved because the torque may not be zero.

[9] Non conservative forces are forces with the property that the work done by the force in moving a particle between two points is dependent on the path taken.Also the work done over a closed loop is not zero.Defining of scalar potential is not possible in case of non conservative forces because the change in potential energy between two points will depend on path taken.

SetId=120

[10] It is not possible for a particle to move on a circular path in such a way that its speed and force remains constant, and only the velocity and acceleration may (or may not) always change with time.

[11] If two bodies starting from a point A reach a point B, following different paths, their displacement will be, in general different, but the distances covered will always be the same.

[12] A particle is observed from two frames S_1 and S_2. The frame S_2 moves with respect to S_1 with an acceleration a. If F_1 and F_2 be the pseudoforces when seen from S_1 and S_2 respectively it is not possible to have $F_1 = F_2 = 0$

[13] When there is no external forces act on a system of many particles, and there are only internal forces acting on the particles. The third law gives that the internal forces are pairwise equal and opposite.Thus the sum of internal forces is zero and the momentum of each particle is conserved.

[14] The kinetic energy of a body does not change if any one of the following is true
(i)force is always perpendicular to the velocity
(ii) the force is always perpendicular to the acceleration
(iii) the object remains stationary
(iv) the object moves in such a way that the point of application of the force remains fixed.

SetId=120

[15] For the Newton's Law of Motion to hold true,the physically apparent but nonexistent force needed by an observer in a non-inertial frame is called the pseudo force.
1) Caused by relative acceleration of the origin in a straight line
2) Centrifugal and Centripetal forces
3) Coriolis force
4) Euler force

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SetId=121

[1] Displacement is equal to the vector difference $\vec{r}_f - \vec{r}_i$ of the position vectors of initial and final points. The distance covered will be $|\vec{r}_f - \vec{r}_i|$

[2] The law of conservation of angular momentum states that The total angular momentum of a system is constant in both magnitude and direction if the resultant torque, of the external forces acting on the system, is zero.

[3] A bob is attached to ceiling by a string and moves in a horizontal circular plane is an example. In this case the law of conservation of angular momentum does not hold.

[4] In the Sun Earth system the angular momentum of the Earth is conserved in every frame of reference

[5] The projection of angular momentum of a conical pendulum in the horizontal plane is a constant of motion when the origin is chosen to be at fixed at the point of suspension. SetId=121

[6] In the example of conical pendulum, the x and$y$ components of angular momentum change. This follows from the angular momentum conservation as the z components external torque is zero and horizontal components of torque are non zero.

[7] Law of conservation of momentum does not hold when Newton's laws are not valid, e.g. in a non-inertial frame of reference. For example, when we consider collision between two bodies in a non-inertial frame of reference, the law of conservation of momentum cannot be applied because there will be a pseudo force acting on the frame itself.

[8] In order to apply the law of conservation of momentum we must first identify the system. If there is no *net external forces* acting on the system then conservation laws of momentum always holds. The total energy and the total angular momentum may not be conserved.

[9] A non conservative force is the force with the property that the work done in moving a particle between two points is dependent of the path taken.If a particle travels in a closed path, the net work done(the some of the forces acting along the path multiplied by the distance travelled) by a non conservative force is non zero. When an object moves from one location to another, the force changes the potential energy of the object by an amount that depends on the path taken.Non conservative force depends only on the path followed by the object.

SetId=121

[10] For a particle moving on circle the acceleration is always constant in magnitude and directed towards the centre of the circle.

[11] Distance is equal to the length of the path covered. Displacement is the shortest distance between initial and final points.

[12] A particle is observed from two frames S_1 and S_2. The frame S_2 moves with respect to S_1 with an acceleration a. If F_1 and F_2 be the pseudoforces when seen from S_1 and S_2 respectively and if $F_1 = 0$ then we must have $F_2 \neq 0$

[13] During collision of billiard balls momentum is conserved. During explosion of a bomb also momentum is conserved and the total momentum of the fragments of bomb will be zero. This is because all the forces are only internal forces.

[14] The total work done on a particle is always equal to the change in kinetic energy. $\boxed{\text{SetId=121}}$

[15] A force is any interaction which tends to change the motion of an object. It is also *defined* as rate of change of momentum.It is a vector quantity.

Pseudo-force is a fictitious force it is taken by an observer from non inertial frame of reference. This force arises from acceleration of reference frame that is a reference frame which is accelerating or rotating.

The equation of motion is then written by balancing all forces. As an example a particle moving in a circle is seen to be at rest by balancing the centripetal and centrifugal forces.

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SetId=122

[1] Distance is equal to the length of the path covered. Displacement is the shortest distance between initial and final points.

[2] If the net external torque acting on a system is zero,the angular momentum L(vector) of the system remains constant,no matter what changes take place within the system.L(vector)=a constant (net external torque acting on system is zero)

[3] Consider a disc rotating about an axis perpendicular to its plane. On placing a smaller disc with its surface parallel to the surface of the rotating disc, the angular momentum of the system of two discs remains constant as there is no external torque.

[4] In the motion of earth around sun, the angular momentum of the earth about an axis passing through the sun and perpendicular to the plane of motion of earth is conserved.

[5] The law of angular momentum of a is not applicable for the conical pendulum conserved w.r.t. the origin fixed at the point of suspension. SetId=122

[6] Example where law of conservation of angular momentum does not hold: A disc rotating on a horizontal rough surface will not have a constant angular momentum because there will be a constant torque by frictional force. Hence, its angular momentum will decrease, and the law of conservation of angular momentum does not apply.

[7] If I throw a ball upward, it's speed decreases as it rises upwards. There is an external force (gravity) acting on the ball, so the momentum conservation law does not apply. Momentum of the ball is not conserved, however the momentum of the Earth-ball system is conserved as gravity will become an internal force in this case.

[8] In order to apply the law of conservation of momentum we must first identify the system. Then even if there is no *net external forces* acting on the system, all the three conservation laws of momentum, angular momentum and energy may not hold due to presence of internal forces.

SetId=122

[9] In this type of force the work done depends on the path taken by the body.Mechanical energy is not conserved in the system if non conservative force acts on it.

[10] The motion of a bomb dropped from a plane does is not a uniform motion as it follows a parabolic path and not a straight line path.

[11] Distance is a scalar quantity where as the displacement is a vector quantity.

[12] If K is an inertial frame, any frame that moves w.r.t. the frame K with uniform velocity is also an inertial frame.

[13] Give an example where law of conservation of momentum holds: A mass exploding into several pieces in a conservative field like gravitational field(if air resistance is neglected), obeys law of conservation of momentum. If air resistance cannot be neglected then the law of conservation of momentum will not hold.

[14] A particle is acted upon by a force of constant magnitude which is always perpendicular to the velocity of the particle and the motion of the particle takes place in a plane, Then its kinetic energy, speed, velocity acceleration will not change. SetId=122

[15] A psuedo force is an apparent force that acts on all masses whose motion is described with respect to a non-inertial frame of reference like a rotating frame of reference. This force is needed by an observer in an non-inertial frame to make all the Newtons second laws to write correct equation of motion..

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SetId=123 [1] Distance is a scalar quantity where as the displacement is a vector quantity.

[2] The Law of conservation of angular momentum states that when no external torque acts on an object or a closed system of objects undergoing motion about a given axis, the change in angular momentum is zero. Therefore, considering an event where only internal torque or no torque is involved, the total angular momentum of the system before the event is equal to the total angular momentum after the event

[3] Consider a man standing on a spinning platform. Initially, the man spreads out his arms and he spins with a certain angular velocity. The next moment, he pulls his arms inwards keeping them close to his body. We will observe that the angular velocity with which he is spinning now increases. This phenomenon can be explained by the Law Of Conservation of Angular momentum. Initially, since his arms were spread wide, his moment of inertia was large. However, when he pulled them close to his body, his moment of inertia decreased.
In this example the angular velocity of the man increases and therefore the angular momentum also increases.The law of conservation of angular momentum does not apply because the torque of muscular forces is not zero.

[4] For the motion of earth around sun, the angular momentum of the earth about the center of mass of the sun + earth system and perpendicular to the plane of motion of earth is conserved.

[5] The law of angular momentum of a is not applicable for the conical pendulum conserved when the origin is chosen to be at the pendulum bob itself. SetId=123

[6] Example where law of conservation of angular momentum does not hold:Consider a vertical stick on the ground falling to a horizontal position. During the fall, the conservation of angular momentum applied at the point of rotation on the ground and perpendicular to the plane of the stick is not applicable as, the gravitational force which acts vertically downwards assumed at the centre of mass produces an external torque about the axis of rotation

[7] A soldier accelerating away, after detonating a bomb, will find that the total momentum of the fragments of the bomb is zero. This is an example where the law of conservation of momentum holds as the forces on the fragments are internal forces only and sum of all such forces is zero.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then check we should if the laws are applicable or not.

So if there is no *external force* acting on the system all the three quantities, total momentum, total angular momentum, and total kinetic energy will be conserved independent of the nature of forces.

[9] A force is said to be a non-conservative force if the work done by the force in a closed path is non-zero;(i.e) the cyclic integral of the work done is non-zero.

Work done by a non-conservative force is equal to change in total energy of the system.Work-Energy theorem is not applicable in the case of a non-conservative force.Work done by conservative force depends on the path.It differs with the paths taken by the partical even if the initial and final points are same.In case of non-conservative forces,the total mechanical energy is not constant as the energy is dissipated in various forms such as heat energy,sound energy,etc and cannot be recovered.

SetId=123

[10] A wagon sliding on a roller coaster designed in such a way that the wagon covers equal distances in equal times. As the motion of the wagon is uniform, there will be no net force acting on it.

[11] Both displacement and distance tell us about the motion of a body but their study does not tell much about the forces on the body

[12] If K is an inertial frame, any frame that moves w.r.t. the frame K with uniform speed is also an inertial frame.

[13] Also a good example of law of conservation momentum can be seen when a bullet from a rifle is fired.As the bullet is fired and gets out of the rifle, the rifle gives a backward jerk due to the phenomenon of conservation of momentum.

[14] The kinetic energy of a particle is continuously increasing with time, then the angle bewteen the net force and the velocity cannot be greater than or equal to 90^{o} at any time.

SetId=123

[15] One indication that pseudo forces are NON-NEWTONIAN is that they violate Newton's III law and violate the Newton's third law.

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SetId=124

[1] The speed is rate of change of distance and the velocity is the rate of change of displacement.

[2] The law of conservation of angular momentum states that when no external torque acts on an object or a closed system of objects, no change of angular momentum can occur. Hence, the angular momentum before an event involving only internal torques or no torques is equal to the angular momentum after the event . Angular momentum can be calculated with the help of the formula $L = I\omega$ where L stands for Angular momentum, I stands for moment of inertia and ω stands for angular velocity

[3] In the Sun-Earth system, angular momentum of the earth is not conserved but the total angular momentum of the sun and the earth is constant of motion.

[4] In the Sun Earth system the angular momentum of the Earth about the pole star is conserved

[5] The three components of angular momentum of a conical pendulum is conserved w.r.t. the origin at the position of the center of mass of the pendulum. SetId=124

[6] We have a conical pendulum .The forces acting on the bob are tension (along the direction of the string) and gravitational force acting in the vertically downward direction.we have an additional force called the drag force which is tangential to the motion of the bob and acts in the direction opposite to the motion of the bob.The axis of rotation passes through the hinge point and is vertical.The torque due to tension is 0 because the force passes through the axis of rotation.The torque due to mg is also zero since it is parallel to the axis of rotation.but the torque due to drag force is not zero.since the net external torque acting on the bob is not zero,therefore the law of conservation of angular momentum does not hold here

[7] There is no known exception to the law of conservation of momentum in classical mechanics However, an exception to conservation of energy in nuclear physics is observed. In nuclear reactions when two nuclei collide and their mass converts to energy and energy momentum are not conserved.

[8] If we want to apply the conservation laws of momentum, energy and angular momentum, we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *external force* acting on the system, the momentum and angular momentum will be conserved, and depending on the nature of the forces but total energy may or may not be conserved.

[9] A non conservative force is a force where work done in moving a particle between two points depends on the path through which it is taken.Friction is an example of non conservative force.Mechanical energy is not conserved in case of a non conservative force

SetId=124

[10] A simple pendulum moves along a circular arc and does not have constant speed and therefore its motion is not uniform.

[11] Displacement is the shortest distance between initial and final points with direction specified.

[12] A frame rotating w.r.t K with uniform angular velocity is also an inertial frame.

[13] when a man walks on the ice slab where friction does not exist between the ice block and the floor but between the feet of the man and the slab the slab moves back as per the law of conservation of momentum

[14] A heavy body is attached from a spring and is held at point A and is such that the spring is not slack nor is it stretched. It is then released. It goes down upto a point B and then it rises upto point C and executes an oscillatory motion between B and C. During the motion from A to C is first positive (from A to B) and then it is negative from B to A and again remains negative from A to C.

SetId=124

[15] The apparent force which seems to act on an object in an accelerating frame of reference if we wish to describe the object's motion is called a pseudo force.Its a non-existent force used only to describe the motion completely using Newton's second law even though the agent causing the force is undefined.

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SetId=125

[1] For any type of translational motion of a body, the displacement cannot be zero, where as the distance travelled can be zero.

[2] Newton's Second Law of Motion is defined by the expression $F = \frac{dp}{dT}$, where F gives the force vector acting on the system and p gives its momentum vector; in linear motion. A similar expression can be written to describe angular motion, i.e. : $\tau = \frac{dL}{dt}$, where τ is the external torque vector acting on the system, and L is the angular momentum.

If the external torque on the system is zero, then we get the expression as: dL/dt=0. This points out to the fact that, when no external torque is acting on the system, then its angular momentum is constant, no matter what changes occur in the system. This is the Law of Conservation Of Angular Momentum.

[3] Consider a disc and a man system. man is standing on center of the disc rotating with angular velocity.initially man folded his hand.when man stretches his hands then momentum of inertia of system increases.and angular velocity decreases.and total angular momentum remains constant.

[4] For the motion of earth around sun, the angular momentum of the sun about the center of mass of the sun + earth system and perpendicular to the orbital plane of earth is conserved.

For the motion of earth around sun, the angular momentum of the sun about and axis passing through the Earth and perpendicular to the orbital plane of motion of earth is conserved.

[5] Only the z component of the angular momentum of a conical pendulum is conserved w.r.t. the origin fixed at the point of suspension. SetId=125

[6] When you release a toy gyroscope on its pedestal, it initially has no precessional rotation around that pedestal, i.e, the orientation of rotation is fixed. However, it instantaneously starts precessing around the pedestal. Both Kinetic Energy and Angular Momentum now exist where they did not exist a moment earlier. The Kinetic Energy is easy to explain, as appearing due to the body of the gyroscope dropping a tiny fraction of a millimeter in the Earth's gravitational field, giving up exactly the correct amount of Potential Energy. But the Angular Momentum of the Precession which just appeared, does not come from anywhere. This is therefore a Violation of the Conservation of Angular Momentum.

[7] In a system of a canon and a canon ball, total momentum of the system is zero before canon ball is fired. After firing the canon ball, the momentum of the system seems to be conserved as the ball moves forward and the canon moves backward.

[8] To apply the conservation laws of momentum, energy and angular momentum, we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *external force* acting on the system, the energy and momentum will be conserved. However, depending on the nature of the system and of the forces, the total angular momentum may not be conserved.

SetId=125

[9] A force:A force is said to be a *non-//**conservative force* if the*/ work done by it in a closed path is/*/ non-zero./For such forces,potential energy cannot be defined.

[10] A satellite goes around the earth in a circular orbit of 600km with a time period of $5.8 \times 10^3 s$. Its motion will be uniform as it will cover equal distances in equal times.

[11] Displacements, being vector quantity can not compared with, a scalar quantity such as distance.

[12] The Newton's Laws of motion will hold in all frames which are at rest w.r.t. K but do not remain valid in a frame that move with respect to K.

[13] When a freely falling rigid body collides another body in its path momentum the system of two particles is not conserved in the collision as there is external force mg acting on the system.

[14] The kinetic energy of a body does not change if any one of the following is true
(i)force is always perpendicular to the velocity
(ii) the force is always perpendicular to the acceleration
(iii) the object remains stationary
(iv) the object moves in such a way that the point of application of the force remains fixed.

SetId=125

[15] The physically apparent, but nonexistent, force needed by an observer in a noninertial frame to make Newton's laws of motion hold true is called pseudoforce.

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SetId=126

[1] Displacements, being vector quantity can not compared with, a scalar quantity such as distance.

[2] If the net external torque acting on a system is zero, the angular momentum L of the system remains constant, no matter what changes take place within the system.

$$\sum(T_{\text{ext}}) = \frac{dL}{dt}$$

The law states that when there is no net external torque, $\frac{dL}{dt}$ is zero implying that the total angular momentum of system is constant.

i.e. $L = a$ constant (isolated system)

[3] The conservation of angular momentum of a system of bodies requires that the the sum of torque due to <u>all forces</u> be equal to zero. Now consider a situation where the forces are such that the sum of torques of external forces is zero w.r.t. some axes K. Since the value of torque depends of the choices of axes, the sum of torques due to all <u>internal forces</u> will depend on the choice of axes and in general it will be non zero. Therefore, for a system of several bodies, for a given choice of axes K, there will be situations when the total angular momentum may not be conserved.

[4] For the motion of earth around sun, the sum of angular momenta of the Sun and the Earth about the center of mass of the sun + earth system is conserved.

[5] The z component of angular momentum of a conical pendulum is not conserved w.r.t. the origin fixed at the point of suspension; but the x and y components are conserved. SetId=126

[6] There is no case where LAW OF CONSERVATION OF ANGULAR MOMENTUM does'nt hold.But there are cases where conservation of angular momentum does not hold.A body in vertical circular motion is an example where angular momentum is not conserved. Here the law of conservation does not apply.

[7] When applying the conservation laws of momentum, energy and angular momentum we must define the system first.Only then check if the laws is applicable or not.

As an example: when a ball is dropped from a height, it gains momentum down if we consider the ball as our system.This is because the force of gravity acts as an external force.

However, if we change our system and consider earth as a part of our system too, then the momentum remains conserved because the earth gains momentum up.

[8] In order to apply the law of conservation of momentum we must first identify the system. If there is no *external forces* acting on the system then conservation laws of momentum always holds. And depending on the nature of the system and of the forces, the total kinetic energy and the total angular momentum may not be conserved.

[9] A force that is not conservative is nonconservative force. The work done by a noconservative force cannot be represented by a potential energy function. That is work done by a nonconservative force is dependent on the path through which the system is moved. Some nonconservative forces cause the mechanical energy to be lost or dissipiated. Such forces are called dissipiative forces. There is no way to get back the lost mechanical energy. Nonconservative forces can also increase the mechanical energy. This is arrived from the concept of irreversible process.

SetId=126

[10] A uniform motion is defined to be the one in which a body covers equal distances in equal time intervals.

[11] Distance depends on the path where as the displacement depends on the end point only

[12] Staying inside a bullet train moving with constant velocity (no jerks etc) an experiment can always be performed which will tell us the numerical velocity of the bullet train

[13] If we take some amount of a substance like construction putty, cement, cake batter, playing dough,etc and drop it on the ground, it does not bounce back, like a rubber ball would bounce, and hence the momentum it had before striking the ground seems to have been lost. Hence it appears that the law of conservation of linear momentum does not hold.

[14] The total work done on a particle is always equal to the change in kinetic energy. SetId=126

[15] Pseudo forces come into picture when Newton's laws of motion have to be applied to describe the motion of bodies in non-inertial frames. These forces have no real existence.

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[1] Distance depends on the path where as the displacement depends on the end point only.

[2] When the net external torque acting on a body or a system of bodies is zero about a particular axis, then the angular momentum of each body is conserved about that axis.

[3] Example where law of conservation of angular momentum does not hold:
When there is external force like frictional force acting on a object when it is rotating we cannot use conservation of angular momentum as the friction force acting on the object produces an external torque.

[4] For the motion of the Earth around the sun, the total of angular momenta of the Earth and the Sun, about in a reference frame fixed in the pole star, is conserved.

[5] Only the z component of angular momentum of a conical pendulum is conserved w.r.t. the origin fixed at the point of suspension. SetId=127

[6] A sphere rolling on a rough surface.Due to friction there is external torque so the angular momentum changes which results in the slowing of the sphere. The angular momentum keeps changing. Even in case like this one, it is wrong to say that the Law of Angular Momentum Conservation does not hold.

[7] Statement: Law of Conservation of energy states that "ENERGY CAN NEITHER BE CREATED NOR DESTROYED",but it can be changed from one form to other.

EXPLANATION: Statement implies that the total amount of energy in an isolated system remains constant although it may change forms. viz, kinetic energy may change to potential;chemical to electrical energies etc.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then check if the laws is applicable or not.

So if there is no *net external force* acting on the system all the three conservation laws will hold.

[9] Nonconservative forces are forces, such that the work done by these forces are path dependent. Work done by these forces around a close path is not necessarily equal to zero. Hence if a particle is acted on by a non-conservative force and that particle returns to its original position, that particle will experience a net loss of energy. Energy will thus not be conserved for particle. Potential Energy can not be defined for these type of forces.

SetId=127

[10] A particle moves on a circular path. Then its speed, direction of force, velocity and acceleration must always change with time.

[11] Distance equal to zero $\Rightarrow$ displacement=0; but Displacement=0

[12] Staying inside a bullet train moving with constant velocity (no jerks etc) an experiment can always be performed which will tell us the numerical value of the acceleration of the bullet train

[13] When we consider collision between two bodies in a non-inertial frame of reference, the law of conservation of momentum cannot be applied because there will be a pseudo force acting on the frame itself.

[14] A particle is acted upon by a force of constant magnitude which is always perpendicular to the velocity of the particle and the motion of the particle takes place in a plane, Then its kinetic energy, speed, velocity acceleration will not change. SetId=127

[15] In a non-inertial frame of reference the accelration of the body that we measure, is not the true acceleration, as the frame itself accelerates.Thus,force(F=ma) is also not the true force acting on the body.The extra force added to make it a true value is called pseudo force.Thus pseudo force does not really act on a body but just compensates the change produced by the non inertial frame, in true acceleration.

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[1] Distance equal to zero implies displacement=0; and Displacement=0 also implies distance = 0

[2] The law of conservation of angular momentum states that in absence of an external torque on an object or a closed system of objects the total angular momentum of the system remains constant. Thus if $\vec{\tau} = 0 => \vec{L} =$ constant where τ is the torque and $\vec{L}$ is the angular momentum of the system.

[3] A bob attached to a ceiling by a string moving in a horizontal circular plane is an example where the total angular momentum of the bob about the point of suspension is not conserved. This is because the the torque due to the weight of the bob about the point of suspension does not vanish and has non zero horizontal component. Only the vertical component of the angular component is conserved.

[4] For the motion of the Earth around the sun, the total of angular momenta of the Earth and the Sun, is conserved in every inertial frame of reference; but the angular momentum of the Earth (or of the sun)is not conserved in every inertial frame.

[5] The projection of angular momentum of a conical pendulum in the horizontal plane is a constant of motion when the origin is chosen to be at fixed at the point of suspension. SetId=128

[6] Consider a rod of length l. Let us give an impulse to one end . Now the angular momentum about the oposite end is not zero since the impulse provides some torque . So the angular momentum is not conserved .

$$\text{torque} = \text{impulse} * \ell.$$

$d\ell/dt$ is not equal to zero and the law of conservation of angular momentum does not hold.

[7] Oscillating simple pendulum is a very good example where potential energy gets converted to kinetic energy and kinetic to potential energy. Some energy gets dissipated as heat if we consider air resistance. Energy as a whole is conserved if we consider universe as system, the energy has just changed its form.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then check we should if the laws are applicable or not.

So if there is no *external force* acting on the system all the three quantities, total momentum is conserved. The total angular momentum is also because the torque of internal forces will be zero. The conservation of energy depends on the nature of forces. will be conserved.

[9] Non Conservative force is a force with the property that workdone in moving an object from one point to another is dependent on the path taken .

Non Conservative Force can arise in classical physics due to neglected degrees of freedom or time dependent potentials.

SetId=128 Friction may be treated without resorting the use of non conservative forces by considering the motion of individual molecules.

[10] A particle moves on a circular path. Then its speed, direction offorce, can remain constant by velocity and acceleration must always change with time.

[11] If P and Q are the initial and the final points of a path of a particle, displacement is a vector whose direction is along PQ and has magnitude is equal to the length of line PQ

[12] Assume bullet train, moving with out any jerks, is going on a circular arc of radius R with constant speed. Then an experiment is to be performed entirely within the train without any measurement on objects outside the train. Such an experiment can tell only radius of the track.

[13] When a system is acted upon by external forces like friction etc, the conservation principle does not hold good,there will be impulse imparted and so we cant conserve momentum. This is case when a collision between two elastic balls take place on a rough horizontal table. The total momentum just after the collision will be different from the total momentum just before the collision. Here momentum is not conserved as there is external force friction is present.

[14] The kinetic energy of a particle is continuously increasing with time, then the angle bewteen the net force and the velocity cannot be greater than or equal to 90^o at any time. SetId=128

[15] A force is any interaction which tends to change the motion of an object. It is *equal to* the rate of change of momentum by Newton's second law.

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[1] If P and Q are the initial and the final points of a path of a particle, displacement is a vector whose direction is along PQ and has magnitude is equal to the length of line PQ

[2] If no net external torque acts on a system, the total angular momentum of the system remains constant.

[3] Law of conservation of angular momentum holds in case of long jump. When a athlete takes off from the ground in a running long jump, the forces on the launching foot give the athlete an angular momentum with a forward rotation around a horizontal axis. Such rotation would not allow the jumper to land properly. In the landing, the legs should be together and extended forward at an angle so that the heels mark the sand at the greatest distance. Once airborne, the angular momentum cannot change (it is conserved) because no external torque acts to change it. However, the jumper can shift most of the angular momentum to the arms by rotating them in windmill fashion. Then the body remains upright in the proper orientation of landing.

[4] In the Sun Earth system the angular momentum of the Earth is conserved in every frame of reference

[5] The law of angular momentum of a is not applicable for the conical pendulum conserved w.r.t. the origin fixed at the point of suspension. SetId=129

[6] Let us consider a rotating skew rod. In the absence of friction or any other drag force, the rod should continuously spin without stopping. Here the net torque about the axis of rotation is 0 and hence angular momentum is conserved. It therefore follows from law of conservation of angular momentum that a spinning skew rod will keep rotating with constant angular velocity if there is no external torque. So law of conservation of angular momentum does not hold.

[7] Law of conservation of momentum does not hold whenever an external force or impulse acts on the system. For example,when a body collides with earth then it bounces back to a lesser height as it loses some velocity.

In this example the momentum of a ball is not conserved due to impulsive force by ground in the normal direction.

However, strictly speaking the system that should be considered here is the ball-earth system and the total momentum is conserved.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *net external force* acting on the system, the momentum is conserved. The definition of angular momentum and torque depends on the choice of axes, and therefore it may not be be conserved. The conservation of total energy holds only for conservative forces.

When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *net external force* acting on the system, the energy and momentum will be conserved. However, the total angular momentum may not be conserved because the torque may not be zero.

[9] A non-conservative force is a force with the property that the work done in moving a particle between two points is dependent of the path taken . Mostly the enery of the particle in a non conservative force field dissipates in the form of heat or sound . Since the lost energy cannot be bought back ,conservation of mechanical energy does not hold true .

SetId=129

[10] A particle moves on a circular path. Then under suitable conditions its speed may remain constant, but the force, velocity and acceleration must always change with time.

[11] If P and Q are the initial and the final points of a path of a particle,the displacement is the vector $\overrightarrow{PQ}$.

[12] Assume bullet train, moving with out any jerks, is going on a circular arc of radius R with constant speed. Then an experiment is to be performed entirely within the train without any measurement on objects outside the train. Such an experiment can tell both speed of the train and radius of the track.

[13] When we are in accelerating frame if we observe any collision between two bodies then the law of conservation of momentum does not hold in that frame of reference. On the other hand the law of conservation of momentum holds in all inertial frames.

[14] A heavy body is attached from a spring and is held at point A and is such that the spring is not slack nor is it stretched. It is then released. It goes down upto a point B and then it rises upto point C and executes an oscillatory motion between B and C. During the motion from A to C is first positive (from A to B) and then it is negative from B to A and again remains negative from A to C. SetId=129

[15] Newton's laws are not valid on non-inertial frame of reference. So to validate Newton's laws of motion pseudo force (fictious or virtual force) is introduced.
Pseudo force acts in non-inertial frame. Its magnitude is always mass of the body multiplied by acceleration of the frame. It is always in direction opposite to the acceleration of the frame of reference. The resultant of pseudo forces and real forces is always zero.

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SetId=130

[1] If P and Q are the initial and the final points of a path of a particle,the displacement is the vector $\overrightarrow{PQ}$.

[2] The law of conservation of angular momentum states that when no external torque is applied on an object or a closed system of objects about an axis, the angular momentum about that axis remains constant.

[3] The total angular momentum of a body remains constant of motion when the net torque of the external forces acting on the body is zero.
In general, we have a system of particles such that the net torque of the external forces on the system, w.r.t. some axes K, is zero, the total angular momentum may not remain conserved, because the torque due to the internal forces may not be zero.

[4] In the motion of earth around sun, the angular momentum of the earth about an axis passing through the sun and perpendicular to the plane of motion of earth is conserved.

[5] The law of angular momentum of a is not applicable for the conical pendulum conserved when the origin is chosen to be at the pendulum bob itself. SetId=130

[6] In the example of skew rod the angular velocity does not change even though the torque applied is nonzero. However there is no contradiction as in this case the law of conservation of momentum is not applicable. conservation is violated.

[7] If a bullet hits a wooden board and gets embedded in the board, the total energy and the total momentum of the bullet and the board are conserved.

[8] In order to apply the law of conservation of momentum we must first identify the system. If there is no *net external forces* acting on the system then conservation laws of momentum always holds. The total energy and the total angular momentum may not be conserved.

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[9] If the work done by a force depends on the path followed by the particle, it is called a Non conservative force. Work done by a non conservative force is not zero in round trip.

[10] A particle moves on a circular path. Then under suitable conditions its speed and acceleration may remain constant, but the force, and velocity must always change with time.

[11] If two bodies starting from a point A reach a point B, following different paths, their displacement will be, in general different, but the distances covered will always be the same.

[12] Assume bullet train, moving with out any jerks, is going on a circular arc of radius R with constant speed. Then an experiment is to be performed entirely within the train without any measurement on objects outside the train. Such an experiment can tell only speed of the track.

[13] When a freely falling body hits another rigid body in its path then momentum is not conserved as external force mg acts on both the bodies. The total momentum after the collision will be different from the total momentum before the hit.

[14] The kinetic energy of a body does not change if any one of the following is true
(i)force is always perpendicular to the velocity
(ii) the force is always perpendicular to the acceleration
(iii) the object remains stationary
(iv) the object moves in such a way that the point of application of the force remains fixed. SetId=130

[15] These forces are non-real forces but must be taken into account while applying Newton's Law's of Motion in accelerating frame of reference as compared to an inertial frame of reference.

The centrifugal and centripetal forces are examples of pesudo-forces.

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[1] If two bodies starting from a point A reach a point B, following different paths, their displacement will be, in general different, but the distances covered will always be the same.

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[2] The angular momentum of a given system of bodies shall remain conserved unless acted upon by an external unbalanced torque.

[3] An example where law of conservation of angular momentum holds:
The Law of conservation of angular momentum holds in the case of a ballet dancer performing a pirouette.

When the dancer extends her arms outward, the angular velocity of her rotation decreases whereas when she keeps her arms close to her body, the angular velocity increases. This is because her moment of inertia changes as she moves her arms outward and inward. It can be noted that she as a system has no external torque acting upon her.

[4] For the motion of earth around sun, the angular momentum of the earth about the center of mass of the sun + earth system and perpendicular to the plane of motion of earth is conserved.

[5] The three components of angular momentum of a conical pendulum is conserved w.r.t. the origin at the position of the center of mass of the pendulum. SetId=131

[6] Example where law of conservation of angular momentum does not hold:If a particle undergoes conical motion and the only force acting on particle is central force like tension of the string.Then total external torque about fixed point A is zero,yet angular momentum is not conserved,as angular momentum keeps on changing direction.

[7] If a bullet hits a wooden board and gets embedded in the board, the total energy of the bullet and the board system is conserved but the total momentum is not conserved.

[8] In order to apply the law of conservation of momentum we must first identify the system. Then even if there is no *net external forces* acting on the system, all the three conservation laws of momentum, angular momentum and energy may not hold due to presence of internal forces.

[9] The workdone by a non conservative force is dependant on its path. the work varies as the path varies.

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[10] When the force is kept constant as function of time, it is possible for a particle to move on a circular path in such a way that its speed remains constant, but the velocity and acceleration must always change with time.

[11] Distance is equal to the length of the path covered. Displacement is the shortest distance between initial and final points.

[12] A particle is observed from two frames S_1 and S_2. The frame S_2 moves with respect to S_1 with an acceleration a. If F_1 and F_2 be the pseudoforces when seen from S_1 and S_2 respectively it is not possible to have $F_1 = F_2 = 0$

[13] .The law of conservation of momentum does not hold good when net external forces acting on the system is not zero.when two bodies collide law of conservation of momentum is applicable on system of two bodies but on not individual bodies because external impulse acts on them.

[14] The total work done on a particle is always equal to the change in kinetic energy. SetId=131

[15] When observing our system from a reference frame which is accelerating compared to an inertial frame,in order to make it easier to apply newtons laws, we can apply a pseudo force on all objects in the universe proportional to their mass capable of causing an acceleration equal and opposite to that of our reference frame. Hence serving to in a way "stop"(or make inertial) our reference frame, and making it easier for us to investigate the motion.

This application of pseudo force doesn't change the motion of the object because just as we can choose an arbitrary reference frame, we can choose an arbitrary force to cause the same acceleration in every object in the whole universe without changing the relative motions of objects. (as all motion is truly relative, we will still get correct answers for our investigations.

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[1] Displacement is equal to the vector difference $\vec{r}_f - \vec{r}_i$ of the position vectors of initial and final points. The distance covered will be $|\vec{r}_f - \vec{r}_i|$

[2] When the net external torque acting on a system about a given axis is zero, the total angular momentum of the system about that axis remains consant.

[3] In case of a skater, who can be considered an isolated system, so no torue will be acting on him/her. When the arms are extended, the moment of inertia is more. When his hands are closely held, the moment of inertia is lesser. Since the angular momentum is same, the angular acceleration changes accordingly.

[4] In the Sun Earth system the angular momentum of the Earth about the pole star is conserved

[5] Only the z component of the angular momentum of a conical pendulum is conserved w.r.t. the origin fixed at the point of suspension. SetId=132

[6] A nonzero torque always causes the angular velocity to change, because a change in angular momentum means a change in angular velocity $L = I\omega$

[7] If a bullet hits a wooden board and gets embedded in the board, both total energy and the total momentum of the bullet and the board are not conserved.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then check we should if the laws are applicable or not.

So if there is no *external force* acting on the system all the three quantities, total momentum, total angular momentum, and total kinetic energy will be conserved independent of the nature of forces.

SetId=132

[9] A non conservative force is a force with the property that the work done in moving a particle between two points is dependent on the path followed.

[10] It is not possible for a particle to move on a circular path in such a way that its speed and force remains constant, and only the velocity and acceleration may (or may not) always change with time.

[11] Distance is a scalar quantity where as the displacement is a vector quantity.

[12] A particle is observed from two frames S_1 and S_2. The frame S_2 moves with respect to S_1 with an acceleration a. If F_1 and F_2 be the pseudoforces when seen from S_1 and S_2 respectively and if $F_1 = 0$ then we must have $F_2 \neq 0$

[13] A block moving in the air breaks up into two parts and the parts separate, then the total momentum must be the same before and after the break.

[14] A particle is acted upon by a force of constant magnitude which is always perpendicular to the velocity of the particle and the motion of the particle takes place in a plane, Then its kinetic energy, speed, velocity acceleration will not change. SetId=132

[15] Various types of forces in nature can be grouped in four categories:
(a)Gravitational; (b)Electromagnetic; (c)Nuclear; (d)Weak
There are also some non-fundamental forces such as:
(i)Normal reaction on bodies in contact with surfaces , (ii) Friction,(iii) Tension,(iv)Elastic force.

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[1] Distance is equal to the length of the path covered. Displacement is the shortest distance between initial and final points.

[2] This law sates that when no net torque of all forces acts on a object or a system of objects then total angular momentum of system is conserved.The angular momentum before an event is equal to angular momentum after that event.mathematically explained by when, net torque=0 ;then, total angular momentum(L)=constant.

[3] Example where law of conservation of angular momentum holds:
Let us assume a student seated on a stool that can rotate freely about a vertical axis. The student has been set into rotation at a modest initial angular speed ω . He holds two dumbbells in his outstretched hands. His angular momentum vector L lies along the vertical rotation axis, pointing upwards. Now he pulls in his arms;this action reduces his rotational inertia from its value I_{initial} to a final value I_{final} because he moves the mass closer to the rotational axis. His rate of rotation increases markedly, from ω_{initial} to ω_{final}. The student can then slow down by extending his arms once more,moving the dumbbells outward. No external torque acts on the system consisting of the student, stool and the dumbbells. Thus the angular momentum of the system about the rotational axis remains constant. $I_{\text{initial}} * \omega_{\text{initial}} = I_{\text{final}} * \omega_{\text{final}}$.

[4] For the motion of earth around sun, the angular momentum of the sun about the center of mass of the sun + earth system and perpendicular to the orbital plane of earth is conserved.

For the motion of earth around sun, the angular momentum of the sun about and axis passing through the Earth and perpendicular to the orbital plane of motion of earth is conserved.

[5] The z component of angular momentum of a conical pendulum is not conserved w.r.t. the origin fixed at the point of suspension; but the x and y components are conserved. SetId=133

[6] A nonzero torque always implies change in angular momentum and may not give rise to a change in magnitude of angular velocity. A non zero torque may mean change only the direction of the angular momentum and not the angular velocity.

[7] There are certain situations where it appears that the law of conservation of linear momentum does not hold. For example if we take some amount of a substance like construction putty, cement, cake batter, playing dough,etc and drop it on the ground, it does not bounce back like a rubber ball would and hence the momentum it had before striking the ground seems to have been lost. Hence it appears that the law of conservation of linear momentum does not hold.

[8] If we want to apply the conservation laws of momentum, energy and angular momentum, we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *external force* acting on the system, the momentum and angular momentum will be conserved, and depending on the nature of the forces but total energy may or may not be conserved.

[9] A non conservative force is a force with the property that the work done in moving a particle between two points is dependent of the taken path.

Friction, for example, does less work on a book dragged across a table if the book is dragged straight across than if the book is dragged in a curved path.

To write the equation for conservation of energy for non conservative forces we need to include the work done by the non conservative force also.This is because forces like friction liberate heat which are not included in the mechanical energy.

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[10] For a particle moving on circle the acceleration is always constant in magnitude and directed towards the centre of the circle.

[11] Both displacement and distance tell us about the motion of a body but their study does not tell much about the forces on the body

[12] If K is an inertial frame, any frame that moves w.r.t. the frame K with uniform velocity is also an inertial frame.

[13] A ball hits the floor and rebounds after an inelastic collision. In this case the total momentum of the ball before and after the collsion is conserved. Also the total enrgy of the ball and the earth remains the same

[14] The kinetic energy of a particle is continuously increasing with time, then the angle bewteen the net force and the velocity cannot be greater than or equal to 90^o at any time.

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[15] A force is agency that which changes or tends to change the state of rest or motion of a body.

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SetId=134 [1] Distance is a scalar quantity where as the displacement is a vector quantity.

[2] Statement of Law of Conservation of Angular Momentum:
Differentiating $\vec{L} = \vec{r} \times \vec{p}$ w.r.t, time,

$$\begin{aligned} \frac{dL}{dt} &= \frac{d\vec{r} \times \vec{p}}{dt} = \frac{d\vec{r}}{dt} \times \vec{p} + \vec{r} \times \frac{d\vec{p}}{dt} = \vec{v} \times (m\vec{v}) + \vec{r} \times \vec{F} \\ &= \vec{r} \times \vec{F} (\because v \times v = 0) \\ &= \vec{\tau} \end{aligned}$$

here $\vec{\tau}$ represents the net torque acting on a rigid body rotating about a fixed axis.This torque must take into account of all the forces, be it external or internal forces

[3] A bob is attached to ceiling by a string and moves in a horizontal circular plane is an example. In this case the law of conservation of angular momentum does not hold.

[4] For the motion of earth around sun, the sum of angular momenta of the Sun and the Earth about the center of mass of the sun + earth system is conserved.

[5] Only the z component of angular momentum of a conical pendulum is conserved w.r.t. the origin fixed at the point of suspension. SetId=134

[6] In the example of a rotating skew rod the torque due to the external gravitational forces is zero , but the angular momentum is not constant Therefore the law of conservation of angular momentum is violated.

[7] A tennis ball is dropped from height h and after hitting the ground and it bounces back and rises to the same height. In this case the momentum of the ball is conserved because (under ideal conditions) the momentum after it hits the ground will be equal to the momentum it had before hitting the ground.

[8] To apply the conservation laws of momentum, energy and angular momentum, we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *external force* acting on the system, the energy and momentum will be conserved. However, depending on the nature of the system and of the forces, the total angular momentum may not be conserved.

[9] A non conservative force is a force with the property that the work done in moving a particle between two points is dependent of the taken path.

Friction, for example, does less work on a book dragged across a table if the book is dragged straight across than if the book is dragged in a curved path.

To write the equation for conservation of energy for nonconservative forces we need toinclude the work done by the non conservative force also.This is because forces like friction liberate heat which are not included in the mechanical energy. SetId=134

[10] The motion of a bomb dropped from a plane does is not a uniform motion as it follows a parabolic path and not a straight line path.

[11] Displacement is the shortest distance between initial and final points with direction specified.

[12] If K is an inertial frame, any frame that moves w.r.t. the frame K with uniform speed is also an inertial frame.

[13] In a head on elastic collision of two identical bodies of equal masses the velocities, the speeds, the momenta and the kinetic energy are all exchanged.

[14] A heavy body is attached from a spring and is held at point A and is such that the spring is not slack nor is it stretched. It is then released. It goes down upto a point B and then it rises upto point C and executes an oscillatory motion between B and C. During the motion from A to C is first positive (from A to B) and then it is negative from B to A and again remains negative from A to C. SetId=134

[15] The forces may be of the following two types - *Contact forces* (those that act when bodies are in physical contact) eg. friction, normal reaction, bouyancy etc. and*Action-at-a-distance forces* (those that act when bodies are not in contact) eg. Gravity, electostatic forces, magnetic forces etc. There At the root level, forces are of the following fundamental types :- (a) *Gravitational forces* - weakest of all forces, always attractive
(b) *Electromagnetic forces* - stronger than gravitational forces, can be attractive or repulsive,
(c) *Nuclear forces* - exist at atomic level, have very short range,
(d) *Weak nuclear forces* associated with beta particle emission

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SetId=135

[1] The speed is rate of change of distance and the velocity is the rate of change of displacement.

[2] Statement of Law of Conservation of Angular Momentum: For a system of many particles The net torque due all the forces, be it external or internal forces. But as the torque due to all the internal forces cancel out, it sufficient to consider the external forces acting on the system.

[3] Consider a disc rotating about an axis perpendicular to its plane. On placing a smaller disc with its surface parallel to the surface of the rotating disc, the angular momentum of the system of two discs remains constant as there is no external torque.

[4] For the motion of the Earth around the sun, the total of angular momenta of the Earth and the Sun, about in a reference frame fixed in the pole star, is conserved.

[5] The projection of angular momentum of a conical pendulum in the horizontal plane is a constant of motion when the origin is chosen to be at fixed at the point of suspension. SetId=135

[6] In the example of skew rod, the angular momentum changes with time and there is a non zero torque coming from action of forces other than gravitational forces. Hence the law of conservation of angular momentum dos not apply.

[7] Law of conservation of momentum does not hold when Newton's laws are not valid, e.g. in a non-inertial frame of reference. For example, when we consider collision between two bodies in a non-inertial frame of reference, the law of conservation of momentum cannot be applied because there will be a pseudo force acting on the frame itself.

[8] In order to apply the law of conservation of momentum we must first identify the system. If there is no *external forces* acting on the system then conservation laws of momentum always holds. And depending on the nature of the system and of the forces, the total kinetic energy and the total angular momentum may not be conserved.

[9] The non conservative force is a force with a property thet the work done between two points depends on path taken. If a particle moves along a curve path, to know about the work done by a non conservative force we should have the equation of the path along which the particle had move.The work done would be

WORK = INTEGRAL (F.dx)

The equation of conservation of mechanical energy for a non conservative force would be

SetId=135

$KE_{\text{final}} + PE_{final} = KE_{initial} + PE_{initial} + W_{nc}$

[10] A wagon sliding on a roller coaster designed in such a way that the wagon covers equal distances in equal times. As the motion of the wagon is uniform, there will be no net force acting on it.

[11] Displacements, being vector quantity can not compared with, a scalar quantity such as distance.

[12] A frame rotating w.r.t K with uniform angular velocity is also an inertial frame.

[13] For a system of several particles the conservation of total linear momentum is equivalent to the statement that their centre of mass moves like a free particle.

[14] The kinetic energy of a body does not change if any one of the following is true
(i)force is always perpendicular to the velocity
(ii) the force is always perpendicular to the acceleration
(iii) the object remains stationary
(iv) the object moves in such a way that the point of application of the force remains fixed. SetId=135

[15] The main differences between force and pseudo force are -
(1) Forces have a real presence while pseudo forces don't.
(2) Forces can be accounted for by Newton's laws.
(3) Pseudo forces are only taken into account when the reference frame is accelerated.

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[1] For any type of translational motion of a body, the displacement cannot be zero, where as the distance travelled can be zero.

[2] Depending on the torques acting on a system, the angular momentum can be conserved only in one or two directions, but may not be conserved in all. For instance, if an isolated body has no torque acting on it only in the direction along the Z axis, then the angular momentum is conserved only in that direction.

[3] Consider a man standing on a spinning platform. Initially, the man spreads out his arms and he spins with a certain angular velocity. The next moment, he pulls his arms inwards keeping them close to his body. We will observe that the angular velocity with which he is spinning now increases. This phenomenon can be explained by the Law Of Conservation of Angular momentum. Initially, since his arms were spread wide, his moment of inertia was large. However, when he pulled them close to his body, his moment of inertia decreased.
In this example the angular velocity of the man increases and therefore the angular momentum also increases.The law of conservation of angular momentum does not apply because the torque of muscular forces is not zero.

[4] For the motion of the Earth around the sun, the total of angular momenta of the Earth and the Sun, is conserved in every inertial frame of reference; but the angular momentum of the Earth (or of the sun)is not conserved in every inertial frame.

[5] The law of angular momentum of a is not applicable for the conical pendulum conserved w.r.t. the origin fixed at the point of suspension. SetId=136

[6] In the example of conical pendulum, the z- component of angular momentum does not change. This follows from the angular momentum conservation as there is no external torque.

[7] If I throw a ball upward, it's speed decreases as it rises upwards. There is an external force (gravity) acting on the ball, so the momentum conservation law does not apply. Momentum of the ball is not conserved, however the momentum of the Earth-ball system is conserved as gravity will become an internal force in this case.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then check if the laws is applicable or not.

So if there is no *net external force* acting on the system all the three conservation laws will hold.

[9] Nonconservative forces arise due to neglected degrees of freedom or from time dependent potentials. The work done by a nonconservative force depends upon the path taken. It causes a change in the mechanical energy of the system. It adds or removes mechanical energy from a system.

SetId=136

[10] A simple pendulum moves along a circular arc and does not have constant speed and therefore its motion is not uniform.

[11] Distance depends on the path where as the displacement depends on the end point only

[12] The Newton's Laws of motion will hold in all frames which are at rest w.r.t. K but do not remain valid in a frame that move with respect to K.

[13] The total mechanical energy of a system may not be conserved if there are no external forces and the internal forces are conservative.

[14] The total work done on a particle is always equal to the change in kinetic energy. SetId=136

[15] A force is any interaction which tends to change the motion of an object. It is also *defined* as rate of change of momentum. It is a vector quantity.

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[1] Displacements, being vector quantity can not compared with, a scalar quantity such as distance.

[2] According to Law of Conservation of Angular momentum,if no external torque acts on an object or system of objects,angular momentum of an object or system of objects remains CONSTANT or no change in angular momentum can occur.

Also it states that,only external torque can change angular momentm of the system where as the torque produced by internal forces can not change the angular momentum of the system

[3] In the Sun-Earth system, angular momentum of the earth is not conserved but the total angular momentum of the sun and the earth is constant of motion.

[4] In the Sun Earth system the angular momentum of the Earth is conserved in every frame of reference

[5] The law of angular momentum of a is not applicable for the conical pendulum conserved when the origin is chosen to be at the pendulum bob itself. SetId=137

[6] In the example of conical pendulum, the x and$y$ components of angular momentum change. This follows from the angular momentum conservation as the z components external torque is zero and horizontal components of torque are non zero.

[7] A soldier accelerating away, after detonating a bomb, will find that the total momentum of the fragments of the bomb is zero. This is an example where the law of conservation of momentum holds as the forces on the fragments are internal forces only and sum of all such forces is zero.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then check we should if the laws are applicable or not.

So if there is no *external force* acting on the system all the three quantities, total momentum is conserved. The total angular momentum is also because the torque of internal forces will be zero. The conservation of energy depends on the nature of forces. will be conserved.

[9] The work done by a *Nonconservative Force *is not recoverable*.*The work done by a *Non Conservative force* is usually dissipated in the form of Heat and Sound.

SetId=137 Non conservative force *cannot* be expressed in the form of *Potential Energy*.

[10] A satellite goes around the earth in a circular orbit of 600km with a time period of $5.8 \times 10^3 s$. Its motion will be uniform as it will cover equal distances in equal times.

[11] Distance equal to zero $\Rightarrow$ displacement=0; but Displacement=0

[12] Staying inside a bullet train moving with constant velocity (no jerks etc) an experiment can always be performed which will tell us the numerical velocity of the bullet train

[13] When a bullet fired on a wooden block, some energy is transferred to the block and the total mechanical energy of the block and the bullet is conserved.

[14] A particle is acted upon by a force of constant magnitude which is always perpendicular to the velocity of the particle and the motion of the particle takes place in a plane, Then its kinetic energy, speed, velocity acceleration will not change. $\boxed{\text{SetId=137}}$

[15] Explain Pseudo Force: While applying Newton's laws of motion in non-inertial frame of reference it gives answers which contradict observations. Thus, to account for this,using Newton's Laws, we introduce a "fake" or pseudo force which gives answers that match the observations in a non-inertial frame.

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SetId=138

[1] Distance depends on the path where as the displacement depends on the end point only.

[2] The law of conservation of angular momentum states that when the net external torque acting on the system is zero, then the angular momentum of the system remains constant.both the initial and final momentum should be taken from a fixed inertial frame of reference provided.

[3] Consider a disc and a man system. man is standing on center of the disc rotating with angular velocity.initially man folded his hand.when man stretches his hands then momentum of inertia of system increases.and angular velocity decreases.and total angular momentum remains constant.

[4] In the motion of earth around sun, the angular momentum of the earth about an axis passing through the sun and perpendicular to the plane of motion of earth is conserved.

[5] The three components of angular momentum of a conical pendulum is conserved w.r.t. the origin at the position of the center of mass of the pendulum. SetId=138

[6] Example where law of conservation of angular momentum does not hold: A disc rotating on a horizontal rough surface will not have a constant angular momentum because there will be a constant torque by frictional force. Hence, its angular momentum will decrease, and the law of conservation of angular momentum does not apply.

[7] There is no known exception to the law of conservation of momentum in classical mechanics However, an exception to conservation of energy in nuclear physics is observed. In nuclear reactions when two nuclei collide and their mass converts to energy and energy momentum are not conserved.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *net external force* acting on the system, the momentum is conserved. The definition of angular momentum and torque depends on the choice of axes, and therefore it may not be be conserved. The conservation of total energy holds only for conservative forces.

When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *net external force* acting on the system, the energy and momentum will be conserved. However, the total angular momentum may not be conserved because the torque may not be zero.

[9] * A non conservative force is a force that acts on a particle(or point), such that the work done by this force in moving this particle from one point to another is */dependent of path taken/* that is the work done depends on the path itself. * For example frictional force is non conservative because the work done by friction always acts in the direction of travel and therefore depends on length L of the path taken.

SetId=138

[10] A uniform motion is defined to be the one in which a body covers equal distances in equal time intervals.

[11] If P and Q are the initial and the final points of a path of a particle, displacement is a vector whose direction is along PQ and has magnitude is equal to the length of line PQ

[12] Staying inside a bullet train moving with constant velocity (no jerks etc) an experiment can always be performed which will tell us the numerical value of the acceleration of the bullet train

[13] When a moving car hits a parked lorry and causes the parked lorry to move ,energy is transferred from moving the car to the lorry and the total energy of the lorry and the car is conserved.

[14] The kinetic energy of a particle is continuously increasing with time, then the angle bewteen the net force and the velocity cannot be greater than or equal to 90^{o} at any time.

SetId=138

[15] When a train is at rest and a ball is hung from the ceiling with a string, an observer in the train sees that the string is vertical. But when the train starts moving, the observer sees that the string makes an angle with the vertical and is tilted in forward direction . This means that some force other than gravity and tension must act on the ball. That force is the pseudo force.

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SetId=139

[1] Distance equal to zero implies displacement=0; and Displacement=0 also implies distance = 0

[2] The law of conservation of angular momentum states that The total angular momentum of a system is constant in both magnitude and direction if the resultant torque, of the external forces acting on the system, is zero.

[3] The conservation of angular momentum of a system of bodies requires that the the sum of torque due to all forces be equal to zero. Now consider a situation where the forces are such that the sum of torques of external forces is zero w.r.t. some axes K. Since the value of torque depends of the choices of axes, the sum of torques due to all internal forces will depend on the choice of axes and in general it will be non zero. Therefore, for a system of several bodies, for a given choice of axes K, there will be situations when the total angular momentum may not be conserved.

[4] For the motion of earth around sun, the angular momentum of the earth about the center of mass of the sun + earth system and perpendicular to the plane of motion of earth is conserved.

[5] Only the z component of the angular momentum of a conical pendulum is conserved w.r.t. the origin fixed at the point of suspension. SetId=139

[6] Example where law of conservation of angular momentum does not hold:Consider a vertical stick on the ground falling to a horizontal position. During the fall, the conservation of angular momentum applied at the point of rotation on the ground and perpendicular to the plane of the stick is not applicable as, the gravitational force which acts vertically downwards assumed at the centre of mass produces an external torque about the axis of rotation

[7] In a system of a canon and a canon ball, total momentum of the system is zero before canon ball is fired. After firing the canon ball, the momentum of the system seems to be conserved as the ball moves forward and the canon moves backward.

[8] In order to apply the law of conservation of momentum we must first identify the system. If there is no *net external forces* acting on the system then conservation laws of momentum always holds. The total energy and the total angular momentum may not be conserved.

[9] A force with the property that the work done in moving a particle is dependent on the path followed. The work done by a conservative force in moving a body from an initial location to a final location is dependent on the path taken between the two points

SetId=139

[10] A particle moves on a circular path. Then its speed, direction of force, velocity and acceleration must always change with time.

[11] If P and Q are the initial and the final points of a path of a particle,the displacement is the vector $\overrightarrow{PQ}$.

[12] Assume bullet train, moving with out any jerks, is going on a circular arc of radius R with constant speed. Then an experiment is to be performed entirely within the train without any measurement on objects outside the train. Such an experiment can tell only radius of the track.

[13] When a bomb explodes the total mechanical energy is not conserved. But the total chemical energy and the mechanical energy is conserved.

[14] A heavy body is attached from a spring and is held at point A and is such that the spring is not slack nor is it stretched. It is then released. It goes down upto a point B and then it rises upto point C and executes an oscillatory motion between B and C. During the motion from A to C is first positive (from A to B) and then it is negative from B to A and again remains negative from A to C. SetId=139

[15] Since newton's laws are not valid in non-inertial frames, pseudoforces (which do not exist in reality) are used to help us formualate and use Newton's laws of motion in non-inertial frames.

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SetId=140

[1] If P and Q are the initial and the final points of a path of a particle, displacement is a vector whose direction is along PQ and has magnitude is equal to the length of line PQ

[2] If the net external torque acting on a system is zero,the angular momentum L(vector) of the system remains constant,no matter what changes take place within the system.L(vector)=a constant (net external torque acting on system is zero)

[3] Example where law of conservation of angular momentum does not hold:
When there is external force like frictional force acting on a object when it is rotating we cannot use conservation of angular momentum as the friction force acting on the object produces an external torque.

[4] In the Sun Earth system the angular momentum of the Earth about the pole star is conserved

[5] The z component of angular momentum of a conical pendulum is not conserved w.r.t. the origin fixed at the point of suspension; but the x and y components are conserved. SetId=140

[6] We have a conical pendulum .The forces acting on the bob are tension (along the direction of the string) and gravitational force acting in the vertically downward direction.we have an additional force called the drag force which is tangential to the motion of the bob and acts in the direction opposite to the motion of the bob.The axis of rotation passes through the hinge point and is vertical.The torque due to tension is 0 because the force passes through the axis of rotation.The torque due to mg is also zero since it is parallel to the axis of rotation.but the torque due to drag force is not zero.since the net external torque acting on the bob is not zero,therefore the law of conservation of angular momentum does not hold here

[7] When applying the conservation laws of momentum, energy and angular momentum we must define the system first.Only then check if the laws is applicable or not.

As an example: when a ball is dropped from a height, it gains momentum down if we consider the ball as our system.This is because the force of gravity acts as an external force.

However, if we change our system and consider earth as a part of our system too, then the momentum remains conserved because the earth gains momentum up.

[8] In order to apply the law of conservation of momentum we must first identify the system. Then even if there is no *net external forces* acting on the system, all the three conservation laws of momentum, angular momentum and energy may not hold due to presence of internal forces.

[9] The work done by non conservative force is dependent on the path taken by the particle in reaching final position from initial position. Non conservative force depends on the distance travelled by the particle

SetId=140

[10] A particle moves on a circular path. Then its speed, direction offorce, can remain constant by velocity and acceleration must always change with time.

[11] If two bodies starting from a point A reach a point B, following different paths, their displacement will be, in general different, but the distances covered will always be the same.

[12] Assume bullet train, moving with out any jerks, is going on a circular arc of radius R with constant speed. Then an experiment is to be performed entirely within the train without any measurement on objects outside the train. Such an experiment can tell both speed of the train and radius of the track.

[13] When a ball rolls over a rough surface, it comes to stop after some time. This is because transational and rotational kinetic energy initially present in the ball continuosly gets converted to heat due to friction. When all the kinetic energy changes to heat, the ball stops. The total mechanical energy of the ball is not conserved.

[14] The kinetic energy of a body does not change if any one of the following is true
(i)force is always perpendicular to the velocity
(ii) the force is always perpendicular to the acceleration
(iii) the object remains stationary
(iv) the object moves in such a way that the point of application of the force remains fixed.

SetId=140

[15] Force is defined as the rate of change of linear momentum. In other words it is the agency which changes or tends to change the (a) State of rest; (b)State of uniform motion (c) Direction of body's motion; (d) Shape of the body

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SetId=141

[1] If P and Q are the initial and the final points of a path of a particle,the displacement is the vector $\overrightarrow{PQ}$.

[2] The Law of conservation of angular momentum states that when no external torque acts on an object or a closed system of objects undergoing motion about a given axis, the change in angular momentum is zero. Therefore, considering an event where only internal torque or no torque is involved, the total angular momentum of the system before the event is equal to the total angular momentum after the event

[3] A bob attached to a ceiling by a string moving in a horizontal circular plane is an example where the total angular momentum of the bob about the point of suspension is not conserved. This is because the the torque due to the weight of the bob about the point of suspension does not vanish and has non zero horizontal component. Only the vertical component of the angular component is conserved.

[4] For the motion of earth around sun, the angular momentum of the sun about the center of mass of the sun + earth system and perpendicular to the orbital plane of earth is conserved.

For the motion of earth around sun, the angular momentum of the sun about and axis passing through the Earth and perpendicular to the orbital plane of motion of earth is conserved.

[5] Only the z component of angular momentum of a conical pendulum is conserved w.r.t. the origin fixed at the point of suspension. SetId=141

[6] When you release a toy gyroscope on its pedestal, it initially has no precessional rotation around that pedestal, i.e, the orientation of rotation is fixed. However, it instantaneously starts precessing around the pedestal. Both Kinetic Energy and Angular Momentum now exist where they did not exist a moment earlier. The Kinetic Energy is easy to explain, as appearing due to the body of the gyroscope dropping a tiny fraction of a millimeter in the Earth's gravitational field, giving up exactly the correct amount of Potential Energy. But the Angular Momentum of the Precession which just appeared, does not come from anywhere. This is therefore a Violation of the Conservation of Angular Momentum.

[7] Statement: Law of Conservation of energy states that "ENERGY CAN NEITHER BE CREATED NOR DESTROYED",but it can be changed from one form to other.

EXPLANATION: Statement implies that the total amount of energy in an isolated system remains constant although it may change forms. viz, kinetic energy may change to potential;chemical to electrical energies etc.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then check we should if the laws are applicable or not.

So if there is no *external force* acting on the system all the three quantities, total momentum, total angular momentum, and total kinetic energy will be conserved independent of the nature of forces.

[9] The work done by non conservative force is dependent on the path taken by the particle in reaching final position from initial position. Non conservative force depends on the distance travelled by the particle

SetId=141

[10] A particle moves on a circular path. Then under suitable conditions its speed may remain constant, but the force, velocity and acceleration must always change with time.

[11] Distance is equal to the length of the path covered. Displacement is the shortest distance between initial and final points.

[12] Assume bullet train, moving with out any jerks, is going on a circular arc of radius R with constant speed. Then an experiment is to be performed entirely within the train without any measurement on objects outside the train. Such an experiment can tell only speed of the track.

[13] Let us consider that a pendulum is oscillating moving in a vertical plane. Mean while let another bob which is attached to a spring and is executing a simple harmonic motion in horizontal direction comes and hits the pendulum. Here conservation of momentum does not hold good as tension(external force) is acting on the system.(pendulum)

[14] The total work done on a particle is always equal to the change in kinetic energy. SetId=141

[15] Real forces have their origin in matter such as electricity, gravitation etc., while pseudo forces are caused by inertial motion.

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[1] If two bodies starting from a point A reach a point B, following different paths, their displacement will be, in general different, but the distances covered will always be the same.

[2] The law of conservation of angular momentum states that when no external torque acts on an object or a closed system of objects, no change of angular momentum can occur. Hence, the angular momentum before an event involving only internal torques or no torques is equal to the angular momentum after the event . Angular momentum can be calculated with the help of the formula $L = I\omega$ where L stands for Angular momentum, I stands for moment of inertia and ω stands for angular velocity

[3] Law of conservation of angular momentum holds in case of long jump. When a athlete takes off from the ground in a running long jump, the forces on the launching foot give the athlete an angular momentum with a forward rotation around a horizontal axis. Such rotation would not allow the jumper to land properly. In the landing, the legs should be together and extended forward at an angle so that the heels mark the sand at the greatest distance. Once airborne, the angular momentum cannot change (it is conserved) because no external torque acts to change it. However, the jumper can shift most of the angular momentum to the arms by rotating them in windmill fashion. Then the body remains upright in the proper orientation of landing.

[4] For the motion of earth around sun, the sum of angular momenta of the Sun and the Earth about the center of mass of the sun + earth system is conserved.

[5] The projection of angular momentum of a conical pendulum in the horizontal plane is a constant of motion when the origin is chosen to be at fixed at the point of suspension.

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[6] There is no case where LAW OF CONSERVATION OF ANGULAR MOMENTUM does'nt hold.But there are cases where conservation of angular momentum does not hold.A body in vertical circular motion is an example where angular momentum is not conserved. Here the law of conservation does not apply.

[7] Oscillating simple pendulum is a very good example where potential energy gets converted to kinetic energy and kinetic to potential energy. Some energy gets dissipated as heat if we consider air resistance. Energy as a whole is conserved if we consider universe as system, the energy has just changed its form.

[8] If we want to apply the conservation laws of momentum, energy and angular momentum, we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *external force* acting on the system, the momentum and angular momentum will be conserved, and depending on the nature of the forces but total energy may or may not be conserved.

[9] Nonconservative forces are those forces in which the work done in moving a particle is dependant on the path taken to cover the distance. Some energy woul be lost to the environment in the form of heat, sound, etc. The energy in the final state is less than that in the initial state.

SetId=142

[10] A particle moves on a circular path. Then under suitable conditions its speed and acceleration may remain constant, but the force, and velocity must always change with time.

[11] Distance is a scalar quantity where as the displacement is a vector quantity.

[12] A particle is observed from two frames S_1 and S_2. The frame S_2 moves with respect to S_1 with an acceleration a. If F_1 and F_2 be the pseudoforces when seen from S_1 and S_2 respectively it is not possible to have $F_1 = F_2 = 0$

[13] The law of conservation of momentum does not hold in relativistic situations, i.e., where the speeds of the masses involved are close to the speed of light.

[14] A particle is acted upon by a force of constant magnitude which is always perpendicular to the velocity of the particle and the motion of the particle takes place in a plane, Then its kinetic energy, speed, velocity acceleration will not change.

SetId=142

[15] 1)When we start rolling a body on a rough ground, it stops rolling after certain period because of frictional force.
2)When we leave a body from a certain height, it falls due to the act of gravitational force.

1)When a body is rotating in a circular path due to the centrifugal force which is the pseudo force. 2) When the lift is accelerating upwards, the upwards force felt by passengers a pseudo force.

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[1] Displacement is equal to the vector difference $\vec{r}_f - \vec{r}_i$ of the position vectors of initial and final points. The distance covered will be $|\vec{r}_f - \vec{r}_i|$

[2] Newton's Second Law of Motion is defined by the expression $F = \frac{dp}{dT}$, where F gives the force vector acting on the system and p gives its momentum vector; in linear motion. A similar expression can be written to describe angular motion, i.e. : $\tau = \frac{dL}{dt}$, where τ is the external torque vector acting on the system, and L is the angular momentum.

If the external torque on the system is zero, then we get the expression as: dL/dt=0. This points out to the fact that, when no external torque is acting on the system, then its angular momentum is constant, no matter what changes occur in the system. This is the Law of Conservation Of Angular Momentum.

[3] The total angular momentum of a body remains constant of motion when the net torque of the external forces acting on the body is zero.
In general, we have a system of particles such that the net torque of the external forces on the system, w.r.t. some axes K, is zero, the total angular momentum may not remain conserved, because the torque due to the internal forces may not be zero.

[4] For the motion of the Earth around the sun, the total of angular momenta of the Earth and the Sun, about in a reference frame fixed in the pole star, is conserved.

[5] The law of angular momentum of a is not applicable for the conical pendulum conserved w.r.t. the origin fixed at the point of suspension. SetId=143

[6] A sphere rolling on a rough surface.Due to friction there is external torque so the angular momentum changes which results in the slowing of the sphere. The angular momentum keeps changing. Even in case like this one, it is wrong to say that the Law of Angular Momentum Conservation does not hold.

[7] Law of conservation of momentum does not hold whenever an external force or impulse acts on the system. For example,when a body collides with earth then it bounces back to a lesser height as it loses some velocity.

In this example the momentum of a ball is not conserved due to impulsive force by ground in the normal direction.

However, strictly speaking the system that should be considered here is the ball-earth system and the total momentum is conserved.

[8] To apply the conservation laws of momentum, energy and angular momentum, we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *external force* acting on the system, the energy and momentum will be conserved. However, depending on the nature of the system and of the forces, the total angular momentum may not be conserved.

[9] The work done by such forces depends on the path taken. The work done cannot be represented as a potential energy function.Work done by such forces is always negative.

SetId=143

[10] When the force is kept constant as function of time, it is possible for a particle to move on a circular path in such a way that its speed remains constant, but the velocity and acceleration must always change with time.

[11] Both displacement and distance tell us about the motion of a body but their study does not tell much about the forces on the body

[12] A particle is observed from two frames S_1 and S_2. The frame S_2 moves with respect to S_1 with an acceleration a. If F_1 and F_2 be the pseudoforces when seen from S_1 and S_2 respectively and if $F_1 = 0$ then we must have $F_2 \neq 0$

[13] when we are in accelerating frame if we observe any collision between two bodies then the law of conservation of momentum does not hold in that frame of reference.

[14] The kinetic energy of a particle is continuously increasing with time, then the angle bewteen the net force and the velocity cannot be greater than or equal to 90^{o} at any time.

SetId=143

[15] Newton's first law defines inertial frame. An inertial frame is a frame in which the first law hold. It also makes it possible to compare and tell two force being equal or not. The second law defines the force.

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SetId=144

[1] Distance is equal to the length of the path covered. Displacement is the shortest distance between initial and final points.

[2] If the net external torque acting on a system is zero, the angular momentum L of the system remains constant, no matter what changes take place within the system.

$$\sum(T_{\text{ext}}) = \frac{dL}{dt}$$

The law states that when there is no net external torque, $\frac{dL}{dt}$ is zero implying that the total angular momentum of system is constant.

i.e. $L = a$ constant (isolated system)

[3] An example where law of conservation of angular momentum holds:
The Law of conservation of angular momentum holds in the case of a ballet dancer performing a pirouette.

When the dancer extends her arms outward, the angular velocity of her rotation decreases whereas when she keeps her arms close to her body, the angular velocity increases. This is because her moment of inertia changes as she moves her arms outward and inward. It can be noted that she as a system has no external torque acting upon her.

[4] For the motion of the Earth around the sun, the total of angular momenta of the Earth and the Sun, is conserved in every inertial frame of reference; but the angular momentum of the Earth (or of the sun)is not conserved in every inertial frame.

[5] The law of angular momentum of a is not applicable for the conical pendulum conserved when the origin is chosen to be at the pendulum bob itself. SetId=144

[6] Consider a rod of length l. Let us give an impulse to one end . Now the angular momentum about the oposite end is not zero since the impulse provides some torque . So the angular momentum is not conserved .

$$\text{torque} = \text{impulse} * \ell.$$

$d\ell/dt$ is not equal to zero and the law of conservation of angular momentum does not hold.

[7] If a bullet hits a wooden board and gets embedded in the board, the total energy and the total momentum of the bullet and the board are conserved.

[8] In order to apply the law of conservation of momentum we must first identify the system. If there is no *external forces* acting on the system then conservation laws of momentum always holds. And depending on the nature of the system and of the forces, the total kinetic energy and the total angular momentum may not be conserved.

[9] A nonconservative force is a force with the property that the work done in moving a particle depends on the path taken.Also, the net work done in a closed loop is non zero.

SetId=144

[10] It is not possible for a particle to move on a circular path in such a way that its speed and force remains constant, and only the velocity and acceleration may (or may not) always change with time.

[11] Displacement is the shortest distance between initial and final points with direction specified.

[12] If K is an inertial frame, any frame that moves w.r.t. the frame K with uniform velocity is also an inertial frame.

[13] Give an example where law of conservation of momentum does not hold all cases when seen from non inertial frame of references for example when we see two cars collide from a moving bus there momentum is not conserved

[14] A heavy body is attached from a spring and is held at point A and is such that the spring is not slack nor is it stretched. It is then released. It goes down upto a point B and then it rises upto point C and executes an oscillatory motion between B and C. During the motion from A to C is first positive (from A to B) and then it is negative from B to A and again remains negative from A to C.

SetId=144

[15] The magnitude of the pseudo force arising in a non-inertial frame is always equal to the mass of the body under consideration multiplied by the acceleration of the frame of reference and the direction of pseudoforce is always opposite to the direction of acceleration of the frame.

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SetId=145 [1] Distance is a scalar quantity where as the displacement is a vector quantity.

[2] When the net external torque acting on a body or a system of bodies is zero about a particular axis, then the angular momentum of each body is conserved about that axis.

[3] In case of a skater, who can be considered an isolated system, so no torue will be acting on him/her. When the arms are extended, the moment of inertia is more. When his hands are closely held, the moment of inertia is lesser. Since the angular momentum is same, the angular acceleration changes accordingly.

[4] In the Sun Earth system the angular momentum of the Earth is conserved in every frame of reference

[5] The three components of angular momentum of a conical pendulum is conserved w.r.t. the origin at the position of the center of mass of the pendulum. SetId=145

[6] Let us consider a rotating skew rod. In the absence of friction or any other drag force, the rod should continuously spin without stopping. Here the net torque about the axis of rotation is 0 and hence angular momentum is conserved. It therefore follows from law of conservation of angular momentum that a spinning skew rod will keep rotating with constant angular velocity if there is no external torque. So law of conservation of angular momentum does not hold.

[7] If a bullet hits a wooden board and gets embedded in the board, the total energy of the bullet and the board system is conserved but the total momentum is not conserved.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then check if the laws is applicable or not.

So if there is no *net external force* acting on the system all the three conservation laws will hold.

[9] A force whose work done is a path function is called a non-conservative force. All the forces which do not satisfy the definition of conservative forces are non-conservative in nature. The work done by these forces dissipates into heat energy, sound energy, light energy, etc. Therefore, law of conservation of mechanical energy cannot be applied to a system on which a non-conservative force is acting. No potential function
SetId=145 can be defined for these forces.

[10] For a particle moving on circle the acceleration is always constant in magnitude and directed towards the centre of the circle.

[11] Displacements, being vector quantity can not compared with, a scalar quantity such as distance.

[12] If K is an inertial frame, any frame that moves w.r.t. the frame K with uniform speed is also an inertial frame.

[13] When a tennis ball hits the ground at an oblique angle, the angle of reflection is equal to the angle of incidence. This is a simple consequence of conservation of horizontal component of momentum.

[14] The kinetic energy of a body does not change if any one of the following is true
(i)force is always perpendicular to the velocity
(ii) the force is always perpendicular to the acceleration
(iii) the object remains stationary
(iv) the object moves in such a way that the point of application of the force remains fixed. SetId=145

[15] A force is any interaction which tends to change the motion of an object. It is also *defined* as rate of change of momentum.It is a vector quantity.
A physically apparent but nonexistent force felt by an observer in a noninertial frame (that is, a frame undergoing acceleration).

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[1] The speed is rate of change of distance and the velocity is the rate of change of displacement.

[2] The law of conservation of angular momentum states that in absence of an external torque on an object or a closed system of objects the total angular momentum of the system remains constant. Thus if $\vec{\tau} = 0 => \vec{L} =$ constant where τ is the torque and $\vec{L}$ is the angular momentum of the system.

[3] Example where law of conservation of angular momentum holds:
Let us assume a student seated on a stool that can rotate freely about a vertical axis. The student has been set into rotation at a modest initial angular speed ω . He holds two dumbbells in his outstretched hands. His angular momentum vector L lies along the vertical rotation axis, pointing upwards. Now he pulls in his arms;this action reduces his rotational inertia from its value I_{initial} to a final value I_{final} because he moves the mass closer to the rotational axis. His rate of rotation increases markedly, from ω_{initial} to ω_{final}. The student can then slow down by extending his arms once more,moving the dumbbells outward. No external torque acts on the system consisting of the student, stool and the dumbbells. Thus the angular momentum of the system about the rotational axis remains constant. $I_{\text{initial}} * \omega_{\text{initial}} = I_{\text{final}} * \omega_{\text{final}}$.

[4] In the motion of earth around sun, the angular momentum of the earth about an axis passing through the sun and perpendicular to the plane of motion of earth is conserved.

[5] Only the z component of the angular momentum of a conical pendulum is conserved w.r.t. the origin fixed at the point of suspension. SetId=146

[6] In the example of skew rod the angular velocity does not change even though the torque applied is nonzero. However there is no contradiction as in this case the law of conservation of momentum is not applicable. conservation is violated.

[7] If a bullet hits a wooden board and gets embedded in the board, both total energy and the total momentum of the bullet and the board are not conserved.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then check we should if the laws are applicable or not.

So if there is no *external force* acting on the system all the three quantities, total momentum is conserved. The total angular momentum is also because the torque of internal forces will be zero. The conservation of energy depends on the nature of forces. will be conserved.

[9] *Non conservative forces* are the type of forces in which the work done by the forces is purely dependent on the path taken by the body.Thus the net work done by the forces in cyclic path is never equal to zero.

SetId=146

[10] The motion of a bomb dropped from a plane does is not a uniform motion as it follows a parabolic path and not a straight line path.

[11] Distance depends on the path where as the displacement depends on the end point only

[12] A frame rotating w.r.t K with uniform angular velocity is also an inertial frame.

[13] when a ball is dropped from a height, it gains momentum down if we consider the ball as our system.This is because the force of gravity acts as an external force.

However, if we change our system and consider earth as a part of our system too, then the momentum remains conserved because the earth gains momentum up.

[14] The total work done on a particle is always equal to the change in kinetic energy. SetId=146

[15] Psuedo Force is defined as an apparent force that acts in only non-inertial frames. Pseudo Forces are also called Fictitious Forces. It is an Imaginary force. It is independent of mass.

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[1] For any type of translational motion of a body, the displacement cannot be zero, where as the distance travelled can be zero.

[2] If no net external torque acts on a system, the total angular momentum of the system remains constant.

[3] A bob is attached to ceiling by a string and moves in a horizontal circular plane is an example. In this case the law of conservation of angular momentum does not hold.

[4] For the motion of earth around sun, the angular momentum of the earth about the center of mass of the sun + earth system and perpendicular to the plane of motion of earth is conserved.

[5] The z component of angular momentum of a conical pendulum is not conserved w.r.t. the origin fixed at the point of suspension; but the x and y components are conserved.

SetId=147

[6] Example where law of conservation of angular momentum does not hold:If a particle undergoes conical motion and the only force acting on particle is central force like tension of the string.Then total external torque about fixed point A is zero,yet angular momentum is not conserved,as angular momentum keeps on changing direction.

[7] There are certain situations where it appears that the law of conservation of linear momentum does not hold. For example if we take some amount of a substance like construction putty, cement, cake batter, playing dough,etc and drop it on the ground, it does not bounce back like a rubber ball would and hence the momentum it had before striking the ground seems to have been lost. Hence it appears that the law of conservation of linear momentum does not hold.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *net external force* acting on the system, the momentum is conserved. The definition of angular momentum and torque depends on the choice of axes, and therefore it may not be be conserved. The conservation of total energy holds only for conservative forces.

When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *net external force* acting on the system, the energy and momentum will be conserved. However, the total angular momentum may not be conserved because the torque may not be zero.

[9] Non-conservative forces are path-dependent forces, i.e. the work done on a body by these forces depends on the path taken by the body. Mechanical energy of a system is not conserved when a conservative force acts on it but the total energy is conserved. Therefore, the mechanical energy lost by the system is liberated in some other form such as light energy, heat energy, etc.

For example, when a body is moving along a surface, frictional force acts on the body as well. Due to this frictional force, the body loses its mechanical energy, and this loss is generally released in the form of heat energy to the surroundings. Thus, the mechanical energy will not be conserved and frictional force can be classified as a non-conservative force.

SetId=147

[10] A wagon sliding on a roller coaster designed in such a way that the wagon covers equal distances in equal times. As the motion of the wagon is uniform, there will be no net force acting on it.

[11] Distance equal to zero $\Rightarrow$ displacement=0; but Displacement=0

[12] The Newton's Laws of motion will hold in all frames which are at rest w.r.t. K but do not remain valid in a frame that move with respect to K.

[13] There is no known exception to the law of conservation of momentum in classical mechanics however when two bodies collide and their mass converts to energy, an exception in nuclear physics is observed. In real life this is observed in nuclear reactions at atomic level.

[14] A particle is acted upon by a force of constant magnitude which is always perpendicular to the velocity of the particle and the motion of the particle takes place in a plane, Then its kinetic energy, speed, velocity acceleration will not change. SetId=147

[15] Psuedo Force is defined as an apparent force that acts in only non-inertial frames. Pseudo Forces are also called Fictious Forces. It is an Imaginary force. It is always proportional to mass. It is sometimes dependent on speed.

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SetId=148

[1] Displacements, being vector quantity can not compared with, a scalar quantity such as distance.

[2] The law of conservation of angular momentum states that when no external torque is applied on an object or a closed system of objects about an axis, the angular momentum about that axis remains constant.

[3] Consider a disc rotating about an axis perpendicular to its plane. On placing a smaller disc with its surface parallel to the surface of the rotating disc, the angular momentum of the system of two discs remains constant as there is no external torque.

[4] In the Sun Earth system the angular momentum of the Earth about the pole star is conserved

[5] Only the z component of angular momentum of a conical pendulum is conserved w.r.t. the origin fixed at the point of suspension. SetId=148

[6] A nonzero torque always causes the angular velocity to change, because a change in angular momentum means a change in angular velocity $L = I\omega$

[7] A tennis ball is dropped from height h and after hitting the ground and it bounces back and rises to the same height. In this case the momentum of the ball is conserved because (under ideal conditions) the momentum after it hits the ground will be equal to the momentum it had before hitting the ground.

[8] In order to apply the law of conservation of momentum we must first identify the system. If there is no *net external forces* acting on the system then conservation laws of momentum always holds. The total energy and the total angular momentum may not be conserved.

[9] It is a force for which the work done by that force on an object or a particle in moving it between any two points depends on its path travelled.This force doesn't conserves the mechanical energy.The work done by a non-conservative force on an object in moving it in a circular path is not equal to zero.

SetId=148

[10] A simple pendulum moves along a circular arc and does not have constant speed and therefore its motion is not uniform.

[11] If P and Q are the initial and the final points of a path of a particle, displacement is a vector whose direction is along PQ and has magnitude is equal to the length of line PQ

[12] Staying inside a bullet train moving with constant velocity (no jerks etc) an experiment can always be performed which will tell us the numerical velocity of the bullet train

[13] When there is no external forces act on a system of many particles, and there are only internal forces acting on the particles. The third law gives that the internal forces are pairwise equal and opposite.Thus the sum of internal forces is zero and the momentum of each particle is conserved.

[14] The kinetic energy of a particle is continuously increasing with time, then the angle bewteen the net force and the velocity cannot be greater than or equal to 90^o at any time. SetId=148

[15] Since pseudo forces are not real forces, they do not affect the conservation laws and all the three conservation laws hold in noninertial frames.

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SetId=149

[1] Distance depends on the path where as the displacement depends on the end point only.

[2] The angular momentum of a given system of bodies shall remain conserved unless acted upon by an external unbalanced torque.

[3] Consider a man standing on a spinning platform. Initially, the man spreads out his arms and he spins with a certain angular velocity. The next moment, he pulls his arms inwards keeping them close to his body. We will observe that the angular velocity with which he is spinning now increases. This phenomenon can be explained by the Law Of Conservation of Angular momentum. Initially, since his arms were spread wide, his moment of inertia was large. However, when he pulled them close to his body, his moment of inertia decreased.
In this example the angular velocity of the man increases and therefore the angular momentum also increases.The law of conservation of angular momentum does not apply because the torque of muscular forces is not zero.

[4] For the motion of earth around sun, the angular momentum of the sun about the center of mass of the sun + earth system and perpendicular to the orbital plane of earth is conserved.

For the motion of earth around sun, the angular momentum of the sun about and axis passing through the Earth and perpendicular to the orbital plane of motion of earth is conserved.

[5] The projection of angular momentum of a conical pendulum in the horizontal plane is a constant of motion when the origin is chosen to be at fixed at the point of suspension. SetId=149

[6] A nonzero torque always implies change in angular momentum and may not give rise to a change in magnitude of angular velocity. A non zero torque may mean change only the direction of the angular momentum and not the angular velocity.

[7] Law of conservation of momentum does not hold when Newton's laws are not valid, e.g. in a non-inertial frame of reference. For example, when we consider collision between two bodies in a non-inertial frame of reference, the law of conservation of momentum cannot be applied because there will be a pseudo force acting on the frame itself.

[8] In order to apply the law of conservation of momentum we must first identify the system. Then even if there is no *net external forces* acting on the system, all the three conservation laws of momentum, angular momentum and energy may not hold due to presence of internal forces.

SetId=149

[9] Explain Nonconservative force: This force is just opposite to that of conservative force. The work done by this force depends on the path taken by the particle on which the force is applied.This force does not conserve mechanical energy.If a particle travels in a closed loop, the net work done by a non consevative force is non zero.

[10] A satellite goes around the earth in a circular orbit of 600km with a time period of $5.8 \times 10^3 s$. Its motion will be uniform as it will cover equal distances in equal times.

[11] If P and Q are the initial and the final points of a path of a particle,the displacement is the vector $\overrightarrow{PQ}$.

[12] Staying inside a bullet train moving with constant velocity (no jerks etc) an experiment can always be performed which will tell us the numerical value of the acceleration of the bullet train

[13] During collision of billiard balls momentum is conserved. During explosion of a bomb also momentum is conserved and the total momentum of the fragments of bomb will be zero. This is because all the forces are only internal forces.

[14] A heavy body is attached from a spring and is held at point A and is such that the spring is not slack nor is it stretched. It is then released. It goes down upto a point B and then it rises upto point C and executes an oscillatory motion between B and C. During the motion from A to C is first positive (from A to B) and then it is negative from B to A and again remains negative from A to C. SetId=149

[15] A force is any interaction which tends to change the motion of an object. Newtons' second tell us that it is *equal* to the rate of change of momentum.It is a vector quantity. Real forces can be distinguished from pseudo forces because the pseudo forces always proportional to the mass of the body. All real forces, except the gravitational force, do not depend on the mass of the body.

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SetId=150

[1] Distance equal to zero implies displacement=0; and Displacement=0 also implies distance = 0

[2] When the net external torque acting on a system about a given axis is zero, the total angular momentum of the system about that axis remains consant.

[3] In the Sun-Earth system, angular momentum of the earth is not conserved but the total angular momentum of the sun and the earth is constant of motion.

[4] For the motion of earth around sun, the sum of angular momenta of the Sun and the Earth about the center of mass of the sun + earth system is conserved.

[5] The law of angular momentum of a is not applicable for the conical pendulum conserved w.r.t. the origin fixed at the point of suspension. SetId=150

[6] In the example of a rotating skew rod the torque due to the external gravitational forces is zero , but the angular momentum is not constant Therefore the law of conservation of angular momentum is violated.

[7] If I throw a ball upward, it's speed decreases as it rises upwards. There is an external force (gravity) acting on the ball, so the momentum conservation law does not apply. Momentum of the ball is not conserved, however the momentum of the Earth-ball system is conserved as gravity will become an internal force in this case.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then check we should if the laws are applicable or not.

So if there is no *external force* acting on the system all the three quantities, total momentum, total angular momentum, and total kinetic energy will be conserved independent of the nature of forces.

[9] Non conservative force is the force in which the work done by a particle in going from one point to another is path dependent.

For non conservative forces mechanical energy is not conserved,mostly lost in the form of heat and light.The work done by a non conservative force is equal to the change in mechanical energy.

SetId=150

For non conservative force $E_{\text{initial}} > E_{\text{final}}$

[10] A uniform motion is defined to be the one in which a body covers equal distances in equal time intervals.

[11] If two bodies starting from a point A reach a point B, following different paths, their displacement will be, in general different, but the distances covered will always be the same.

[12] Assume bullet train, moving with out any jerks, is going on a circular arc of radius R with constant speed. Then an experiment is to be performed entirely within the train without any measurement on objects outside the train. Such an experiment can tell only radius of the track.

[13] Give an example where law of conservation of momentum holds: A mass exploding into several pieces in a conservative field like gravitational field(if air resistance is neglected), obeys law of conservation of momentum. If air resistance cannot be neglected then the law of conservation of momentum will not hold.

[14] The kinetic energy of a body does not change if any one of the following is true
(i)force is always perpendicular to the velocity
(ii) the force is always perpendicular to the acceleration
(iii) the object remains stationary
(iv) the object moves in such a way that the point of application of the force remains fixed. SetId=150

[15] Examples of pseudoforce are Coriolis Force, Centrifugal Force, and magnetic force on currents.
Psuedo force also called as fictitious force is an apparent force that are needed for masses whose their motion is described using a non inertial frame of reference.

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SetId=151

[1] If P and Q are the initial and the final points of a path of a particle, displacement is a vector whose direction is along PQ and has magnitude is equal to the length of line PQ

[2] This law sates that when no net torque of all forces acts on a object or a system of objects then total angular momentum of system is conserved.The angular momentum before an event is equal to angular momentum after that event.mathematically explained by when, net torque=0 ;then, total angular momentum(L)=constant.

[3] Consider a disc and a man system. man is standing on center of the disc rotating with angular velocity.initially man folded his hand.when man stretches his hands then momentum of inertia of system increases.and angular velocity decreases.and total angular momentum remains constant.

[4] For the motion of the Earth around the sun, the total of angular momenta of the Earth and the Sun, about in a reference frame fixed in the pole star, is conserved.

[5] The law of angular momentum of a is not applicable for the conical pendulum conserved when the origin is chosen to be at the pendulum bob itself. SetId=151

[6] In the example of skew rod, the angular momentum changes with time and there is a non zero torque coming from action of forces other than gravitational forces. Hence the law of conservation of angular momentum dos not apply.

[7] A soldier accelerating away, after detonating a bomb, will find that the total momentum of the fragments of the bomb is zero. This is an example where the law of conservation of momentum holds as the forces on the fragments are internal forces only and sum of all such forces is zero.

[8] If we want to apply the conservation laws of momentum, energy and angular momentum, we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *external force* acting on the system, the momentum and angular momentum will be conserved, and depending on the nature of the forces but total energy may or may not be conserved.

SetId=151

[9] A force is said to be non-conservative, if the work done by the force is dependent on the path taken. It could also be defined as a force for which the work done during a cyclic process is non-zero.

[10] A particle moves on a circular path. Then its speed, direction of force, velocity and acceleration must always change with time.

[11] Distance is equal to the length of the path covered. Displacement is the shortest distance between initial and final points.

[12] Assume bullet train, moving with out any jerks, is going on a circular arc of radius R with constant speed. Then an experiment is to be performed entirely within the train without any measurement on objects outside the train. Such an experiment can tell both speed of the train and radius of the track.

[13] Also a good example of law of conservation momentum can be seen when a bullet from a rifle is fired.As the bullet is fired and gets out of the rifle, the rifle gives a backward jerk due to the phenomenon of conservation of momentum.

[14] The total work done on a particle is always equal to the change in kinetic energy. SetId=151

[15] Examples of pseudo-force are Coriolis Force, Centrifugal Force, Centripetal force and magnetic force on currents. The pseudo forces do not obey Newton's third law and therefore the total momentum does not appear to be conserved in a non-inertial frame.

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SetId=152

[1] If P and Q are the initial and the final points of a path of a particle,the displacement is the vector $\overrightarrow{PQ}$.

[2] Statement of Law of Conservation of Angular Momentum:
Differentiating $\vec{L} = \vec{r} \times \vec{p}$ w.r.t, time,

$$\begin{aligned}\frac{dL}{dt} &= \frac{d\vec{r} \times \vec{p}}{dt} = \frac{d\vec{r}}{dt} \times \vec{p} + \vec{r} \times \frac{d\vec{p}}{dt} = \vec{v} \times (m\vec{v}) + \vec{r} \times \vec{F} \\ &= \vec{r} \times \vec{F}(\because v \times v = 0) \\ &= \vec{\tau}\end{aligned}$$

here $\vec{\tau}$ represents the net torque acting on a rigid body rotating about a fixed axis.This torque must take into account of all the forces, be it external or internal forces

[3] The conservation of angular momentum of a system of bodies requires that the the sum of torque due to <u>all forces</u> be equal to zero. Now consider a situation where the forces are such that the sum of torques of external forces is zero w.r.t. some axes K. Since the value of torque depends of the choices of axes, the sum of torques due to all <u>internal forces</u> will depend on the choice of axes and in general it will be non zero. Therefore, for a system of several bodies, for a given choice of axes K, there will be situations when the total angular momentum may not be conserved.

[4] For the motion of the Earth around the sun, the total of angular momenta of the Earth and the Sun, is conserved in every inertial frame of reference; but the angular momentum of the Earth (or of the sun)is not conserved in every inertial frame.

[5] The three components of angular momentum of a conical pendulum is conserved w.r.t. the origin at the position of the center of mass of the pendulum. SetId=152

[6] In the example of conical pendulum, the z- component of angular momentum does not change. This follows from the angular momentum conservation as there is no external torque.

[7] There is no known exception to the law of conservation of momentum in classical mechanics However, an exception to conservation of energy in nuclear physics is observed. In nuclear reactions when two nuclei collide and their mass converts to energy and energy momentum are not conserved.

[8] To apply the conservation laws of momentum, energy and angular momentum, we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *external force* acting on the system, the energy and momentum will be conserved. However, depending on the nature of the system and of the forces, the total angular momentum may not be conserved.

[9] a force is said to be non conservative if work done is dependent on the path of the particle.potential cannot be defined in the case of non conservative forces.work done in closed loop is not equal to zero.

SetId=152

[10] A particle moves on a circular path. Then its speed, direction offorce, can remain constant by velocity and acceleration must always change with time.

[11] Distance is a scalar quantity where as the displacement is a vector quantity.

[12] Assume bullet train, moving with out any jerks, is going on a circular arc of radius R with constant speed. Then an experiment is to be performed entirely within the train without any measurement on objects outside the train. Such an experiment can tell only speed of the track.

[13] when a man walks on the ice slab where friction does not exist between the ice block and the floor but between the feet of the man and the slab the slab moves back as per the law of conservation of momentum

[14] A particle is acted upon by a force of constant magnitude which is always perpendicular to the velocity of the particle and the motion of the particle takes place in a plane, Then its kinetic energy, speed, velocity acceleration will not change. SetId=152

[15] FORCE is any interaction which tends to change the motion of an object.It has both magnitude and direction,making it a vector quantity.

A psuedo force is an apparent force that acts on all masses whose motion is described with respect to a non-inertial frame of reference like a rotating frame of reference.This force is needed by an observer in an non-inertial frame to make all the Newtons Laws of motion hold true.

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[1] If two bodies starting from a point A reach a point B, following different paths, their displacement will be, in general different, but the distances covered will always be the same.

[2] Statement of Law of Conservation of Angular Momentum: For a system of many particles The net torque due all the forces, be it external or internal forces. But as the torque due to all the internal forces cancel out, it sufficient to consider the external forces acting on the system.

[3] Example where law of conservation of angular momentum does not hold:
When there is external force like frictional force acting on a object when it is rotating we cannot use conservation of angular momentum as the friction force acting on the object produces an external torque.

[4] In the Sun Earth system the angular momentum of the Earth is conserved in every frame of reference

[5] Only the z component of the angular momentum of a conical pendulum is conserved w.r.t. the origin fixed at the point of suspension. SetId=153

[6] In the example of conical pendulum, the x and$y$ components of angular momentum change. This follows from the angular momentum conservation as the z components external torque is zero and horizontal components of torque are non zero.

[7] In a system of a canon and a canon ball, total momentum of the system is zero before canon ball is fired. After firing the canon ball, the momentum of the system seems to be conserved as the ball moves forward and the canon moves backward.

[8] In order to apply the law of conservation of momentum we must first identify the system. If there is no *external forces* acting on the system then conservation laws of momentum always holds. And depending on the nature of the system and of the forces, the total kinetic energy and the total angular momentum may not be conserved.

[9] Explain Nonconservative Forces:

The forces that depend on the path taken by the particle are called non-conservative forces.

Mechanical energy is not conserved during the action of a non conservative force, instead, it is lost as other forms of enery like heat, light, etc.

Potential energy is not defined for a non-conservative force.

The initial and final kinetic energy in a closed loop is not equal.

The work done by a non conservative force in a closed loop is non zero. In practice, the net work is invariably negative.

Work done by a non conservative force cannot be completely recovered.

For a non conservative force,

$$/text(KE)//_f//+(\text{PE})//_f// = (\text{KE})_i+(\text{PE})_i//+//\text{Work Done})//\text{non-conservative force}//$$

SetId=153

[10] A particle moves on a circular path. Then under suitable conditions its speed may remain constant, but the force, velocity and acceleration must always change with time.

[11] Both displacement and distance tell us about the motion of a body but their study does not tell much about the forces on the body

[12] A particle is observed from two frames S_1 and S_2. The frame S_2 moves with respect to S_1 with an acceleration a. If F_1 and F_2 be the pseudoforces when seen from S_1 and S_2 respectively it is not possible to have $F_1 = F_2 = 0$

[13] When a freely falling rigid body collides another body in its path momentum the system of two particles is not conserved in the collision as there is external force mg acting on the system.

[14] The kinetic energy of a particle is continuously increasing with time, then the angle bewteen the net force and the velocity cannot be greater than or equal to 90° at any time. SetId=153

[15] FORCE is any interaction which tends to change the motion of an object.It has both magnitude and direction,making it a vector quantity. A pseudo-force F doesn't arise from any physical interaction between two objects, but rather from the acceleration 'a' of the non-inertial reference frame itself. These forces have no real existence but must be taken into account in an accelerating frame of reference to make all the three Newton's Laws of motion applicable to the system

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[1] Displacement is equal to the vector difference $\vec{r}_f - \vec{r}_i$ of the position vectors of initial and final points. The distance covered will be $|\vec{r}_f - \vec{r}_i|$

[2] Depending on the torques acting on a system, the angular momentum can be conserved only in one or two directions, but may not be conserved in all. For instance, if an isolated body has no torque acting on it only in the direction along the Z axis, then the angular momentum is conserved only in that direction.

[3] A bob attached to a ceiling by a string moving in a horizontal circular plane is an example where the total angular momentum of the bob about the point of suspension is not conserved. This is because the the torque due to the weight of the bob about the point of suspension does not vanish and has non zero horizontal component. Only the vertical component of the angular component is conserved.

[4] In the motion of earth around sun, the angular momentum of the earth about an axis passing through the sun and perpendicular to the plane of motion of earth is conserved.

[5] The z component of angular momentum of a conical pendulum is not conserved w.r.t. the origin fixed at the point of suspension; but the x and y components are conserved. SetId=154

[6] Example where law of conservation of angular momentum does not hold: A disc rotating on a horizontal rough surface will not have a constant angular momentum because there will be a constant torque by frictional force. Hence, its angular momentum will decrease, and the law of conservation of angular momentum does not apply.

[7] When applying the conservation laws of momentum, energy and angular momentum we must define the system first.Only then check if the laws is applicable or not.

As an example: when a ball is dropped from a height, it gains momentum down if we consider the ball as our system.This is because the force of gravity acts as an external force.

However, if we change our system and consider earth as a part of our system too, then the momentum remains conserved because the earth gains momentum up.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then check if the laws is applicable or not.

So if there is no *net external force* acting on the system all the three conservation laws will hold.

[9] A non conservative force is one where the mechanical energy is not conserved.Here the work done is dependent on the path taken .Different amounts of work need to be done in different paths.Here potential energy would have no meaning as it would keep changing with the path.Here some amount of mechanical energy is lost as sound energy or heat energy and hence is not conserved.

SetId=154

[10] A particle moves on a circular path. Then under suitable conditions its speed and acceleration may remain constant, but the force, and velocity must always change with time.

[11] Displacement is the shortest distance between initial and final points with direction specified.

[12] A particle is observed from two frames S_1 and S_2. The frame S_2 moves with respect to S_1 with an acceleration a. If F_1 and F_2 be the pseudoforces when seen from S_1 and S_2 respectively and if $F_1 = 0$ then we must have $F_2 \neq 0$

[13] If we take some amount of a substance like construction putty, cement, cake batter, playing dough,etc and drop it on the ground, it does not bounce back, like a rubber ball would bounce, and hence the momentum it had before striking the ground seems to have been lost. Hence it appears that the law of conservation of linear momentum does not hold.

[14] A heavy body is attached from a spring and is held at point A and is such that the spring is not slack nor is it stretched. It is then released. It goes down upto a point B and then it rises upto point C and executes an oscillatory motion between B and C. During the motion from A to C is first positive (from A to B) and then it is negative from B to A and again remains negative from A to C. SetId=154

[15] FORCE is any interaction which tends to change the motion of an object.It has both magnitude and direction,making it a vector quantity.
A pseudo-force results from acceleration of the frame of reference in which the objects reside. It is taken into account so that Newton's second law isn't invalidated. The pseudo force acting on an object can always be mathematically expressed as the product of the mass of the object and the acceleration of the frame of reference.

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[1] Distance is equal to the length of the path covered. Displacement is the shortest distance between initial and final points.

[2] According to Law of Conservation of Angular momentum,if no external torque acts on an object or system of objects,angular momentum of an object or system of objects remains CONSTANT or no change in angular momentum can occur.

Also it states that,only external torque can change angular momentm of the system where as the torque produced by internal forces can not change the angular momentum of the system

[3] Law of conservation of angular momentum holds in case of long jump. When a athlete takes off from the ground in a running long jump, the forces on the launching foot give the athlete an angular momentum with a forward rotation around a horizontal axis. Such rotation would not allow the jumper to land properly. In the landing, the legs should be together and extended forward at an angle so that the heels mark the sand at the greatest distance. Once airborne, the angular momentum cannot change (it is conserved) because no external torque acts to change it. However, the jumper can shift most of the angular momentum to the arms by rotating them in windmill fashion. Then the body remains upright in the proper orientation of landing.

[4] For the motion of earth around sun, the angular momentum of the earth about the center of mass of the sun + earth system and perpendicular to the plane of motion of earth is conserved.

[5] Only the z component of angular momentum of a conical pendulum is conserved w.r.t. the origin fixed at the point of suspension. SetId=155

[6] Example where law of conservation of angular momentum does not hold:Consider a vertical stick on the ground falling to a horizontal position. During the fall, the conservation of angular momentum applied at the point of rotation on the ground and perpendicular to the plane of the stick is not applicable as, the gravitational force which acts vertically downwards assumed at the centre of mass produces an external torque about the axis of rotation

[7] Statement: Law of Conservation of energy states that "ENERGY CAN NEITHER BE CREATED NOR DESTROYED",but it can be changed from one form to other.

EXPLANATION: Statement implies that the total amount of energy in an isolated system remains constant although it may change forms. viz, kinetic energy may change to potential;chemical to electrical energies etc.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then check we should if the laws are applicable or not.

So if there is no *external force* acting on the system all the three quantities, total momentum is conserved. The total angular momentum is also because the torque of internal forces will be zero. The conservation of energy depends on the nature of forces. will be conserved.

[9] The force whose work depends on path taken is called a non conservative force.friction for example does less work on a book dragged across a table if the book is dragged straight across than if the book is dragged in a curved path.

SetId=155

[10] When the force is kept constant as function of time, it is possible for a particle to move on a circular path in such a way that its speed remains constant, but the velocity and acceleration must always change with time.

[11] Displacements, being vector quantity can not compared with, a scalar quantity such as distance.

[12] If K is an inertial frame, any frame that moves w.r.t. the frame K with uniform velocity is also an inertial frame.

[13] When we consider collision between two bodies in a non-inertial frame of reference, the law of conservation of momentum cannot be applied because there will be a pseudo force acting on the frame itself.

[14] The kinetic energy of a body does not change if any one of the following is true
(i)force is always perpendicular to the velocity
(ii) the force is always perpendicular to the acceleration
(iii) the object remains stationary
(iv) the object moves in such a way that the point of application of the force remains fixed.

SetId=155

[15] Explain Force:FORCE is any interaction which tends to change the motion of an object.It has both magnitude and direction,making it a vector quantity.
In the case of a non inertial frame, we can use the second law of motion by adding a pseudo force to the system which makes it an inertial frame of reference.

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[1] Distance is a scalar quantity where as the displacement is a vector quantity.

[2] The law of conservation of angular momentum states that when the net external torque acting on the system is zero, then the angular momentum of the system remains constant.both the initial and final momentum should be taken from a fixed inertial frame of reference provided.

[3] The total angular momentum of a body remains constant of motion when the net torque of the external forces acting on the body is zero.
In general, we have a system of particles such that the net torque of the external forces on the system, w.r.t. some axes K, is zero, the total angular momentum may not remain conserved, because the torque due to the internal forces may not be zero.

[4] In the Sun Earth system the angular momentum of the Earth about the pole star is conserved

[5] The projection of angular momentum of a conical pendulum in the horizontal plane is a constant of motion when the origin is chosen to be at fixed at the point of suspension.

SetId=156

[6] We have a conical pendulum .The forces acting on the bob are tension (along the direction of the string) and gravitational force acting in the vertically downward direction.we have an additional force called the drag force which is tangential to the motion of the bob and acts in the direction opposite to the motion of the bob.The axis of rotation passes through the hinge point and is vertical.The torque due to tension is 0 because the force passes through the axis of rotation.The torque due to mg is also zero since it is parallel to the axis of rotation.but the torque due to drag force is not zero.since the net external torque acting on the bob is not zero,therefore the law of conservation of angular momentum does not hold here

[7] Oscillating simple pendulum is a very good example where potential energy gets converted to kinetic energy and kinetic to potential energy. Some energy gets dissipated as heat if we consider air resistance. Energy as a whole is conserved if we consider universe as system, the energy has just changed its form.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *net external force* acting on the system, the momentum is conserved. The definition of angular momentum and torque depends on the choice of axes, and therefore it may not be be conserved. The conservation of total energy holds only for conservative forces.

When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *net external force* acting on the system, the energy and momentum will be conserved. However, the total angular momentum may not be conserved because the torque may not be zero.

[9] ** Nonconservative force is a force in which the amount of work done by the force is dependent of the path taken to change a state of a system. SetId=156

[10] It is not possible for a particle to move on a circular path in such a way that its speed and force remains constant, and only the velocity and acceleration may (or may not) always change with time.

[11] Distance depends on the path where as the displacement depends on the end point only

[12] If K is an inertial frame, any frame that moves w.r.t. the frame K with uniform speed is also an inertial frame.

[13] When a system is acted upon by external forces like friction etc, the conservation principle does not hold good,there will be impulse imparted and so we cant conserve momentum. This is case when a collision between two elastic balls take place on a rough horizontal table. The total momentum just after the collision will be different from the total momentum just before the collision. Here momentum is not conserved as there is external force friction is present.

[14] The total work done on a particle is always equal to the change in kinetic energy. SetId=156

[15] For the Newton's Law of Motion to hold true,the physically apparent but nonexistent force needed by an observer in a non-inertial frame is called the pseudo force.
1) Caused by relative acceleration of the origin in a straight line
2) Centrifugal and Centripetal forces
3) Coriolis force
4) Euler force

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[1] The speed is rate of change of distance and the velocity is the rate of change of displacement.

[2] The law of conservation of angular momentum states that The total angular momentum of a system is constant in both magnitude and direction if the resultant torque, of the external forces acting on the system, is zero.

[3] An example where law of conservation of angular momentum holds:
The Law of conservation of angular momentum holds in the case of a ballet dancer performing a pirouette.

When the dancer extends her arms outward, the angular velocity of her rotation decreases whereas when she keeps her arms close to her body, the angular velocity increases. This is because her moment of inertia changes as she moves her arms outward and inward. It can be noted that she as a system has no external torque acting upon her.

[4] For the motion of earth around sun, the angular momentum of the sun about the center of mass of the sun + earth system and perpendicular to the orbital plane of earth is conserved.

For the motion of earth around sun, the angular momentum of the sun about and axis passing through the Earth and perpendicular to the orbital plane of motion of earth is conserved.

[5] The law of angular momentum of a is not applicable for the conical pendulum conserved w.r.t. the origin fixed at the point of suspension. SetId=157

[6] When you release a toy gyroscope on its pedestal, it initially has no precessional rotation around that pedestal, i.e, the orientation of rotation is fixed. However, it instantaneously starts precessing around the pedestal. Both Kinetic Energy and Angular Momentum now exist where they did not exist a moment earlier. The Kinetic Energy is easy to explain, as appearing due to the body of the gyroscope dropping a tiny fraction of a millimeter in the Earth's gravitational field, giving up exactly the correct amount of Potential Energy. But the Angular Momentum of the Precession which just appeared, does not come from anywhere. This is therefore a Violation of the Conservation of Angular Momentum.

[7] Law of conservation of momentum does not hold whenever an external force or impulse acts on the system. For example,when a body collides with earth then it bounces back to a lesser height as it loses some velocity.

In this example the momentum of a ball is not conserved due to impulsive force by ground in the normal direction.

However, strictly speaking the system that should be considered here is the ball-earth system and the total momentum is conserved.

[8] In order to apply the law of conservation of momentum we must first identify the system. If there is no *net external forces* acting on the system then conservation laws of momentum always holds. The total energy and the total angular momentum may not be conserved.

[9] Nonconservative force is any force where the work done by the force on the object depends on the path of motion of the object.the work done by the frictional force results in to loss of the energy of the system in the form of heat or other form of energy.

SetId=157

[10] For a particle moving on circle the acceleration is always constant in magnitude and directed towards the centre of the circle.

[11] Distance equal to zero $\Rightarrow$ displacement=0; but Displacement=0

[12] A frame rotating w.r.t K with uniform angular velocity is also an inertial frame.

[13] When we are in accelerating frame if we observe any collision between two bodies then the law of conservation of momentum does not hold in that frame of reference. On the other hand the law of conservation of momentum holds in all inertial frames.

[14] A particle is acted upon by a force of constant magnitude which is always perpendicular to the velocity of the particle and the motion of the particle takes place in a plane, Then its kinetic energy, speed, velocity acceleration will not change. SetId=157

[15] A force is any interaction which tends to change the motion of an object. It is also *defined* as rate of change of momentum.It is a vector quantity.

Pseudo-force is a fictitious force it is taken by an observer from non inertial frame of reference. This force arises from acceleration of reference frame that is a reference frame which is accelerating or rotating.

The equation of motion is then written by balancing all forces. As an example a particle moving in a circle is seen to be at rest by balancing the centripetal and centrifugal forces.

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[1] For any type of translational motion of a body, the displacement cannot be zero, where as the distance travelled can be zero.

[2] If the net external torque acting on a system is zero,the angular momentum L(vector) of the system remains constant,no matter what changes take place within the system.L(vector)=a constant (net external torque acting on system is zero)

[3] In case of a skater, who can be considered an isolated system, so no torue will be acting on him/her. When the arms are extended, the moment of inertia is more. When his hands are closely held, the moment of inertia is lesser. Since the angular momentum is same, the angular acceleration changes accordingly.

[4] For the motion of earth around sun, the sum of angular momenta of the Sun and the Earth about the center of mass of the sun + earth system is conserved.

[5] The law of angular momentum of a is not applicable for the conical pendulum conserved when the origin is chosen to be at the pendulum bob itself. SetId=158

[6] There is no case where LAW OF CONSERVATION OF ANGULAR MOMENTUM does'nt hold.But there are cases where conservation of angular momentum does not hold.A body in vertical circular motion is an example where angular momentum is not conserved. Here the law of conservation does not apply.

[7] If a bullet hits a wooden board and gets embedded in the board, the total energy and the total momentum of the bullet and the board are conserved.

[8] In order to apply the law of conservation of momentum we must first identify the system. Then even if there is no *net external forces* acting on the system, all the three conservation laws of momentum, angular momentum and energy may not hold due to presence of internal forces.

[9] nonconservative force is any force ,where the work done by the force depends on the path of motion of the body.The work done by such a force is equal to the change in mechanical energy of the system.Energy mostly observed to be lost in form of heat, by the action of non conservative force.

SetId=158

[10] The motion of a bomb dropped from a plane does is not a uniform motion as it follows a parabolic path and not a straight line path.

[11] If P and Q are the initial and the final points of a path of a particle, displacement is a vector whose direction is along PQ and has magnitude is equal to the length of line PQ

[12] The Newton's Laws of motion will hold in all frames which are at rest w.r.t. K but do not remain valid in a frame that move with respect to K.

[13] When a freely falling body hits another rigid body in its path then momentum is not conserved as external force mg acts on both the bodies. The total momentum after the collision will be different from the total momentum before the hit.

[14] The kinetic energy of a particle is continuously increasing with time, then the angle bewteen the net force and the velocity cannot be greater than or equal to 90^o at any time. SetId=158

[15] A psuedo force is an apparent force that acts on all masses whose motion is described with respect to a non-inertial frame of reference like a rotating frame of reference. This force is needed by an observer in an non-inertial frame to make all the Newtons second laws to write correct equation of motion..

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[1] Displacements, being vector quantity can not compared with, a scalar quantity such as distance.

[2] The Law of conservation of angular momentum states that when no external torque acts on an object or a closed system of objects undergoing motion about a given axis, the change in angular momentum is zero. Therefore, considering an event where only internal torque or no torque is involved, the total angular momentum of the system before the event is equal to the total angular momentum after the event

[3] Example where law of conservation of angular momentum holds:
Let us assume a student seated on a stool that can rotate freely about a vertical axis. The student has been set into rotation at a modest initial angular speed ω . He holds two dumbbells in his outstretched hands. His angular momentum vector L lies along the vertical rotation axis, pointing upwards. Now he pulls in his arms;this action reduces his rotational inertia from its value I_{initial} to a final value I_{final} because he moves the mass closer to the rotational axis. His rate of rotation increases markedly, from ω_{initial} to ω_{final}. The student can then slow down by extending his arms once more,moving the dumbbells outward. No external torque acts on the system consisting of the student, stool and the dumbbells. Thus the angular momentum of the system about the rotational axis remains constant. $I_{\text{initial}} * \omega_{\text{initial}} = I_{\text{final}} * \omega_{\text{final}}$.

[4] For the motion of the Earth around the sun, the total of angular momenta of the Earth and the Sun, about in a reference frame fixed in the pole star, is conserved.

[5] The three components of angular momentum of a conical pendulum is conserved w.r.t. the origin at the position of the center of mass of the pendulum. SetId=159

[6] A sphere rolling on a rough surface.Due to friction there is external torque so the angular momentum changes which results in the slowing of the sphere. The angular momentum keeps changing. Even in case like this one, it is wrong to say that the Law of Angular Momentum Conservation does not hold.

[7] If a bullet hits a wooden board and gets embedded in the board, the total energy of the bullet and the board system is conserved but the total momentum is not conserved.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then check we should if the laws are applicable or not.

So if there is no *external force* acting on the system all the three quantities, total momentum, total angular momentum, and total kinetic energy will be conserved independent of the nature of forces.

[9] The work done by a "non-conservative" force does depend on the path taken. Non-conservative forces cannot be associated with a potential energy. If some of the internal forces of a system are non-conservative, the mechanical energy of the system is not constant.Work-energy theorem is valid even in the presence of some non-conservative forces.

SetId=159

[10] A wagon sliding on a roller coaster designed in such a way that the wagon covers equal distances in equal times. As the motion of the wagon is uniform, there will be no net force acting on it.

[11] If P and Q are the initial and the final points of a path of a particle,the displacement is the vector $\overrightarrow{PQ}$.

[12] Staying inside a bullet train moving with constant velocity (no jerks etc) an experiment can always be performed which will tell us the numerical velocity of the bullet train

[13] .The law of conservation of momentum does not hold good when net external forces acting on the system is not zero.when two bodies collide law of conservation of momentum is applicable on system of two bodies but on not individual bodies because external impulse acts on them.

[14] A heavy body is attached from a spring and is held at point A and is such that the spring is not slack nor is it stretched. It is then released. It goes down upto a point B and then it rises upto point C and executes an oscillatory motion between B and C. During the motion from A to C is first positive (from A to B) and then it is negative from B to A and again remains negative from A to C.

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[15] One indication that pseudo forces are NON-NEWTONIAN is that they violate Newton's III law and violate the Newton's third law.

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[1] Distance depends on the path where as the displacement depends on the end point only.

[2] The law of conservation of angular momentum states that when no external torque acts on an object or a closed system of objects, no change of angular momentum can occur. Hence, the angular momentum before an event involving only internal torques or no torques is equal to the angular momentum after the event . Angular momentum can be calculated with the help of the formula $L = I\omega$ where L stands for Angular momentum, I stands for moment of inertia and ω stands for angular velocity

[3] A bob is attached to ceiling by a string and moves in a horizontal circular plane is an example. In this case the law of conservation of angular momentum does not hold.

[4] For the motion of the Earth around the sun, the total of angular momenta of the Earth and the Sun, is conserved in every inertial frame of reference; but the angular momentum of the Earth (or of the sun)is not conserved in every inertial frame.

[5] Only the z component of the angular momentum of a conical pendulum is conserved w.r.t. the origin fixed at the point of suspension. SetId=160

[6] Consider a rod of length l. Let us give an impulse to one end . Now the angular momentum about the oposite end is not zero since the impulse provides some torque . So the angular momentum is not conserved .

$$\text{torque} = \text{impulse} * \ell.$$

$d\ell/dt$ is not equal to zero and the law of conservation of angular momentum does not hold.

[7] If a bullet hits a wooden board and gets embedded in the board, both total energy and the total momentum of the bullet and the board are not conserved.

[8] If we want to apply the conservation laws of momentum, energy and angular momentum, we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *external force* acting on the system, the momentum and angular momentum will be conserved, and depending on the nature of the forces but total energy may or may not be conserved.

[9] Non conservative forces are forces with the property that the work done by the force in moving a particle between two points is dependent on the path taken.Also the work done over a closed loop is not zero.Defining of scalar potential is not possible in case of non conservative forces because the change in potential energy between
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two points will depend on path taken.

[10] A simple pendulum moves along a circular arc and does not have constant speed and therefore its motion is not uniform.

[11] If two bodies starting from a point A reach a point B, following different paths, their displacement will be, in general different, but the distances covered will always be the same.

[12] Staying inside a bullet train moving with constant velocity (no jerks etc) an experiment can always be performed which will tell us the numerical value of the acceleration of the bullet train

[13] A block moving in the air breaks up into two parts and the parts separate, then the total momentum must be the same before and after the break.

[14] The kinetic energy of a body does not change if any one of the following is true
(i)force is always perpendicular to the velocity
(ii) the force is always perpendicular to the acceleration
(iii) the object remains stationary
(iv) the object moves in such a way that the point of application of the force remains fixed. SetId=160

[15] The apparent force which seems to act on an object in an accelerating frame of reference if we wish to describe the object's motion is called a pseudo force.Its a non-existent force used only to describe the motion completely using Newton's second law even though the agent causing the force is undefined.

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[1] Distance equal to zero implies displacement=0; and Displacement=0 also implies distance = 0

[2] Newton's Second Law of Motion is defined by the expression $F = \frac{dp}{dT}$, where F gives the force vector acting on the system and p gives its momentum vector; in linear motion. A similar expression can be written to describe angular motion, i.e. : $\tau = \frac{dL}{dt}$, where τ is the external torque vector acting on the system, and L is the angular momentum.

If the external torque on the system is zero, then we get the expression as: dL/dt=0. This points out to the fact that, when no external torque is acting on the system, then its angular momentum is constant, no matter what changes occur in the system. This is the Law of Conservation Of Angular Momentum.

[3] Consider a disc rotating about an axis perpendicular to its plane. On placing a smaller disc with its surface parallel to the surface of the rotating disc, the angular momentum of the system of two discs remains constant as there is no external torque.

[4] In the Sun Earth system the angular momentum of the Earth is conserved in every frame of reference

[5] The z component of angular momentum of a conical pendulum is not conserved w.r.t. the origin fixed at the point of suspension; but the x and y components are conserved.

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[6] Let us consider a rotating skew rod. In the absence of friction or any other drag force, the rod should continuously spin without stopping. Here the net torque about the axis of rotation is 0 and hence angular momentum is conserved. It therefore follows from law of conservation of angular momentum that a spinning skew rod will keep rotating with constant angular velocity if there is no external torque. So law of conservation of angular momentum does not hold.

[7] There are certain situations where it appears that the law of conservation of linear momentum does not hold. For example if we take some amount of a substance like construction putty, cement, cake batter, playing dough,etc and drop it on the ground, it does not bounce back like a rubber ball would and hence the momentum it had before striking the ground seems to have been lost. Hence it appears that the law of conservation of linear momentum does not hold.

[8] To apply the conservation laws of momentum, energy and angular momentum, we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *external force* acting on the system, the energy and momentum will be conserved. However, depending on the nature of the system and of the forces, the total angular momentum may not be conserved.

[9] A non conservative force is the force with the property that the work done in moving a particle between two points is dependent of the path taken.If a particle travels in a closed path, the net work done(the some of the forces acting along the path multiplied by the distance travelled) by a non conservative force is non zero. When an object moves from one location to another, the force changes the potential energy of the object by an amount that depends on the path taken.Non conservative force depends only on the path followed by the object.

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[10] A satellite goes around the earth in a circular orbit of 600km with a time period of $5.8 \times 10^3 s$. Its motion will be uniform as it will cover equal distances in equal times.

[11] Distance is equal to the length of the path covered. Displacement is the shortest distance between initial and final points.

[12] Assume bullet train, moving with out any jerks, is going on a circular arc of radius R with constant speed. Then an experiment is to be performed entirely within the train without any measurement on objects outside the train. Such an experiment can tell only radius of the track.

[13] A ball hits the floor and rebounds after an inelastic collision. In this case the total momentum of the ball before and after the collsion is conserved. Also the total enrgy of the ball and the earth remains the same

[14] The total work done on a particle is always equal to the change in kinetic energy. SetId=161

[15] The physically apparent, but nonexistent, force needed by an observer in a noninertial frame to make Newton's laws of motion hold true is called pseudoforce.

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[1] If P and Q are the initial and the final points of a path of a particle, displacement is a vector whose direction is along PQ and has magnitude is equal to the length of line PQ

[2] If the net external torque acting on a system is zero, the angular momentum L of the system remains constant, no matter what changes take place within the system.

$$\sum(T_{\text{ext}}) = \frac{dL}{dt}$$

The law states that when there is no net external torque, $\frac{dL}{dt}$ is zero implying that the total angular momentum of system is constant.

i.e. $L = a$ constant (isolated system)

[3] Consider a man standing on a spinning platform. Initially, the man spreads out his arms and he spins with a certain angular velocity. The next moment, he pulls his arms inwards keeping them close to his body. We will observe that the angular velocity with which he is spinning now increases. This phenomenon can be explained by the Law Of Conservation of Angular momentum. Initially, since his arms were spread wide, his moment of inertia was large. However, when he pulled them close to his body, his moment of inertia decreased.
In this example the angular velocity of the man increases and therefore the angular momentum also increases.The law of conservation of angular momentum does not apply because the torque of muscular forces is not zero.

[4] In the motion of earth around sun, the angular momentum of the earth about an axis passing through the sun and perpendicular to the plane of motion of earth is conserved.

[5] Only the z component of angular momentum of a conical pendulum is conserved w.r.t. the origin fixed at the point of suspension. SetId=162

[6] In the example of skew rod the angular velocity does not change even though the torque applied is nonzero. However there is no contradiction as in this case the law of conservation of momentum is not applicable. conservation is violated.

[7] A tennis ball is dropped from height h and after hitting the ground and it bounces back and rises to the same height. In this case the momentum of the ball is conserved because (under ideal conditions) the momentum after it hits the ground will be equal to the momentum it had before hitting the ground.

[8] In order to apply the law of conservation of momentum we must first identify the system. If there is no *external forces* acting on the system then conservation laws

of momentum always holds. And depending on the nature of the system and of the forces, the total kinetic energy and the total angular momentum may not be conserved.

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[9] In this type of force the work done depends on the path taken by the body.Mechanical energy is not conserved in the system if non conservative force acts on it.

[10] A uniform motion is defined to be the one in which a body covers equal distances in equal time intervals.

[11] Distance is a scalar quantity where as the displacement is a vector quantity.

[12] Assume bullet train, moving with out any jerks, is going on a circular arc of radius R with constant speed. Then an experiment is to be performed entirely within the train without any measurement on objects outside the train. Such an experiment can tell both speed of the train and radius of the track.

[13] In a head on elastic collision of two identical bodies of equal masses the velocities, the speeds, the momenta and the kinetic energy are all exchanged.

[14] A particle is acted upon by a force of constant magnitude which is always perpendicular to the velocity of the particle and the motion of the particle takes place in a plane, Then its kinetic energy, speed, velocity acceleration will not change. SetId=162

[15] Pseudo forces come into picture when Newton's laws of motion have to be applied to describe the motion of bodies in non-inertial frames. These forces have no real existence.

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[1] If P and Q are the initial and the final points of a path of a particle,the displacement is the vector $\overrightarrow{PQ}$.

[2] When the net external torque acting on a body or a system of bodies is zero about a particular axis, then the angular momentum of each body is conserved about that axis.

[3] In the Sun-Earth system, angular momentum of the earth is not conserved but the total angular momentum of the sun and the earth is constant of motion.

[4] For the motion of earth around sun, the angular momentum of the earth about the center of mass of the sun + earth system and perpendicular to the plane of motion of earth is conserved.

[5] The projection of angular momentum of a conical pendulum in the horizontal plane is a constant of motion when the origin is chosen to be at fixed at the point of suspension. SetId=163

[6] Example where law of conservation of angular momentum does not hold:If a particle undergoes conical motion and the only force acting on particle is central force like tension of the string.Then total external torque about fixed point A is zero,yet angular momentum is not conserved,as angular momentum keeps on changing direction.

[7] Law of conservation of momentum does not hold when Newton's laws are not valid, e.g. in a non-inertial frame of reference. For example, when we consider collision between two bodies in a non-inertial frame of reference, the law of conservation of momentum cannot be applied because there will be a pseudo force acting on the frame itself.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then check if the laws is applicable or not.

So if there is no *net external force* acting on the system all the three conservation laws will hold.

[9] A force is said to be a non-conservative force if the work done by the force in a closed path is non-zero;(i.e) the cyclic integral of the work done is non-zero.

Work done by a non-conservative force is equal to change in total energy of the system.Work-Energy theorem is not applicable in the case of a non-conservative force.Work done by conservative force depends on the path.It differs with the paths taken by the partical even if the initial and final points are same.In case of non-conservative forces,the total mechanical energy is not constant as the energy is dissipated in various forms such as heat energy,sound energy,etc and cannot be recovered.

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[10] A particle moves on a circular path. Then its speed, direction of force, velocity and acceleration must always change with time.

[11] Both displacement and distance tell us about the motion of a body but their study does not tell much about the forces on the body

[12] Assume bullet train, moving with out any jerks, is going on a circular arc of radius R with constant speed. Then an experiment is to be performed entirely within the train without any measurement on objects outside the train. Such an experiment can tell only speed of the track.

[13] For a system of several particles the conservation of total linear momentum is equivalent to the statement that their centre of mass moves like a free particle.

[14] The kinetic energy of a particle is continuously increasing with time, then the angle bewteen the net force and the velocity cannot be greater than or equal to 90^o at any time. SetId=163

[15] In a non-inertial frame of reference the accelration of the body that we measure, is not the true acceleration, as the frame itself accelerates.Thus,force(F=ma) is also not the true force acting on the body.The extra force added to make it a true value is called pseudo force.Thus pseudo force does not really act on a body but just compensates the change produced by the non inertial frame, in true acceleration.

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SetId=164

[1] If two bodies starting from a point A reach a point B, following different paths, their displacement will be, in general different, but the distances covered will always be the same.

[2] The law of conservation of angular momentum states that in absence of an external torque on an object or a closed system of objects the total angular momentum of the system remains constant. Thus if $\vec{\tau} = 0 => \vec{L} =$ constant where τ is the torque and $\vec{L}$ is the angular momentum of the system.

[3] Consider a disc and a man system. man is standing on center of the disc rotating with angular velocity.initially man folded his hand.when man stretches his hands then momentum of inertia of system increases.and angular velocity decreases.and total angular momentum remains constant.

[4] In the Sun Earth system the angular momentum of the Earth about the pole star is conserved

[5] The law of angular momentum of a is not applicable for the conical pendulum conserved w.r.t. the origin fixed at the point of suspension. SetId=164

[6] A nonzero torque always causes the angular velocity to change, because a change in angular momentum means a change in angular velocity $L = I\omega$

[7] If I throw a ball upward, it's speed decreases as it rises upwards. There is an external force (gravity) acting on the ball, so the momentum conservation law does not apply. Momentum of the ball is not conserved, however the momentum of the Earth-ball system is conserved as gravity will become an internal force in this case.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then check we should if the laws are applicable or not.

So if there is no *external force* acting on the system all the three quantities, total momentum is conserved. The total angular momentum is also because the torque of internal forces will be zero. The conservation of energy depends on the nature of forces. will be conserved.

[9] A non conservative force is a force where work done in moving a particle between two points depends on the path through which it is taken.Friction is an example of non conservative force.Mechanical energy is not conserved in case of a non conservative force SetId=164

[10] A particle moves on a circular path. Then its speed, direction offorce, can remain constant by velocity and acceleration must always change with time.

[11] Displacement is the shortest distance between initial and final points with direction specified.

[12] A particle is observed from two frames S_1 and S_2. The frame S_2 moves with respect to S_1 with an acceleration a. If F_1 and F_2 be the pseudoforces when seen from S_1 and S_2 respectively it is not possible to have $F_1 = F_2 = 0$

[13] The total mechanical energy of a system may not be conserved if there are no external forces and the internal forces are conservative.

[14] A heavy body is attached from a spring and is held at point A and is such that the spring is not slack nor is it stretched. It is then released. It goes down upto a point B and then it rises upto point C and executes an oscillatory motion between B and C. During the motion from A to C is first positive (from A to B) and then it is negative from B to A and again remains negative from A to C. SetId=164

[15] A force is any interaction which tends to change the motion of an object. It is *equal to* the rate of change of momentum by Newton's second law.

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SetId=165

[1] Displacement is equal to the vector difference $\vec{r}_f - \vec{r}_i$ of the position vectors of initial and final points. The distance covered will be $|\vec{r}_f - \vec{r}_i|$

[2] If no net external torque acts on a system, the total angular momentum of the system remains constant.

[3] The conservation of angular momentum of a system of bodies requires that the the sum of torque due to all forces be equal to zero. Now consider a situation where the forces are such that the sum of torques of external forces is zero w.r.t. some axes K. Since the value of torque depends of the choices of axes, the sum of torques due to all internal forces will depend on the choice of axes and in general it will be non zero. Therefore, for a system of several bodies, for a given choice of axes K, there will be situations when the total angular momentum may not be conserved.

[4] For the motion of earth around sun, the angular momentum of the sun about the center of mass of the sun + earth system and perpendicular to the orbital plane of earth is conserved.

For the motion of earth around sun, the angular momentum of the sun about and axis passing through the Earth and perpendicular to the orbital plane of motion of earth is conserved.

[5] The law of angular momentum of a is not applicable for the conical pendulum conserved when the origin is chosen to be at the pendulum bob itself. SetId=165

[6] A nonzero torque always implies change in angular momentum and may not give rise to a change in magnitude of angular velocity. A non zero torque may mean change only the direction of the angular momentum and not the angular velocity.

[7] A soldier accelerating away, after detonating a bomb, will find that the total momentum of the fragments of the bomb is zero. This is an example where the law of conservation of momentum holds as the forces on the fragments are internal forces only and sum of all such forces is zero.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *net external force* acting on the system, the momentum is conserved. The definition of angular momentum and torque depends on the choice of axes, and therefore it may not be be conserved. The conservation of total energy holds only for conservative forces.

When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *net external force* acting on the system, the energy and momentum will be conserved. However, the total angular momentum may not be conserved because the torque may not be zero.

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[9] A force:A force is said to be a *non-//**conservative force* if the*/ work done by it in a closed path is/*/ non-zero./For such forces,potential energy cannot be defined.

[10] A particle moves on a circular path. Then under suitable conditions its speed may remain constant, but the force, velocity and acceleration must always change with time.

[11] Displacements, being vector quantity can not compared with, a scalar quantity such as distance.

[12] A particle is observed from two frames S_1 and S_2. The frame S_2 moves with respect to S_1 with an acceleration a. If F_1 and F_2 be the pseudoforces when seen from S_1 and S_2 respectively and if $F_1 = 0$ then we must have $F_2 \neq 0$

[13] When a bullet fired on a wooden block, some energy is transferred to the block and the total mechanical energy of the block and the bullet is conserved.

[14] The kinetic energy of a body does not change if any one of the following is true
(i)force is always perpendicular to the velocity
(ii) the force is always perpendicular to the acceleration
(iii) the object remains stationary
(iv) the object moves in such a way that the point of application of the force remains fixed. SetId=165

[15] Newton's laws are not valid on non-inertial frame of reference. So to validate Newton's laws of motion pseudo force (fictious or virtual force) is introduced.
Pseudo force acts in non-inertial frame. Its magnitude is always mass of the body multiplied by acceleration of the frame. It is always in direction opposite to the acceleration of the frame of reference. The resultant of pseudo forces and real forces is always zero.

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SetId=166

[1] Distance is equal to the length of the path covered. Displacement is the shortest distance between initial and final points.

[2] The law of conservation of angular momentum states that when no external torque is applied on an object or a closed system of objects about an axis, the angular momentum about that axis remains constant.

[3] Example where law of conservation of angular momentum does not hold:
When there is external force like frictional force acting on a object when it is rotating we cannot use conservation of angular momentum as the friction force acting on the object produces an external torque.

[4] For the motion of earth around sun, the sum of angular momenta of the Sun and the Earth about the center of mass of the sun + earth system is conserved.

[5] The three components of angular momentum of a conical pendulum is conserved w.r.t. the origin at the position of the center of mass of the pendulum. SetId=166

[6] In the example of a rotating skew rod the torque due to the external gravitational forces is zero , but the angular momentum is not constant Therefore the law of conservation of angular momentum is violated.

[7] There is no known exception to the law of conservation of momentum in classical mechanics However, an exception to conservation of energy in nuclear physics is observed. In nuclear reactions when two nuclei collide and their mass converts to energy and energy momentum are not conserved.

[8] In order to apply the law of conservation of momentum we must first identify the system. If there is no *net external forces* acting on the system then conservation laws of momentum always holds. The total energy and the total angular momentum may not be conserved.

[9] A force that is not conservative is nonconservative force. The work done by a noconservative force cannot be represented by a potential energy function. That is work done by a nonconservative force is dependent on the path through which the system is moved. Some nonconservative forces cause the mechanical energy to be lost or dissipiated. Such forces are called dissipiative forces. There is no way to get back the lost mechanical energy. Nonconservative forces can also increase the mechanical energy. This is arrived from the concept of irreversible process.

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[10] A particle moves on a circular path. Then under suitable conditions its speed and acceleration may remain constant, but the force, and velocity must always change with time.

[11] Distance depends on the path where as the displacement depends on the end point only

[12] If K is an inertial frame, any frame that moves w.r.t. the frame K with uniform velocity is also an inertial frame.

[13] When a moving car hits a parked lorry and causes the parked lorry to move ,energy is transferred from moving the car to the lorry and the total energy of the lorry and the car is conserved.

[14] The total work done on a particle is always equal to the change in kinetic energy. SetId=166

[15] These forces are non-real forces but must be taken into account while applying Newton's Law's of Motion in accelerating frame of reference as compared to an inertial frame of reference.

The centrifugal and centripetal forces are examples of pesudo-forces.

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[1] Distance is a scalar quantity where as the displacement is a vector quantity.

[2] The angular momentum of a given system of bodies shall remain conserved unless acted upon by an external unbalanced torque.

[3] A bob attached to a ceiling by a string moving in a horizontal circular plane is an example where the total angular momentum of the bob about the point of suspension is not conserved. This is because the the torque due to the weight of the bob about the point of suspension does not vanish and has non zero horizontal component. Only the vertical component of the angular component is conserved.

[4] For the motion of the Earth around the sun, the total of angular momenta of the Earth and the Sun, about in a reference frame fixed in the pole star, is conserved.

[5] Only the z component of the angular momentum of a conical pendulum is conserved w.r.t. the origin fixed at the point of suspension. SetId=167

[6] In the example of skew rod, the angular momentum changes with time and there is a non zero torque coming from action of forces other than gravitational forces. Hence the law of conservation of angular momentum dos not apply.

[7] In a system of a canon and a canon ball, total momentum of the system is zero before canon ball is fired. After firing the canon ball, the momentum of the system seems to be conserved as the ball moves forward and the canon moves backward.

[8] In order to apply the law of conservation of momentum we must first identify the system. Then even if there is no *net external forces* acting on the system, all the three conservation laws of momentum, angular momentum and energy may not hold due to presence of internal forces.

[9] Nonconservative forces are forces, such that the work done by these forces are path dependent. Work done by these forces around a close path is not necessarily equal to zero. Hence if a particle is acted on by a non-conservative force and that particle returns to its original position, that particle will experience a net loss of energy. Energy will thus not be conserved for particle. Potential Energy can not be defined for these type of forces.

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[10] When the force is kept constant as function of time, it is possible for a particle to move on a circular path in such a way that its speed remains constant, but the velocity and acceleration must always change with time.

[11] Distance equal to zero $\Rightarrow$ displacement=0; but Displacement=0

[12] If K is an inertial frame, any frame that moves w.r.t. the frame K with uniform speed is also an inertial frame.

[13] When a bomb explodes the total mechanical energy is not conserved. But the total chemical energy and the mechanical energy is conserved.

[14] A particle is acted upon by a force of constant magnitude which is always perpendicular to the velocity of the particle and the motion of the particle takes place in a plane, Then its kinetic energy, speed, velocity acceleration will not change. SetId=167

[15] When observing our system from a reference frame which is accelerating compared to an inertial frame,in order to make it easier to apply newtons laws, we can apply a pseudo force on all objects in the universe proportional to their mass capable of causing an acceleration equal and opposite to that of our reference frame. Hence serving to in a way "stop"(or make inertial) our reference frame, and making it easier for us to investigate the motion.

This application of pseudo force doesn't change the motion of the object because just as we can choose an arbitrary reference frame, we can choose an arbitrary force to cause the same acceleration in every object in the whole universe without changing the relative motions of objects. (as all motion is truly relative, we will still get correct answers for our investigations.

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[1] The speed is rate of change of distance and the velocity is the rate of change of displacement.

[2] When the net external torque acting on a system about a given axis is zero, the total angular momentum of the system about that axis remains consant.

[3] Law of conservation of angular momentum holds in case of long jump. When a athlete takes off from the ground in a running long jump, the forces on the launching foot give the athlete an angular momentum with a forward rotation around a horizontal axis. Such rotation would not allow the jumper to land properly. In the landing, the legs should be together and extended forward at an angle so that the heels mark the sand at the greatest distance. Once airborne, the angular momentum cannot change (it is conserved) because no external torque acts to change it. However, the jumper can shift most of the angular momentum to the arms by rotating them in windmill fashion. Then the body remains upright in the proper orientation of landing.

[4] For the motion of the Earth around the sun, the total of angular momenta of the Earth and the Sun, is conserved in every inertial frame of reference; but the angular momentum of the Earth (or of the sun)is not conserved in every inertial frame.

[5] The z component of angular momentum of a conical pendulum is not conserved w.r.t. the origin fixed at the point of suspension; but the x and y components are conserved.

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[6] In the example of conical pendulum, the z- component of angular momentum does not change. This follows from the angular momentum conservation as there is no external torque.

[7] When applying the conservation laws of momentum, energy and angular momentum we must define the system first.Only then check if the laws is applicable or not.

As an example: when a ball is dropped from a height, it gains momentum down if we consider the ball as our system.This is because the force of gravity acts as an external force.

However, if we change our system and consider earth as a part of our system too, then the momentum remains conserved because the earth gains momentum up.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then check we should if the laws are applicable or not.

So if there is no *external force* acting on the system all the three quantities, total momentum, total angular momentum, and total kinetic energy will be conserved independent of the nature of forces.

[9] Non Conservative force is a force with the property that workdone in moving an object from one point to another is dependent on the path taken .

Non Conservative Force can arise in classical physics due to neglected degrees of freedom or time dependent potentials.

Friction may be treated without resorting the use of non conservative forces by considering the motion of individual molecules.

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[10] It is not possible for a particle to move on a circular path in such a way that its speed and force remains constant, and only the velocity and acceleration may (or may not) always change with time.

[11] If P and Q are the initial and the final points of a path of a particle, displacement is a vector whose direction is along PQ and has magnitude is equal to the length of line PQ

[12] A frame rotating w.r.t K with uniform angular velocity is also an inertial frame.

[13] When a ball rolls over a rough surface, it comes to stop after some time. This is because transational and rotational kinetic energy initially present in the ball continuosly gets converted to heat due to friction. When all the kinetic energy changes to heat, the ball stops. The total mechanical energy of the ball is not conserved.

[14] The kinetic energy of a particle is continuously increasing with time, then the angle bewteen the net force and the velocity cannot be greater than or equal to 90^{o} at any time.

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[15] Various types of forces in nature can be grouped in four categories:
(a)Gravitational; (b)Electromagnetic; (c)Nuclear; (d)Weak
There are also some non-fundamental forces such as:
(i)Normal reaction on bodies in contact with surfaces , (ii) Friction,(iii) Tension,(iv)Elastic force.

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[1] For any type of translational motion of a body, the displacement cannot be zero, where as the distance travelled can be zero.

[2] This law sates that when no net torque of all forces acts on a object or a system of objects then total angular momentum of system is conserved.The angular momentum before an event is equal to angular momentum after that event.mathematically explained by when, net torque=0 ;then, total angular momentum(L)=constant.

[3] The total angular momentum of a body remains constant of motion when the net torque of the external forces acting on the body is zero.
In general, we have a system of particles such that the net torque of the external forces on the system, w.r.t. some axes K, is zero, the total angular momentum may not remain conserved, because the torque due to the internal forces may not be zero.

[4] In the Sun Earth system the angular momentum of the Earth is conserved in every frame of reference

[5] Only the z component of angular momentum of a conical pendulum is conserved w.r.t. the origin fixed at the point of suspension. SetId=169

[6] In the example of conical pendulum, the x and$y$ components of angular momentum change. This follows from the angular momentum conservation as the z components external torque is zero and horizontal components of torque are non zero.

[7] Statement: Law of Conservation of energy states that "ENERGY CAN NEITHER BE CREATED NOR DESTROYED",but it can be changed from one form to other.

EXPLANATION: Statement implies that the total amount of energy in an isolated system remains constant although it may change forms. viz, kinetic energy may change to potential;chemical to electrical energies etc.

[8] If we want to apply the conservation laws of momentum, energy and angular momentum, we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *external force* acting on the system, the momentum and angular momentum will be conserved, and depending on the nature of the forces but total energy may or may not be conserved.

[9] A non-conservative force is a force with the property that the work done in moving a particle between two points is dependent of the path taken . Mostly the enery of the particle in a non conservative force field dissipates in the form of heat or sound . Since the lost energy cannot be bought back ,conservation of mechanical energy
SetId=169 does not hold true .

[10] For a particle moving on circle the acceleration is always constant in magnitude and directed towards the centre of the circle.

[11] If P and Q are the initial and the final points of a path of a particle,the displacement is the vector $\overrightarrow{PQ}$.

[12] The Newton's Laws of motion will hold in all frames which are at rest w.r.t. K but do not remain valid in a frame that move with respect to K.

[13] Let us consider that a pendulum is oscillating moving in a vertical plane. Mean while let another bob which is attached to a spring and is executing a simple harmonic motion in horizontal direction comes and hits the pendulum. Here conservation of momentum does not hold good as tension(external force) is acting on the system.(pendulum)

[14] A heavy body is attached from a spring and is held at point A and is such that the spring is not slack nor is it stretched. It is then released. It goes down upto a point B and then it rises upto point C and executes an oscillatory motion between B and C. During the motion from A to C is first positive (from A to B) and then it is negative from B to A and again remains negative from A to C. SetId=169

[15] A force is agency that which changes or tends to change the state of rest or motion of a body.

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[1] Displacements, being vector quantity can not compared with, a scalar quantity such as distance.

[2] Statement of Law of Conservation of Angular Momentum:
Differentiating $\vec{L} = \vec{r} \times \vec{p}$ w.r.t, time,

$$\begin{aligned} \frac{dL}{dt} &= \frac{d\vec{r} \times \vec{p}}{dt} = \frac{d\vec{r}}{dt} \times \vec{p} + \vec{r} \times \frac{d\vec{p}}{dt} = \vec{v} \times (m\vec{v}) + \vec{r} \times \vec{F} \\ &= \vec{r} \times \vec{F} (\because v \times v = 0) \\ &= \vec{\tau} \end{aligned}$$

here $\vec{\tau}$ represents the net torque acting on a rigid body rotating about a fixed axis.This torque must take into account of all the forces, be it external or internal forces

[3] An example where law of conservation of angular momentum holds:
The Law of conservation of angular momentum holds in the case of a ballet dancer performing a pirouette.

When the dancer extends her arms outward, the angular velocity of her rotation decreases whereas when she keeps her arms close to her body, the angular velocity increases. This is because her moment of inertia changes as she moves her arms outward and inward. It can be noted that she as a system has no external torque acting upon her.

[4] In the motion of earth around sun, the angular momentum of the earth about an axis passing through the sun and perpendicular to the plane of motion of earth is conserved.

[5] The projection of angular momentum of a conical pendulum in the horizontal plane is a constant of motion when the origin is chosen to be at fixed at the point of suspension. SetId=170

[6] Example where law of conservation of angular momentum does not hold: A disc rotating on a horizontal rough surface will not have a constant angular momentum because there will be a constant torque by frictional force. Hence, its angular momentum will decrease, and the law of conservation of angular momentum does not apply.

[7] Oscillating simple pendulum is a very good example where potential energy gets converted to kinetic energy and kinetic to potential energy. Some energy gets dissipated as heat if we consider air resistance. Energy as a whole is conserved if we consider universe as system, the energy has just changed its form.

[8] To apply the conservation laws of momentum, energy and angular momentum, we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *external force* acting on the system, the energy and momentum will be conserved. However, depending on the nature of the system and of the forces, the total angular momentum may not be conserved.

[9] If the work done by a force depends on the path followed by the particle, it is called a Non conservative force. Work done by a non conservative force is not zero in round trip.

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[10] The motion of a bomb dropped from a plane does is not a uniform motion as it follows a parabolic path and not a straight line path.

[11] If two bodies starting from a point A reach a point B, following different paths, their displacement will be, in general different, but the distances covered will always be the same.

[12] Staying inside a bullet train moving with constant velocity (no jerks etc) an experiment can always be performed which will tell us the numerical velocity of the bullet train

[13] The law of conservation of momentum does not hold in relativistic situations, i.e., where the speeds of the masses involved are close to the speed of light.

[14] The kinetic energy of a body does not change if any one of the following is true
(i)force is always perpendicular to the velocity
(ii) the force is always perpendicular to the acceleration
(iii) the object remains stationary
(iv) the object moves in such a way that the point of application of the force remains fixed.

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[15] The forces may be of the following two types - *Contact forces* (those that act when bodies are in physical contact) eg. friction, normal reaction, bouyancy etc. and*Action-at-a-distance forces* (those that act when bodies are not in contact) eg. Gravity, electostatic forces, magnetic forces etc. There At the root level, forces are of the following fundamental types :- (a) *Gravitational forces* - weakest of all forces, always attractive
(b) *Electromagnetic forces* - stronger than gravitational forces, can be attractive or repulsive,
(c) *Nuclear forces* - exist at atomic level, have very short range,
(d) *Weak nuclear forces* associated with beta particle emission

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[1] Distance depends on the path where as the displacement depends on the end point only.

[2] Statement of Law of Conservation of Angular Momentum: For a system of many particles The net torque due all the forces, be it external or internal forces. But as the torque due to all the internal forces cancel out, it sufficient to consider the external forces acting on the system.

[3] In case of a skater, who can be considered an isolated system, so no torue will be acting on him/her. When the arms are extended, the moment of inertia is more. When his hands are closely held, the moment of inertia is lesser. Since the angular momentum is same, the angular acceleration changes accordingly.

[4] For the motion of earth around sun, the angular momentum of the earth about the center of mass of the sun + earth system and perpendicular to the plane of motion of earth is conserved.

[5] The law of angular momentum of a is not applicable for the conical pendulum conserved w.r.t. the origin fixed at the point of suspension. SetId=171

[6] Example where law of conservation of angular momentum does not hold:Consider a vertical stick on the ground falling to a horizontal position. During the fall, the conservation of angular momentum applied at the point of rotation on the ground and perpendicular to the plane of the stick is not applicable as, the gravitational force which acts vertically downwards assumed at the centre of mass produces an external torque about the axis of rotation

[7] Law of conservation of momentum does not hold whenever an external force or impulse acts on the system. For example,when a body collides with earth then it bounces back to a lesser height as it loses some velocity.

In this example the momentum of a ball is not conserved due to impulsive force by ground in the normal direction.

However, strictly speaking the system that should be considered here is the ball-earth system and the total momentum is conserved.

[8] In order to apply the law of conservation of momentum we must first identify the system. If there is no *external forces* acting on the system then conservation laws of momentum always holds. And depending on the nature of the system and of the forces, the total kinetic energy and the total angular momentum may not be conserved.

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[9] The workdone by a non conservative force is dependant on its path. the work varies as the path varies.

[10] A wagon sliding on a roller coaster designed in such a way that the wagon covers equal distances in equal times. As the motion of the wagon is uniform, there will be no net force acting on it.

[11] Distance is equal to the length of the path covered. Displacement is the shortest distance between initial and final points.

[12] Staying inside a bullet train moving with constant velocity (no jerks etc) an experiment can always be performed which will tell us the numerical value of the acceleration of the bullet train

[13] when we are in accelerating frame if we observe any collision between two bodies then the law of conservation of momentum does not hold in that frame of reference.

[14] The total work done on a particle is always equal to the change in kinetic energy. SetId=171

[15] The main differences between force and pseudo force are -
(1) Forces have a real presence while pseudo forces don't.
(2) Forces can be accounted for by Newton's laws.
(3) Pseudo forces are only taken into account when the reference frame is accelerated.

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[1] Distance equal to zero implies displacement=0; and Displacement=0 also implies distance = 0

[2] Depending on the torques acting on a system, the angular momentum can be conserved only in one or two directions, but may not be conserved in all. For instance, if an isolated body has no torque acting on it only in the direction along the Z axis, then the angular momentum is conserved only in that direction.

[3] Example where law of conservation of angular momentum holds:
Let us assume a student seated on a stool that can rotate freely about a vertical axis. The student has been set into rotation at a modest initial angular speed ω . He holds two dumbbells in his outstretched hands. His angular momentum vector L lies along the vertical rotation axis, pointing upwards. Now he pulls in his arms;this action reduces his rotational inertia from its value I_{initial} to a final value I_{final} because he moves the mass closer to the rotational axis. His rate of rotation increases markedly, from ω_{initial} to ω_{final}. The student can then slow down by extending his arms once more,moving the dumbbells outward. No external torque acts on the system consisting of the student, stool and the dumbbells. Thus the angular momentum of the system about the rotational axis remains constant. $I_{\text{initial}} * \omega_{\text{initial}} = I_{\text{final}} * \omega_{\text{final}}$.

[4] In the Sun Earth system the angular momentum of the Earth about the pole star is conserved

[5] The law of angular momentum of a is not applicable for the conical pendulum conserved when the origin is chosen to be at the pendulum bob itself. SetId=172

[6] We have a conical pendulum .The forces acting on the bob are tension (along the direction of the string) and gravitational force acting in the vertically downward direction.we have an additional force called the drag force which is tangential to the motion of the bob and acts in the direction opposite to the motion of the bob.The axis of rotation passes through the hinge point and is vertical.The torque due to tension is 0 because the force passes through the axis of rotation.The torque due to mg is also zero since it is parallel to the axis of rotation.but the torque due to drag force is not zero.since the net external torque acting on the bob is not zero,therefore the law of conservation of angular momentum does not hold here

[7] If a bullet hits a wooden board and gets embedded in the board, the total energy and the total momentum of the bullet and the board are conserved.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then check if the laws is applicable or not.

So if there is no *net external force* acting on the system all the three conservation laws will hold.

[9] A non conservative force is a force with the property that the work done in moving a particle between two points is dependent on the path followed. SetId=172

[10] A simple pendulum moves along a circular arc and does not have constant speed and therefore its motion is not uniform.

[11] Distance is a scalar quantity where as the displacement is a vector quantity.

[12] Assume bullet train, moving with out any jerks, is going on a circular arc of radius R with constant speed. Then an experiment is to be performed entirely within the train without any measurement on objects outside the train. Such an experiment can tell only radius of the track.

[13] Give an example where law of conservation of momentum does not hold all cases when seen from non inertial frame of references for example when we see two cars collide from a moving bus there momentum is not conserved

[14] A particle is acted upon by a force of constant magnitude which is always perpendicular to the velocity of the particle and the motion of the particle takes place in a plane, Then its kinetic energy, speed, velocity acceleration will not change. SetId=172

[15] A force is any interaction which tends to change the motion of an object. It is also *defined* as rate of change of momentum. It is a vector quantity.

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[1] If P and Q are the initial and the final points of a path of a particle, displacement is a vector whose direction is along PQ and has magnitude is equal to the length of line PQ

[2] According to Law of Conservation of Angular momentum,if no external torque acts on an object or system of objects,angular momentum of an object or system of objects remains CONSTANT or no change in angular momentum can occur.

Also it states that,only external torque can change angular momentm of the system where as the torque produced by internal forces can not change the angular momentum of the system

[3] A bob is attached to ceiling by a string and moves in a horizontal circular plane is an example. In this case the law of conservation of angular momentum does not hold.

[4] For the motion of earth around sun, the angular momentum of the sun about the center of mass of the sun + earth system and perpendicular to the orbital plane of earth is conserved.

For the motion of earth around sun, the angular momentum of the sun about and axis passing through the Earth and perpendicular to the orbital plane of motion of earth is conserved.

[5] The three components of angular momentum of a conical pendulum is conserved w.r.t. the origin at the position of the center of mass of the pendulum. SetId=173

[6] When you release a toy gyroscope on its pedestal, it initially has no precessional rotation around that pedestal, i.e, the orientation of rotation is fixed. However, it instantaneously starts precessing around the pedestal. Both Kinetic Energy and Angular Momentum now exist where they did not exist a moment earlier. The Kinetic Energy is easy to explain, as appearing due to the body of the gyroscope dropping a tiny fraction of a millimeter in the Earth's gravitational field, giving up exactly the correct amount of Potential Energy. But the Angular Momentum of the Precession which just appeared, does not come from anywhere. This is therefore a Violation of the Conservation of Angular Momentum.

[7] If a bullet hits a wooden board and gets embedded in the board, the total energy of the bullet and the board system is conserved but the total momentum is not conserved.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then check we should if the laws are applicable or not.

So if there is no *external force* acting on the system all the three quantities, total momentum is conserved. The total angular momentum is also because the torque

of internal forces will be zero. The conservation of energy depends on the nature of forces. will be conserved.

[9] A non conservative force is a force with the property that the work done in moving a particle between two points is dependent of the taken path.

Friction, for example, does less work on a book dragged across a table if the book is dragged straight across than if the book is dragged in a curved path.

To write the equation for conservation of energy for non conservative forces we need to include the work done by the non conservative force also.This is because forces like friction liberate heat which are not included in the mechanical energy. SetId=173

[10] A satellite goes around the earth in a circular orbit of 600km with a time period of $5.8 \times 10^3 s$. Its motion will be uniform as it will cover equal distances in equal times.

[11] Both displacement and distance tell us about the motion of a body but their study does not tell much about the forces on the body

[12] Assume bullet train, moving with out any jerks, is going on a circular arc of radius R with constant speed. Then an experiment is to be performed entirely within the train without any measurement on objects outside the train. Such an experiment can tell both speed of the train and radius of the track.

[13] When a tennis ball hits the ground at an oblique angle, the angle of reflection is equal to the angle of incidence. This is a simple consequence of conservation of horizontal component of momentum.

[14] The kinetic energy of a particle is continuously increasing with time, then the angle bewteen the net force and the velocity cannot be greater than or equal to 90^o at any time. SetId=173

[15] Explain Pseudo Force: While applying Newton's laws of motion in non-inertial frame of reference it gives answers which contradict observations. Thus, to account for this,using Newton's Laws, we introduce a "fake" or pseudo force which gives answers that match the observations in a non-inertial frame.

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[1] If P and Q are the initial and the final points of a path of a particle,the displacement is the vector $\overrightarrow{PQ}$.

[2] The law of conservation of angular momentum states that when the net external torque acting on the system is zero, then the angular momentum of the system remains constant.both the initial and final momentum should be taken from a fixed inertial frame of reference provided.

[3] Consider a disc rotating about an axis perpendicular to its plane. On placing a smaller disc with its surface parallel to the surface of the rotating disc, the angular momentum of the system of two discs remains constant as there is no external torque.

[4] For the motion of earth around sun, the sum of angular momenta of the Sun and the Earth about the center of mass of the sun + earth system is conserved.

[5] Only the z component of the angular momentum of a conical pendulum is conserved w.r.t. the origin fixed at the point of suspension. SetId=174

[6] There is no case where LAW OF CONSERVATION OF ANGULAR MOMENTUM does'nt hold.But there are cases where conservation of angular momentum does not hold.A body in vertical circular motion is an example where angular momentum is not conserved. Here the law of conservation does not apply.

[7] If a bullet hits a wooden board and gets embedded in the board, both total energy and the total momentum of the bullet and the board are not conserved.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *net external force* acting on the system, the momentum is conserved. The definition of angular momentum and torque depends on the choice of axes, and therefore it may not be be conserved. The conservation of total energy holds only for conservative forces.

When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *net external force* acting on the system, the energy and momentum will be conserved. However, the total angular momentum may not be conserved because the torque may not be zero.

[9] A non conservative force is a force with the property that the work done in moving a particle between two points is dependent of the taken path.

Friction, for example, does less work on a book dragged across a table if the book is dragged straight across than if the book is dragged in a curved path.

SetId=174 To write the equation for conservation of energy for nonconservative forces we need toinclude the work done by the non conservative force also.This is because forces like friction liberate heat which are not included in the mechanical energy.

[10] A uniform motion is defined to be the one in which a body covers equal distances in equal time intervals.

[11] Displacement is the shortest distance between initial and final points with direction specified.

[12] Assume bullet train, moving with out any jerks, is going on a circular arc of radius R with constant speed. Then an experiment is to be performed entirely within the train without any measurement on objects outside the train. Such an experiment can tell only speed of the track.

[13] when a ball is dropped from a height, it gains momentum down if we consider the ball as our system.This is because the force of gravity acts as an external force.

However, if we change our system and consider earth as a part of our system too, then the momentum remains conserved because the earth gains momentum up.

[14] A heavy body is attached from a spring and is held at point A and is such that the spring is not slack nor is it stretched. It is then released. It goes down upto a point B and then it rises upto point C and executes an oscillatory motion between B and C. During the motion from A to C is first positive (from A to B) and then it is negative from B to A and again remains negative from A to C. SetId=174

[15] When a train is at rest and a ball is hung from the ceiling with a string, an observer in the train sees that the string is vertical. But when the train starts moving, the observer sees that the string makes an angle with the vertical and is tilted in forward direction . This means that some force other than gravity and tension must act on the ball. That force is the pseudo force.

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[1] If two bodies starting from a point A reach a point B, following different paths, their displacement will be, in general different, but the distances covered will always be the same.

[2] The law of conservation of angular momentum states that The total angular momentum of a system is constant in both magnitude and direction if the resultant torque, of the external forces acting on the system, is zero.

[3] Consider a man standing on a spinning platform. Initially, the man spreads out his arms and he spins with a certain angular velocity. The next moment, he pulls his arms inwards keeping them close to his body. We will observe that the angular velocity with which he is spinning now increases. This phenomenon can be explained by the Law Of Conservation of Angular momentum. Initially, since his arms were spread wide, his moment of inertia was large. However, when he pulled them close to his body, his moment of inertia decreased.
In this example the angular velocity of the man increases and therefore the angular momentum also increases.The law of conservation of angular momentum does not apply because the torque of muscular forces is not zero.

[4] For the motion of the Earth around the sun, the total of angular momenta of the Earth and the Sun, about in a reference frame fixed in the pole star, is conserved.

[5] The z component of angular momentum of a conical pendulum is not conserved w.r.t. the origin fixed at the point of suspension; but the x and y components are conserved.

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[6] A sphere rolling on a rough surface.Due to friction there is external torque so the angular momentum changes which results in the slowing of the sphere. The angular momentum keeps changing. Even in case like this one, it is wrong to say that the Law of Angular Momentum Conservation does not hold.

[7] There are certain situations where it appears that the law of conservation of linear momentum does not hold. For example if we take some amount of a substance like construction putty, cement, cake batter, playing dough,etc and drop it on the ground, it does not bounce back like a rubber ball would and hence the momentum it had before striking the ground seems to have been lost. Hence it appears that the law of conservation of linear momentum does not hold.

[8] In order to apply the law of conservation of momentum we must first identify the system. If there is no *net external forces* acting on the system then conservation laws of momentum always holds. The total energy and the total angular momentum may not be conserved.

[9] The non conservative force is a force with a property thet the work done between two points depends on path taken. If a particle moves along a curve path, to know about the work done by a non conservative force we should have the equation of the path along which the particle had move.The work done would be

WORK = INTEGRAL (F.dx)

The equation of conservation of mechanical energy for a non conservative force would be

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$KE_{\text{final}} + PE_{final} = KE_{initial} + PE_{initial} + W_{nc}$

[10] A particle moves on a circular path. Then its speed, direction of force, velocity and acceleration must always change with time.

[11] Displacements, being vector quantity can not compared with, a scalar quantity such as distance.

[12] A particle is observed from two frames S_1 and S_2. The frame S_2 moves with respect to S_1 with an acceleration a. If F_1 and F_2 be the pseudoforces when seen from S_1 and S_2 respectively it is not possible to have $F_1 = F_2 = 0$

[13] There is no known exception to the law of conservation of momentum in classical mechanics however when two bodies collide and their mass converts to energy, an exception in nuclear physics is observed. In real life this is observed in nuclear reactions at atomic level.

[14] The kinetic energy of a body does not change if any one of the following is true
(i)force is always perpendicular to the velocity
(ii) the force is always perpendicular to the acceleration
(iii) the object remains stationary
(iv) the object moves in such a way that the point of application of the force remains fixed. SetId=175

[15] Since newton's laws are not valid in non-inertial frames, pseudoforces (which do not exist in reality) are used to help us formualate and use Newton's laws of motion in non-inertial frames.

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[1] Displacement is equal to the vector difference $\vec{r}_f - \vec{r}_i$ of the position vectors of initial and final points. The distance covered will be $|\vec{r}_f - \vec{r}_i|$

[2] If the net external torque acting on a system is zero,the angular momentum L(vector) of the system remains constant,no matter what changes take place within the system.L(vector)=a constant (net external torque acting on system is zero)

[3] In the Sun-Earth system, angular momentum of the earth is not conserved but the total angular momentum of the sun and the earth is constant of motion.

[4] For the motion of the Earth around the sun, the total of angular momenta of the Earth and the Sun, is conserved in every inertial frame of reference; but the angular momentum of the Earth (or of the sun)is not conserved in every inertial frame.

[5] Only the z component of angular momentum of a conical pendulum is conserved w.r.t. the origin fixed at the point of suspension. SetId=176

[6] Consider a rod of length l. Let us give an impulse to one end . Now the angular momentum about the oposite end is not zero since the impulse provides some torque . So the angular momentum is not conserved .

$$\text{torque} = \text{impulse} * \ell.$$

$d\ell/dt$ is not equal to zero and the law of conservation of angular momentum does not hold.

[7] A tennis ball is dropped from height h and after hitting the ground and it bounces back and rises to the same height. In this case the momentum of the ball is conserved because (under ideal conditions) the momentum after it hits the ground will be equal to the momentum it had before hitting the ground.

[8] In order to apply the law of conservation of momentum we must first identify the system. Then even if there is no *net external forces* acting on the system, all the three conservation laws of momentum, angular momentum and energy may not hold due to presence of internal forces.

[9] Nonconservative forces arise due to neglected degrees of freedom or from time dependent potentials. The work done by a nonconservative force depends upon the path taken. It causes a change in the mechanical energy of the system. It adds or removes mechanical energy from a system.

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[10] A particle moves on a circular path. Then its speed, direction offorce, can remain constant by velocity and acceleration must always change with time.

[11] Distance depends on the path where as the displacement depends on the end point only

[12] A particle is observed from two frames S_1 and S_2. The frame S_2 moves with respect to S_1 with an acceleration a. If F_1 and F_2 be the pseudoforces when seen from S_1 and S_2 respectively and if $F_1 = 0$ then we must have $F_2 \neq 0$

[13] When there is no external forces act on a system of many particles, and there are only internal forces acting on the particles. The third law gives that the internal forces are pairwise equal and opposite.Thus the sum of internal forces is zero and the momentum of each particle is conserved.

[14] The total work done on a particle is always equal to the change in kinetic energy. SetId=176

[15] Force is defined as the rate of change of linear momentum. In other words it is the agency which changes or tends to change the (a) State of rest; (b)State of uniform motion (c) Direction of body's motion; (d) Shape of the body

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SetId=177

[1] Distance is equal to the length of the path covered. Displacement is the shortest distance between initial and final points.

[2] The Law of conservation of angular momentum states that when no external torque acts on an object or a closed system of objects undergoing motion about a given axis, the change in angular momentum is zero. Therefore, considering an event where only internal torque or no torque is involved, the total angular momentum of the system before the event is equal to the total angular momentum after the event

[3] Consider a disc and a man system. man is standing on center of the disc rotating with angular velocity.initially man folded his hand.when man stretches his hands then momentum of inertia of system increases.and angular velocity decreases.and total angular momentum remains constant.

[4] In the Sun Earth system the angular momentum of the Earth is conserved in every frame of reference

[5] The projection of angular momentum of a conical pendulum in the horizontal plane is a constant of motion when the origin is chosen to be at fixed at the point of suspension. SetId=177

[6] Let us consider a rotating skew rod. In the absence of friction or any other drag force, the rod should continuously spin without stopping. Here the net torque about the axis of rotation is 0 and hence angular momentum is conserved. It therefore follows from law of conservation of angular momentum that a spinning skew rod will keep rotating with constant angular velocity if there is no external torque. So law of conservation of angular momentum does not hold.

[7] Law of conservation of momentum does not hold when Newton's laws are not valid, e.g. in a non-inertial frame of reference. For example, when we consider collision between two bodies in a non-inertial frame of reference, the law of conservation of momentum cannot be applied because there will be a pseudo force acting on the frame itself.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then check we should if the laws are applicable or not.

So if there is no *external force* acting on the system all the three quantities, total momentum, total angular momentum, and total kinetic energy will be conserved independent of the nature of forces.

[9] The work done by a *Nonconservative Force *is not recoverable*.*The work done by a *Non Conservative force* is usually dissipated in the form of Heat and Sound.

SetId=177 Non conservative force *cannot* be expressed in the form of *Potential Energy*.

[10] A particle moves on a circular path. Then under suitable conditions its speed may remain constant, but the force, velocity and acceleration must always change with time.

[11] Distance equal to zero $\Rightarrow$ displacement=0; but Displacement=0

[12] If K is an inertial frame, any frame that moves w.r.t. the frame K with uniform velocity is also an inertial frame.

[13] During collision of billiard balls momentum is conserved. During explosion of a bomb also momentum is conserved and the total momentum of the fragments of bomb will be zero. This is because all the forces are only internal forces.

[14] A particle is acted upon by a force of constant magnitude which is always perpendicular to the velocity of the particle and the motion of the particle takes place in a plane, Then its kinetic energy, speed, velocity acceleration will not change. $\boxed{\text{SetId=177}}$

[15] Real forces have their origin in matter such as electricity, gravitation etc., while pseudo forces are caused by inertial motion.

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SetId=178

[1] Distance is a scalar quantity where as the displacement is a vector quantity.

[2] The law of conservation of angular momentum states that when no external torque acts on an object or a closed system of objects, no change of angular momentum can occur. Hence, the angular momentum before an event involving only internal torques or no torques is equal to the angular momentum after the event . Angular momentum can be calculated with the help of the formula $L = I\omega$ where L stands for Angular momentum, I stands for moment of inertia and ω stands for angular velocity

[3] The conservation of angular momentum of a system of bodies requires that the the sum of torque due to all forces be equal to zero. Now consider a situation where the forces are such that the sum of torques of external forces is zero w.r.t. some axes K. Since the value of torque depends of the choices of axes, the sum of torques due to all internal forces will depend on the choice of axes and in general it will be non zero. Therefore, for a system of several bodies, for a given choice of axes K, there will be situations when the total angular momentum may not be conserved.

[4] In the motion of earth around sun, the angular momentum of the earth about an axis passing through the sun and perpendicular to the plane of motion of earth is conserved.

[5] The law of angular momentum of a is not applicable for the conical pendulum conserved w.r.t. the origin fixed at the point of suspension. SetId=178

[6] In the example of skew rod the angular velocity does not change even though the torque applied is nonzero. However there is no contradiction as in this case the law of conservation of momentum is not applicable. conservation is violated.

[7] If I throw a ball upward, it's speed decreases as it rises upwards. There is an external force (gravity) acting on the ball, so the momentum conservation law does not apply. Momentum of the ball is not conserved, however the momentum of the Earth-ball system is conserved as gravity will become an internal force in this case.

[8] If we want to apply the conservation laws of momentum, energy and angular momentum, we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *external force* acting on the system, the momentum and angular momentum will be conserved, and depending on the nature of the forces but total energy may or may not be conserved.

[9] * A non conservative force is a force that acts on a particle(or point), such that the work done by this force in moving this particle from one point to another is

/dependent of path taken/ that is the work done depends on the path itself. * For example frictional force is non conservative because the work done by friction always acts in the direction of travel and therefore depends on length L of the path taken.

SetId=178

[10] A particle moves on a circular path. Then under suitable conditions its speed and acceleration may remain constant, but the force, and velocity must always change with time.

[11] If P and Q are the initial and the final points of a path of a particle, displacement is a vector whose direction is along PQ and has magnitude is equal to the length of line PQ

[12] If K is an inertial frame, any frame that moves w.r.t. the frame K with uniform speed is also an inertial frame.

[13] Give an example where law of conservation of momentum holds: A mass exploding into several pieces in a conservative field like gravitational field(if air resistance is neglected), obeys law of conservation of momentum. If air resistance cannot be neglected then the law of conservation of momentum will not hold.

[14] The kinetic energy of a particle is continuously increasing with time, then the angle bewteen the net force and the velocity cannot be greater than or equal to 90^o at any time.

SetId=178

[15] 1)When we start rolling a body on a rough ground, it stops rolling after certain period because of frictional force.
2)When we leave a body from a certain height, it falls due to the act of gravitational force.

1)When a body is rotating in a circular path due to the centrifugal force which is the pseudo force. 2) When the lift is accelerating upwards, the upwards force felt by passengers a pseudo force.

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[1] The speed is rate of change of distance and the velocity is the rate of change of displacement.

[2] Newton's Second Law of Motion is defined by the expression $F = \frac{dp}{dT}$, where F gives the force vector acting on the system and p gives its momentum vector; in linear motion. A similar expression can be written to describe angular motion, i.e. : $\tau = \frac{dL}{dt}$, where τ is the external torque vector acting on the system, and L is the angular momentum.

If the external torque on the system is zero, then we get the expression as: dL/dt=0. This points out to the fact that, when no external torque is acting on the system, then its angular momentum is constant, no matter what changes occur in the system. This is the Law of Conservation Of Angular Momentum.

[3] Example where law of conservation of angular momentum does not hold:
When there is external force like frictional force acting on a object when it is rotating we cannot use conservation of angular momentum as the friction force acting on the object produces an external torque.

[4] For the motion of earth around sun, the angular momentum of the earth about the center of mass of the sun + earth system and perpendicular to the plane of motion of earth is conserved.

[5] The law of angular momentum of a is not applicable for the conical pendulum conserved when the origin is chosen to be at the pendulum bob itself. SetId=179

[6] Example where law of conservation of angular momentum does not hold:If a particle undergoes conical motion and the only force acting on particle is central force like tension of the string.Then total external torque about fixed point A is zero,yet angular momentum is not conserved,as angular momentum keeps on changing direction.

[7] A soldier accelerating away, after detonating a bomb, will find that the total momentum of the fragments of the bomb is zero. This is an example where the law of conservation of momentum holds as the forces on the fragments are internal forces only and sum of all such forces is zero.

[8] To apply the conservation laws of momentum, energy and angular momentum, we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *external force* acting on the system, the energy and momentum will be conserved. However, depending on the nature of the system and of the forces, the total angular momentum may not be conserved.

[9] A force with the property that the work done in moving a particle is dependent on the path followed. The work done by a conservative force in moving a body from an initial location to a final location is dependent on the path taken between the two points

SetId=179

[10] When the force is kept constant as function of time, it is possible for a particle to move on a circular path in such a way that its speed remains constant, but the velocity and acceleration must always change with time.

[11] If P and Q are the initial and the final points of a path of a particle,the displacement is the vector $\overrightarrow{PQ}$.

[12] A frame rotating w.r.t K with uniform angular velocity is also an inertial frame.

[13] Also a good example of law of conservation momentum can be seen when a bullet from a rifle is fired.As the bullet is fired and gets out of the rifle, the rifle gives a backward jerk due to the phenomenon of conservation of momentum.

[14] A heavy body is attached from a spring and is held at point A and is such that the spring is not slack nor is it stretched. It is then released. It goes down upto a point B and then it rises upto point C and executes an oscillatory motion between B and C. During the motion from A to C is first positive (from A to B) and then it is negative from B to A and again remains negative from A to C. SetId=179

[15] Newton's first law defines inertial frame. An inertial frame is a frame in which the first law hold. It also makes it possible to compare and tell two force being equal or not. The second law defines the force.

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[1] For any type of translational motion of a body, the displacement cannot be zero, where as the distance travelled can be zero. SetId=180

[2] If the net external torque acting on a system is zero, the angular momentum L of the system remains constant, no matter what changes take place within the system.

$$\sum(T_{\text{ext}}) = \frac{dL}{dt}$$

The law states that when there is no net external torque, $\frac{dL}{dt}$ is zero implying that the total angular momentum of system is constant.

i.e. $L = a$ constant (isolated system)

[3] A bob attached to a ceiling by a string moving in a horizontal circular plane is an example where the total angular momentum of the bob about the point of suspension is not conserved. This is because the the torque due to the weight of the bob about the point of suspension does not vanish and has non zero horizontal component. Only the vertical component of the angular component is conserved.

[4] In the Sun Earth system the angular momentum of the Earth about the pole star is conserved

[5] The three components of angular momentum of a conical pendulum is conserved w.r.t. the origin at the position of the center of mass of the pendulum. SetId=180

[6] A nonzero torque always causes the angular velocity to change, because a change in angular momentum means a change in angular velocity $L = I\omega$

[7] There is no known exception to the law of conservation of momentum in classical mechanics However, an exception to conservation of energy in nuclear physics is observed. In nuclear reactions when two nuclei collide and their mass converts to energy and energy momentum are not conserved.

[8] In order to apply the law of conservation of momentum we must first identify the system. If there is no *external forces* acting on the system then conservation laws of momentum always holds. And depending on the nature of the system and of the forces, the total kinetic energy and the total angular momentum may not be conserved.

[9] The work done by non conservative force is dependent on the path taken by the particle in reaching final position from initial position. Non conservative force depends on the distance travelled by the particle SetId=180

[10] It is not possible for a particle to move on a circular path in such a way that its speed and force remains constant, and only the velocity and acceleration may (or may not) always change with time.

[11] If two bodies starting from a point A reach a point B, following different paths, their displacement will be, in general different, but the distances covered will always be the same.

[12] The Newton's Laws of motion will hold in all frames which are at rest w.r.t. K but do not remain valid in a frame that move with respect to K.

[13] when a man walks on the ice slab where friction does not exist between the ice block and the floor but between the feet of the man and the slab the slab moves back as per the law of conservation of momentum

[14] The kinetic energy of a body does not change if any one of the following is true
(i)force is always perpendicular to the velocity
(ii) the force is always perpendicular to the acceleration
(iii) the object remains stationary
(iv) the object moves in such a way that the point of application of the force remains fixed. SetId=180

[15] The magnitude of the pseudo force arising in a non-inertial frame is always equal to the mass of the body under consideration multiplied by the acceleration of the frame of reference and the direction of pseudoforce is always opposite to the direction of acceleration of the frame.

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SetId=181

[1] Displacements, being vector quantity can not compared with, a scalar quantity such as distance.

[2] When the net external torque acting on a body or a system of bodies is zero about a particular axis, then the angular momentum of each body is conserved about that axis.

[3] Law of conservation of angular momentum holds in case of long jump. When a athlete takes off from the ground in a running long jump, the forces on the launching foot give the athlete an angular momentum with a forward rotation around a horizontal axis. Such rotation would not allow the jumper to land properly. In the landing, the legs should be together and extended forward at an angle so that the heels mark the sand at the greatest distance. Once airborne, the angular momentum cannot change (it is conserved) because no external torque acts to change it. However, the jumper can shift most of the angular momentum to the arms by rotating them in windmill fashion. Then the body remains upright in the proper orientation of landing.

[4] For the motion of earth around sun, the angular momentum of the sun about the center of mass of the sun + earth system and perpendicular to the orbital plane of earth is conserved.

For the motion of earth around sun, the angular momentum of the sun about and axis passing through the Earth and perpendicular to the orbital plane of motion of earth is conserved.

[5] Only the z component of the angular momentum of a conical pendulum is conserved w.r.t. the origin fixed at the point of suspension. SetId=181

[6] A nonzero torque always implies change in angular momentum and may not give rise to a change in magnitude of angular velocity. A non zero torque may mean change only the direction of the angular momentum and not the angular velocity.

[7] In a system of a canon and a canon ball, total momentum of the system is zero before canon ball is fired. After firing the canon ball, the momentum of the system seems to be conserved as the ball moves forward and the canon moves backward.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then check if the laws is applicable or not.

So if there is no *net external force* acting on the system all the three conservation laws will hold.

[9] The work done by non conservative force is dependent on the path taken by the particle in reaching final position from initial position. Non conservative force depends on the distance travelled by the particle

SetId=181

[10] For a particle moving on circle the acceleration is always constant in magnitude and directed towards the centre of the circle.

[11] Distance is equal to the length of the path covered. Displacement is the shortest distance between initial and final points.

[12] Staying inside a bullet train moving with constant velocity (no jerks etc) an experiment can always be performed which will tell us the numerical velocity of the bullet train

[13] When a freely falling rigid body collides another body in its path momentum the system of two particles is not conserved in the collision as there is external force mg acting on the system.

[14] The total work done on a particle is always equal to the change in kinetic energy. SetId=181

[15] A force is any interaction which tends to change the motion of an object. It is also *defined* as rate of change of momentum.It is a vector quantity.
A physically apparent but nonexistent force felt by an observer in a noninertial frame (that is, a frame undergoing acceleration).

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SetId=182

[1] Distance depends on the path where as the displacement depends on the end point only.

[2] The law of conservation of angular momentum states that in absence of an external torque on an object or a closed system of objects the total angular momentum of the system remains constant. Thus if $\vec{\tau} = 0 => \vec{L} =$ constant where τ is the torque and $\vec{L}$ is the angular momentum of the system.

[3] The total angular momentum of a body remains constant of motion when the net torque of the external forces acting on the body is zero.
In general, we have a system of particles such that the net torque of the external forces on the system, w.r.t. some axes K, is zero, the total angular momentum may not remain conserved, because the torque due to the internal forces may not be zero.

[4] For the motion of earth around sun, the sum of angular momenta of the Sun and the Earth about the center of mass of the sun + earth system is conserved.

[5] The z component of angular momentum of a conical pendulum is not conserved w.r.t. the origin fixed at the point of suspension; but the x and y components are conserved.

SetId=182

[6] In the example of a rotating skew rod the torque due to the external gravitational forces is zero , but the angular momentum is not constant Therefore the law of conservation of angular momentum is violated.

[7] When applying the conservation laws of momentum, energy and angular momentum we must define the system first.Only then check if the laws is applicable or not.

As an example: when a ball is dropped from a height, it gains momentum down if we consider the ball as our system.This is because the force of gravity acts as an external force.

However, if we change our system and consider earth as a part of our system too, then the momentum remains conserved because the earth gains momentum up.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then check we should if the laws are applicable or not.

So if there is no *external force* acting on the system all the three quantities, total momentum is conserved. The total angular momentum is also because the torque of internal forces will be zero. The conservation of energy depends on the nature of forces. will be conserved.

[9] Nonconservative forces are those forces in which the work done in moving a particle is dependant on the path taken to cover the distance. Some energy woul be lost to the environment in the form of heat, sound, etc. The energy in the final state is less than that in the initial state.

SetId=182

[10] The motion of a bomb dropped from a plane does is not a uniform motion as it follows a parabolic path and not a straight line path.

[11] Distance is a scalar quantity where as the displacement is a vector quantity.

[12] Staying inside a bullet train moving with constant velocity (no jerks etc) an experiment can always be performed which will tell us the numerical value of the acceleration of the bullet train

[13] If we take some amount of a substance like construction putty, cement, cake batter, playing dough,etc and drop it on the ground, it does not bounce back, like a rubber ball would bounce, and hence the momentum it had before striking the ground seems to have been lost. Hence it appears that the law of conservation of linear momentum does not hold.

[14] A particle is acted upon by a force of constant magnitude which is always perpendicular to the velocity of the particle and the motion of the particle takes place in a plane, Then its kinetic energy, speed, velocity acceleration will not change.

SetId=182

[15] Psuedo Force is defined as an apparent force that acts in only non-inertial frames. Pseudo Forces are also called Fictitious Forces. It is an Imaginary force. It is independent of mass.

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SetId=183

[1] Distance equal to zero implies displacement=0; and Displacement=0 also implies distance = 0

[2] If no net external torque acts on a system, the total angular momentum of the system remains constant.

[3] An example where law of conservation of angular momentum holds:
The Law of conservation of angular momentum holds in the case of a ballet dancer performing a pirouette.

When the dancer extends her arms outward, the angular velocity of her rotation decreases whereas when she keeps her arms close to her body, the angular velocity increases. This is because her moment of inertia changes as she moves her arms outward and inward. It can be noted that she as a system has no external torque acting upon her.

[4] For the motion of the Earth around the sun, the total of angular momenta of the Earth and the Sun, about in a reference frame fixed in the pole star, is conserved.

[5] Only the z component of angular momentum of a conical pendulum is conserved w.r.t. the origin fixed at the point of suspension. SetId=183

[6] In the example of skew rod, the angular momentum changes with time and there is a non zero torque coming from action of forces other than gravitational forces. Hence the law of conservation of angular momentum dos not apply.

[7] Statement: Law of Conservation of energy states that "ENERGY CAN NEITHER BE CREATED NOR DESTROYED",but it can be changed from one form to other.

EXPLANATION: Statement implies that the total amount of energy in an isolated system remains constant although it may change forms. viz, kinetic energy may change to potential;chemical to electrical energies etc.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *net external force* acting on the system, the momentum is conserved. The definition of angular momentum and torque depends on the choice of axes, and therefore it may not be be conserved. The conservation of total energy holds only for conservative forces.

When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *net external force* acting on the system, the energy and momentum will be conserved. However, the total angular momentum may not be conserved because the torque may not be zero.

[9] The work done by such forces depends on the path taken. The work done cannot be represented as a potential energy function.Work done by such forces is always negative.

SetId=183

[10] A wagon sliding on a roller coaster designed in such a way that the wagon covers equal distances in equal times. As the motion of the wagon is uniform, there will be no net force acting on it.

[11] Both displacement and distance tell us about the motion of a body but their study does not tell much about the forces on the body

[12] Assume bullet train, moving with out any jerks, is going on a circular arc of radius R with constant speed. Then an experiment is to be performed entirely within the train without any measurement on objects outside the train. Such an experiment can tell only radius of the track.

[13] When we consider collision between two bodies in a non-inertial frame of reference, the law of conservation of momentum cannot be applied because there will be a pseudo force acting on the frame itself.

[14] The kinetic energy of a particle is continuously increasing with time, then the angle bewteen the net force and the velocity cannot be greater than or equal to 90° at any time.

SetId=183

[15] Psuedo Force is defined as an apparent force that acts in only non-inertial frames. Pseudo Forces are also called Fictious Forces. It is an Imaginary force. It is always proportional to mass. It is sometimes dependent on speed.

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SetId=184

[1] If P and Q are the initial and the final points of a path of a particle, displacement is a vector whose direction is along PQ and has magnitude is equal to the length of line PQ

[2] The law of conservation of angular momentum states that when no external torque is applied on an object or a closed system of objects about an axis, the angular momentum about that axis remains constant.

[3] In case of a skater, who can be considered an isolated system, so no torue will be acting on him/her. When the arms are extended, the moment of inertia is more. When his hands are closely held, the moment of inertia is lesser. Since the angular momentum is same, the angular acceleration changes accordingly.

[4] For the motion of the Earth around the sun, the total of angular momenta of the Earth and the Sun, is conserved in every inertial frame of reference; but the angular momentum of the Earth (or of the sun)is not conserved in every inertial frame.

[5] The projection of angular momentum of a conical pendulum in the horizontal plane is a constant of motion when the origin is chosen to be at fixed at the point of suspension. SetId=184

[6] In the example of conical pendulum, the z- component of angular momentum does not change. This follows from the angular momentum conservation as there is no external torque.

[7] Oscillating simple pendulum is a very good example where potential energy gets converted to kinetic energy and kinetic to potential energy. Some energy gets dissipated as heat if we consider air resistance. Energy as a whole is conserved if we consider universe as system, the energy has just changed its form.

[8] In order to apply the law of conservation of momentum we must first identify the system. If there is no *net external forces* acting on the system then conservation laws of momentum always holds. The total energy and the total angular momentum may not be conserved.

SetId=184

[9] A nonconservative force is a force with the property that the work done in moving a particle depends on the path taken.Also, the net work done in a closed loop is non zero.

[10] A simple pendulum moves along a circular arc and does not have constant speed and therefore its motion is not uniform.

[11] Displacement is the shortest distance between initial and final points with direction specified.

[12] Assume bullet train, moving with out any jerks, is going on a circular arc of radius R with constant speed. Then an experiment is to be performed entirely within the train without any measurement on objects outside the train. Such an experiment can tell both speed of the train and radius of the track.

[13] When a system is acted upon by external forces like friction etc, the conservation principle does not hold good,there will be impulse imparted and so we cant conserve momentum. This is case when a collision between two elastic balls take place on a rough horizontal table. The total momentum just after the collision will be different from the total momentum just before the collision. Here momentum is not conserved as there is external force friction is present.

[14] A heavy body is attached from a spring and is held at point A and is such that the spring is not slack nor is it stretched. It is then released. It goes down upto a point B and then it rises upto point C and executes an oscillatory motion between B and C. During the motion from A to C is first positive (from A to B) and then it is negative from B to A and again remains negative from A to C. SetId=184

[15] Since pseudo forces are not real forces, they do not affect the conservation laws and all the three conservation laws hold in noninertial frames.

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SetId=185

[1] If P and Q are the initial and the final points of a path of a particle,the displacement is the vector $\overrightarrow{PQ}$.

[2] The angular momentum of a given system of bodies shall remain conserved unless acted upon by an external unbalanced torque.

[3] Example where law of conservation of angular momentum holds:
Let us assume a student seated on a stool that can rotate freely about a vertical axis. The student has been set into rotation at a modest initial angular speed ω . He holds two dumbbells in his outstretched hands. His angular momentum vector L lies along the vertical rotation axis, pointing upwards. Now he pulls in his arms;this action reduces his rotational inertia from its value I_{initial} to a final value I_{final} because he moves the mass closer to the rotational axis. His rate of rotation increases markedly, from ω_{initial} to ω_{final}. The student can then slow down by extending his arms once more,moving the dumbbells outward. No external torque acts on the system consisting of the student, stool and the dumbbells. Thus the angular momentum of the system about the rotational axis remains constant. $I_{\text{initial}} * \omega_{\text{initial}} = I_{\text{final}} * \omega_{\text{final}}$.

[4] In the Sun Earth system the angular momentum of the Earth is conserved in every frame of reference

[5] The law of angular momentum of a is not applicable for the conical pendulum conserved w.r.t. the origin fixed at the point of suspension. SetId=185

[6] In the example of conical pendulum, the x and$y$ components of angular momentum change. This follows from the angular momentum conservation as the z components external torque is zero and horizontal components of torque are non zero.

[7] Law of conservation of momentum does not hold whenever an external force or impulse acts on the system. For example,when a body collides with earth then it bounces back to a lesser height as it loses some velocity.

In this example the momentum of a ball is not conserved due to impulsive force by ground in the normal direction.

However, strictly speaking the system that should be considered here is the ball-earth system and the total momentum is conserved.

[8] In order to apply the law of conservation of momentum we must first identify the system. Then even if there is no *net external forces* acting on the system, all the three conservation laws of momentum, angular momentum and energy may not hold due to presence of internal forces.

[9] A force whose work done is a path function is called a non-conservative force. All the forces which do not satisfy the definition of conservative forces are non-conservative in nature. The work done by these forces dissipates into heat energy, sound energy, light energy, etc. Therefore, law of conservation of mechanical energy cannot be applied to a system on which a non-conservative force is acting. No potential function can be defined for these forces.

SetId=185

[10] A satellite goes around the earth in a circular orbit of 600km with a time period of $5.8 \times 10^3 s$. Its motion will be uniform as it will cover equal distances in equal times.

[11] Displacements, being vector quantity can not compared with, a scalar quantity such as distance.

[12] Assume bullet train, moving with out any jerks, is going on a circular arc of radius R with constant speed. Then an experiment is to be performed entirely within the train without any measurement on objects outside the train. Such an experiment can tell only speed of the track.

[13] When we are in accelerating frame if we observe any collision between two bodies then the law of conservation of momentum does not hold in that frame of reference. On the other hand the law of conservation of momentum holds in all inertial frames.

[14] The kinetic energy of a body does not change if any one of the following is true
(i)force is always perpendicular to the velocity
(ii) the force is always perpendicular to the acceleration
(iii) the object remains stationary
(iv) the object moves in such a way that the point of application of the force remains fixed.

SetId=185

[15] A force is any interaction which tends to change the motion of an object. Newtons' second tell us that it is *equal* to the rate of change of momentum.It is a vector quantity. Real forces can be distinguished from pseudo forces because the pseudo forces always proportional to the mass of the body. All real forces, except the gravitational force, do not depend on the mass of the body.

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[1] If two bodies starting from a point A reach a point B, following different paths, their displacement will be, in general different, but the distances covered will always be the same.

[2] When the net external torque acting on a system about a given axis is zero, the total angular momentum of the system about that axis remains consant.

[3] A bob is attached to ceiling by a string and moves in a horizontal circular plane is an example. In this case the law of conservation of angular momentum does not hold.

[4] In the motion of earth around sun, the angular momentum of the earth about an axis passing through the sun and perpendicular to the plane of motion of earth is conserved.

[5] The law of angular momentum of a is not applicable for the conical pendulum conserved when the origin is chosen to be at the pendulum bob itself. SetId=186

[6] Example where law of conservation of angular momentum does not hold: A disc rotating on a horizontal rough surface will not have a constant angular momentum because there will be a constant torque by frictional force. Hence, its angular momentum will decrease, and the law of conservation of angular momentum does not apply.

[7] If a bullet hits a wooden board and gets embedded in the board, the total energy and the total momentum of the bullet and the board are conserved.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then check we should if the laws are applicable or not.

So if there is no *external force* acting on the system all the three quantities, total momentum, total angular momentum, and total kinetic energy will be conserved independent of the nature of forces.

SetId=186

[9] *Non conservative forces* are the type of forces in which the work done by the forces is purely dependent on the path taken by the body.Thus the net work done by the forces in cyclic path is never equal to zero.

[10] A uniform motion is defined to be the one in which a body covers equal distances in equal time intervals.

[11] Distance depends on the path where as the displacement depends on the end point only

[12] A particle is observed from two frames S_1 and S_2. The frame S_2 moves with respect to S_1 with an acceleration a. If F_1 and F_2 be the pseudoforces when seen from S_1 and S_2 respectively it is not possible to have $F_1 = F_2 = 0$

[13] When a freely falling body hits another rigid body in its path then momentum is not conserved as external force mg acts on both the bodies. The total momentum after the collision will be different from the total momentum before the hit.

[14] The total work done on a particle is always equal to the change in kinetic energy. SetId=186

[15] Examples of pseudoforce are Coriolis Force, Centrifugal Force, and magnetic force on currents.
Psuedo force also called as fictitious force is an apparent force that are needed for masses whose their motion is described using a non inertial frame of reference.

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[1] Displacement is equal to the vector difference $\vec{r}_f - \vec{r}_i$ of the position vectors of initial and final points. The distance covered will be $|\vec{r}_f - \vec{r}_i|$

[2] This law sates that when no net torque of all forces acts on a object or a system of objects then total angular momentum of system is conserved.The angular momentum before an event is equal to angular momentum after that event.mathematically explained by when, net torque=0 ;then, total angular momentum(L)=constant.

[3] Consider a disc rotating about an axis perpendicular to its plane. On placing a smaller disc with its surface parallel to the surface of the rotating disc, the angular momentum of the system of two discs remains constant as there is no external torque.

[4] For the motion of earth around sun, the angular momentum of the earth about the center of mass of the sun + earth system and perpendicular to the plane of motion of earth is conserved.

[5] The three components of angular momentum of a conical pendulum is conserved w.r.t. the origin at the position of the center of mass of the pendulum. SetId=187

[6] Example where law of conservation of angular momentum does not hold:Consider a vertical stick on the ground falling to a horizontal position. During the fall, the conservation of angular momentum applied at the point of rotation on the ground and perpendicular to the plane of the stick is not applicable as, the gravitational force which acts vertically downwards assumed at the centre of mass produces an external torque about the axis of rotation

[7] If a bullet hits a wooden board and gets embedded in the board, the total energy of the bullet and the board system is conserved but the total momentum is not conserved.

[8] If we want to apply the conservation laws of momentum, energy and angular momentum, we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *external force* acting on the system, the momentum and angular momentum will be conserved, and depending on the nature of the forces but total energy may or may not be conserved.

[9] Non-conservative forces are path-dependent forces, i.e. the work done on a body by these forces depends on the path taken by the body. Mechanical energy of a system is not conserved when a conservative force acts on it but the total energy is conserved. Therefore, the mechanical energy lost by the system is liberated in some other form such as light energy, heat energy, etc.

For example, when a body is moving along a surface, frictional force acts on the body as well. Due to this frictional force, the body loses its mechanical energy, and this loss is generally released in the form of heat energy to the surroundings. Thus, the mechanical energy will not be conserved and frictional force can be classified as a non-conservative force.

SetId=187

[10] A particle moves on a circular path. Then its speed, direction of force, velocity and acceleration must always change with time.

[11] Distance equal to zero $\Rightarrow$ displacement=0; but Displacement=0

[12] A particle is observed from two frames S_1 and S_2. The frame S_2 moves with respect to S_1 with an acceleration a. If F_1 and F_2 be the pseudoforces when seen from S_1 and S_2 respectively and if $F_1 = 0$ then we must have $F_2 \neq 0$

[13] .The law of conservation of momentum does not hold good when net external forces acting on the system is not zero.when two bodies collide law of conservation of momentum is applicable on system of two bodies but on not individual bodies because external impulse acts on them.

[14] A particle is acted upon by a force of constant magnitude which is always perpendicular to the velocity of the particle and the motion of the particle takes place in a plane, Then its kinetic energy, speed, velocity acceleration will not change. SetId=187

[15] Examples of pseudo-force are Coriolis Force, Centrifugal Force, Centripetal force and magnetic force on currents. The pseudo forces do not obey Newton's third law and therefore the total momentum does not appear to be conserved in a non-inertial frame.

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[1] Distance is equal to the length of the path covered. Displacement is the shortest distance between initial and final points.

[2] Statement of Law of Conservation of Angular Momentum:
Differentiating $\vec{L} = \vec{r} \times \vec{p}$ w.r.t, time,

$$\begin{aligned}\frac{dL}{dt} &= \frac{d\vec{r} \times \vec{p}}{dt} = \frac{d\vec{r}}{dt} \times \vec{p} + \vec{r} \times \frac{d\vec{p}}{dt} = \vec{v} \times (m\vec{v}) + \vec{r} \times \vec{F} \\ &= \vec{r} \times \vec{F} (\because v \times v = 0) \\ &= \vec{\tau}\end{aligned}$$

here $\vec{\tau}$ represents the net torque acting on a rigid body rotating about a fixed axis.This torque must take into account of all the forces, be it external or internal forces

[3] Consider a man standing on a spinning platform. Initially, the man spreads out his arms and he spins with a certain angular velocity. The next moment, he pulls his arms inwards keeping them close to his body. We will observe that the angular velocity with which he is spinning now increases. This phenomenon can be explained by the Law Of Conservation of Angular momentum. Initially, since his arms were spread wide, his moment of inertia was large. However, when he pulled them close to his body, his moment of inertia decreased.
In this example the angular velocity of the man increases and therefore the angular momentum also increases.The law of conservation of angular momentum does not apply because the torque of muscular forces is not zero.

[4] In the Sun Earth system the angular momentum of the Earth about the pole star is conserved

[5] Only the z component of the angular momentum of a conical pendulum is conserved w.r.t. the origin fixed at the point of suspension. SetId=188

[6] We have a conical pendulum .The forces acting on the bob are tension (along the direction of the string) and gravitational force acting in the vertically downward direction.we have an additional force called the drag force which is tangential to the motion of the bob and acts in the direction opposite to the motion of the bob.The axis of rotation passes through the hinge point and is vertical.The torque due to tension is 0 because the force passes through the axis of rotation.The torque due to mg is also zero since it is parallel to the axis of rotation.but the torque due to drag force is not zero.since the net external torque acting on the bob is not zero,therefore the law of conservation of angular momentum does not hold here

[7] If a bullet hits a wooden board and gets embedded in the board, both total energy and the total momentum of the bullet and the board are not conserved.

[8] To apply the conservation laws of momentum, energy and angular momentum, we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *external force* acting on the system, the energy and momentum will be conserved. However, depending on the nature of the system and of the forces, the total angular momentum may not be conserved.

[9] It is a force for which the work done by that force on an object or a particle in moving it between any two points depends on its path travelled.This force doesn't conserves the mechanical energy.The work done by a non-conservative force on an object in moving it in a circular path is not equal to zero.

SetId=188

[10] A particle moves on a circular path. Then its speed, direction offorce, can remain constant by velocity and acceleration must always change with time.

[11] If P and Q are the initial and the final points of a path of a particle, displacement is a vector whose direction is along PQ and has magnitude is equal to the length of line PQ

[12] If K is an inertial frame, any frame that moves w.r.t. the frame K with uniform velocity is also an inertial frame.

[13] A block moving in the air breaks up into two parts and the parts separate, then the total momentum must be the same before and after the break.

[14] The kinetic energy of a particle is continuously increasing with time, then the angle bewteen the net force and the velocity cannot be greater than or equal to 90^{o} at any time.

SetId=188

[15] FORCE is any interaction which tends to change the motion of an object.It has both magnitude and direction,making it a vector quantity.

A psuedo force is an apparent force that acts on all masses whose motion is described with respect to a non-inertial frame of reference like a rotating frame of reference.This force is needed by an observer in an non-inertial frame to make all the Newtons Laws of motion hold true.

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[1] Distance is a scalar quantity where as the displacement is a vector quantity.

[2] Statement of Law of Conservation of Angular Momentum: For a system of many particles The net torque due all the forces, be it external or internal forces. But as the torque due to all the internal forces cancel out, it sufficient to consider the external forces acting on the system.

[3] In the Sun-Earth system, angular momentum of the earth is not conserved but the total angular momentum of the sun and the earth is constant of motion.

[4] For the motion of earth around sun, the angular momentum of the sun about the center of mass of the sun + earth system and perpendicular to the orbital plane of earth is conserved.

For the motion of earth around sun, the angular momentum of the sun about and axis passing through the Earth and perpendicular to the orbital plane of motion of earth is conserved.

[5] The z component of angular momentum of a conical pendulum is not conserved w.r.t. the origin fixed at the point of suspension; but the x and y components are conserved.

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[6] When you release a toy gyroscope on its pedestal, it initially has no precessional rotation around that pedestal, i.e, the orientation of rotation is fixed. However, it instantaneously starts precessing around the pedestal. Both Kinetic Energy and Angular Momentum now exist where they did not exist a moment earlier. The Kinetic Energy is easy to explain, as appearing due to the body of the gyroscope dropping a tiny fraction of a millimeter in the Earth's gravitational field, giving up exactly the correct amount of Potential Energy. But the Angular Momentum of the Precession which just appeared, does not come from anywhere. This is therefore a Violation of the Conservation of Angular Momentum.

[7] There are certain situations where it appears that the law of conservation of linear momentum does not hold. For example if we take some amount of a substance like construction putty, cement, cake batter, playing dough,etc and drop it on the ground, it does not bounce back like a rubber ball would and hence the momentum it had before striking the ground seems to have been lost. Hence it appears that the law of conservation of linear momentum does not hold.

[8] In order to apply the law of conservation of momentum we must first identify the system. If there is no *external forces* acting on the system then conservation laws of momentum always holds. And depending on the nature of the system and of the forces, the total kinetic energy and the total angular momentum may not be conserved.

[9] Explain Nonconservative force: This force is just opposite to that of conservative force. The work done by this force depends on the path taken by the particle on which the force is applied.This force does not conserve mechanical energy.If a particle travels in a closed loop, the net work done by a non consevative force is non zero.

SetId=189

[10] A particle moves on a circular path. Then under suitable conditions its speed may remain constant, but the force, velocity and acceleration must always change with time.

[11] If P and Q are the initial and the final points of a path of a particle,the displacement is the vector $\overrightarrow{PQ}$.

[12] If K is an inertial frame, any frame that moves w.r.t. the frame K with uniform speed is also an inertial frame.

[13] A ball hits the floor and rebounds after an inelastic collision. In this case the total momentum of the ball before and after the collsion is conserved. Also the total enrgy of the ball and the earth remains the same

[14] A heavy body is attached from a spring and is held at point A and is such that the spring is not slack nor is it stretched. It is then released. It goes down upto a point B and then it rises upto point C and executes an oscillatory motion between B and C. During the motion from A to C is first positive (from A to B) and then it is negative from B to A and again remains negative from A to C.

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[15] FORCE is any interaction which tends to change the motion of an object.It has both magnitude and direction,making it a vector quantity. A pseudo-force F doesn't arise from any physical interaction between two objects, but rather from the acceleration 'a' of the non-inertial reference frame itself. These forces have no real existence but must be taken into account in an accelerating frame of reference to make all the three Newton's Laws of motion applicable to the system

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[1] The speed is rate of change of distance and the velocity is the rate of change of displacement.

[2] Depending on the torques acting on a system, the angular momentum can be conserved only in one or two directions, but may not be conserved in all. For instance, if an isolated body has no torque acting on it only in the direction along the Z axis, then the angular momentum is conserved only in that direction.

[3] Consider a disc and a man system. man is standing on center of the disc rotating with angular velocity.initially man folded his hand.when man stretches his hands then momentum of inertia of system increases.and angular velocity decreases.and total angular momentum remains constant.

[4] For the motion of earth around sun, the sum of angular momenta of the Sun and the Earth about the center of mass of the sun + earth system is conserved.

[5] Only the z component of angular momentum of a conical pendulum is conserved w.r.t. the origin fixed at the point of suspension. SetId=190

[6] There is no case where LAW OF CONSERVATION OF ANGULAR MOMENTUM does'nt hold.But there are cases where conservation of angular momentum does not hold.A body in vertical circular motion is an example where angular momentum is not conserved. Here the law of conservation does not apply.

[7] A tennis ball is dropped from height h and after hitting the ground and it bounces back and rises to the same height. In this case the momentum of the ball is conserved because (under ideal conditions) the momentum after it hits the ground will be equal to the momentum it had before hitting the ground.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then check if the laws is applicable or not.

So if there is no *net external force* acting on the system all the three conservation laws will hold.

[9] Non conservative force is the force in which the work done by a particle in going from one point to another is path dependent.

For non conservative forces mechanical energy is not conserved,mostly lost in the form of heat and light.The work done by a non conservative force is equal to the change in mechanical energy.

SetId=190 For non conservative force $E_{\text{initial}} > E_{\text{final}}$

[10] A particle moves on a circular path. Then under suitable conditions its speed and acceleration may remain constant, but the force, and velocity must always change with time.

[11] If two bodies starting from a point A reach a point B, following different paths, their displacement will be, in general different, but the distances covered will always be the same.

[12] A frame rotating w.r.t K with uniform angular velocity is also an inertial frame.

[13] In a head on elastic collision of two identical bodies of equal masses the velocities, the speeds, the momenta and the kinetic energy are all exchanged.

[14] The kinetic energy of a body does not change if any one of the following is true
(i)force is always perpendicular to the velocity
(ii) the force is always perpendicular to the acceleration
(iii) the object remains stationary
(iv) the object moves in such a way that the point of application of the force remains fixed. SetId=190

[15] FORCE is any interaction which tends to change the motion of an object.It has both magnitude and direction,making it a vector quantity.
A pseudo-force results from acceleration of the frame of reference in which the objects reside. It is taken into account so that Newton's second law isn't invalidated. The pseudo force acting on an object can always be mathematically expressed as the product of the mass of the object and the acceleration of the frame of reference.

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[1] For any type of translational motion of a body, the displacement cannot be zero, where as the distance travelled can be zero.

[2] According to Law of Conservation of Angular momentum,if no external torque acts on an object or system of objects,angular momentum of an object or system of objects remains CONSTANT or no change in angular momentum can occur.

Also it states that,only external torque can change angular momentm of the system where as the torque produced by internal forces can not change the angular momentum of the system

[3] The conservation of angular momentum of a system of bodies requires that the the sum of torque due to all forces be equal to zero. Now consider a situation where the forces are such that the sum of torques of external forces is zero w.r.t. some axes K. Since the value of torque depends of the choices of axes, the sum of torques due to all internal forces will depend on the choice of axes and in general it will be non zero. Therefore, for a system of several bodies, for a given choice of axes K, there will be situations when the total angular momentum may not be conserved.

[4] For the motion of the Earth around the sun, the total of angular momenta of the Earth and the Sun, about in a reference frame fixed in the pole star, is conserved.

[5] The projection of angular momentum of a conical pendulum in the horizontal plane is a constant of motion when the origin is chosen to be at fixed at the point of suspension.

SetId=191

[6] A sphere rolling on a rough surface.Due to friction there is external torque so the angular momentum changes which results in the slowing of the sphere. The angular momentum keeps changing. Even in case like this one, it is wrong to say that the Law of Angular Momentum Conservation does not hold.

[7] Law of conservation of momentum does not hold when Newton's laws are not valid, e.g. in a non-inertial frame of reference. For example, when we consider collision between two bodies in a non-inertial frame of reference, the law of conservation of momentum cannot be applied because there will be a pseudo force acting on the frame itself.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then check we should if the laws are applicable or not.

So if there is no *external force* acting on the system all the three quantities, total momentum is conserved. The total angular momentum is also because the torque of internal forces will be zero. The conservation of energy depends on the nature of forces. will be conserved.

[9] A force is said to be non-conservative, if the work done by the force is dependent on the path taken. It could also be defined as a force for which the work done during a cyclic process is non-zero. SetId=191

[10] When the force is kept constant as function of time, it is possible for a particle to move on a circular path in such a way that its speed remains constant, but the velocity and acceleration must always change with time.

[11] Distance is equal to the length of the path covered. Displacement is the shortest distance between initial and final points.

[12] The Newton's Laws of motion will hold in all frames which are at rest w.r.t. K but do not remain valid in a frame that move with respect to K.

[13] For a system of several particles the conservation of total linear momentum is equivalent to the statement that their centre of mass moves like a free particle.

[14] The total work done on a particle is always equal to the change in kinetic energy. SetId=191

[15] Explain Force:FORCE is any interaction which tends to change the motion of an object.It has both magnitude and direction,making it a vector quantity.
In the case of a non inertial frame, we can use the second law of motion by adding a pseudo force to the system which makes it an inertial frame of reference.

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[1] Displacements, being vector quantity can not compared with, a scalar quantity such as distance.

[2] The law of conservation of angular momentum states that when the net external torque acting on the system is zero, then the angular momentum of the system remains constant.both the initial and final momentum should be taken from a fixed inertial frame of reference provided.

[3] Example where law of conservation of angular momentum does not hold:
When there is external force like frictional force acting on a object when it is rotating we cannot use conservation of angular momentum as the friction force acting on the object produces an external torque.

[4] For the motion of the Earth around the sun, the total of angular momenta of the Earth and the Sun, is conserved in every inertial frame of reference; but the angular momentum of the Earth (or of the sun)is not conserved in every inertial frame.

[5] The law of angular momentum of a is not applicable for the conical pendulum conserved w.r.t. the origin fixed at the point of suspension. SetId=192

[6] Consider a rod of length l. Let us give an impulse to one end . Now the angular momentum about the oposite end is not zero since the impulse provides some torque . So the angular momentum is not conserved .

$$\text{torque} = \text{impulse} * \ell.$$

$d\ell/dt$ is not equal to zero and the law of conservation of angular momentum does not hold.

[7] If I throw a ball upward, it's speed decreases as it rises upwards. There is an external force (gravity) acting on the ball, so the momentum conservation law does not apply. Momentum of the ball is not conserved, however the momentum of the Earth-ball system is conserved as gravity will become an internal force in this case.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *net external force* acting on the system, the momentum is conserved. The definition of angular momentum and torque depends on the choice of axes, and therefore it may not be be conserved. The conservation of total energy holds only for conservative forces.

When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *net external force* acting on the system, the energy and momentum will be conserved. However, the total angular momentum may not be conserved because the torque may not be zero.

[9] a force is said to be non conservative if work done is dependent on the path of the particle.potential cannot be defined in the case of non conservative forces.work done in closed loop is not equal to zero.

SetId=192

[10] It is not possible for a particle to move on a circular path in such a way that its speed and force remains constant, and only the velocity and acceleration may (or may not) always change with time.

[11] Distance is a scalar quantity where as the displacement is a vector quantity.

[12] Staying inside a bullet train moving with constant velocity (no jerks etc) an experiment can always be performed which will tell us the numerical velocity of the bullet train

[13] The total mechanical energy of a system may not be conserved if there are no external forces and the internal forces are conservative.

[14] A particle is acted upon by a force of constant magnitude which is always perpendicular to the velocity of the particle and the motion of the particle takes place in a plane, Then its kinetic energy, speed, velocity acceleration will not change.

SetId=192

[15] For the Newton's Law of Motion to hold true,the physically apparent but nonexistent force needed by an observer in a non-inertial frame is called the pseudo force.
1) Caused by relative acceleration of the origin in a straight line
2) Centrifugal and Centripetal forces
3) Coriolis force
4) Euler force

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[1] Distance depends on the path where as the displacement depends on the end point only.

[2] The law of conservation of angular momentum states that The total angular momentum of a system is constant in both magnitude and direction if the resultant torque, of the external forces acting on the system, is zero.

[3] A bob attached to a ceiling by a string moving in a horizontal circular plane is an example where the total angular momentum of the bob about the point of suspension is not conserved. This is because the the torque due to the weight of the bob about the point of suspension does not vanish and has non zero horizontal component. Only the vertical component of the angular component is conserved.

[4] In the Sun Earth system the angular momentum of the Earth is conserved in every frame of reference

[5] The law of angular momentum of a is not applicable for the conical pendulum conserved when the origin is chosen to be at the pendulum bob itself. SetId=193

[6] Let us consider a rotating skew rod. In the absence of friction or any other drag force, the rod should continuously spin without stopping. Here the net torque about the axis of rotation is 0 and hence angular momentum is conserved. It therefore follows from law of conservation of angular momentum that a spinning skew rod will keep rotating with constant angular velocity if there is no external torque. So law of conservation of angular momentum does not hold.

[7] A soldier accelerating away, after detonating a bomb, will find that the total momentum of the fragments of the bomb is zero. This is an example where the law of conservation of momentum holds as the forces on the fragments are internal forces only and sum of all such forces is zero.

[8] In order to apply the law of conservation of momentum we must first identify the system. If there is no *net external forces* acting on the system then conservation laws of momentum always holds. The total energy and the total angular momentum may not be conserved.

[9] Explain Nonconservative Forces:

The forces that depend on the path taken by the particle are called non-conservative forces.

Mechanical energy is not conserved during the action of a non conservative force, instead, it is lost as other forms of enery like heat, light, etc.

Potential energy is not defined for a non-conservative force.

The initial and final kinetic energy in a closed loop is not equal.

The work done by a non conservative force in a closed loop is non zero. In practice, the net work is invariably negative.

Work done by a non conservative force cannot be completely recovered.

For a non conservative force,

$/text(KE)//_f//$+(PE)$//_f//$ = (KE)$_i$+(PE)$_i$//+//Work Done)//non-conservative force//

SetId=193

[10] For a particle moving on circle the acceleration is always constant in magnitude and directed towards the centre of the circle.

[11] Both displacement and distance tell us about the motion of a body but their study does not tell much about the forces on the body

[12] Staying inside a bullet train moving with constant velocity (no jerks etc) an experiment can always be performed which will tell us the numerical value of the acceleration of the bullet train

[13] When a bullet fired on a wooden block, some energy is transferred to the block and the total mechanical energy of the block and the bullet is conserved.

[14] The kinetic energy of a particle is continuously increasing with time, then the angle bewteen the net force and the velocity cannot be greater than or equal to 90^o at any time. SetId=193

[15] A force is any interaction which tends to change the motion of an object. It is also *defined* as rate of change of momentum.It is a vector quantity.

Pseudo-force is a fictitious force it is taken by an observer from non inertial frame of reference. This force arises from acceleration of reference frame that is a reference frame which is accelerating or rotating.

The equation of motion is then written by balancing all forces. As an example a particle moving in a circle is seen to be at rest by balancing the centripetal and centrifugal forces.

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SetId=194

[1] Distance equal to zero implies displacement=0; and Displacement=0 also implies distance = 0

[2] If the net external torque acting on a system is zero,the angular momentum L(vector) of the system remains constant,no matter what changes take place within the system.L(vector)=a constant (net external torque acting on system is zero)

[3] Law of conservation of angular momentum holds in case of long jump. When a athlete takes off from the ground in a running long jump, the forces on the launching foot give the athlete an angular momentum with a forward rotation around a horizontal axis. Such rotation would not allow the jumper to land properly. In the landing, the legs should be together and extended forward at an angle so that the heels mark the sand at the greatest distance. Once airborne, the angular momentum cannot change (it is conserved) because no external torque acts to change it. However, the jumper can shift most of the angular momentum to the arms by rotating them in windmill fashion. Then the body remains upright in the proper orientation of landing.

[4] In the motion of earth around sun, the angular momentum of the earth about an axis passing through the sun and perpendicular to the plane of motion of earth is conserved.

[5] The three components of angular momentum of a conical pendulum is conserved w.r.t. the origin at the position of the center of mass of the pendulum. SetId=194

[6] In the example of skew rod the angular velocity does not change even though the torque applied is nonzero. However there is no contradiction as in this case the law of conservation of momentum is not applicable. conservation is violated.

[7] There is no known exception to the law of conservation of momentum in classical mechanics However, an exception to conservation of energy in nuclear physics is observed. In nuclear reactions when two nuclei collide and their mass converts to energy and energy momentum are not conserved.

[8] In order to apply the law of conservation of momentum we must first identify the system. Then even if there is no *net external forces* acting on the system, all the three conservation laws of momentum, angular momentum and energy may not hold due to presence of internal forces.

[9] A non conservative force is one where the mechanical energy is not conserved.Here the work done is dependent on the path taken .Different amounts of work need to be done in different paths.Here potential energy would have no meaning as it would keep changing with the path.Here some amount of mechanical energy is lost as sound energy or heat energy and hence is not conserved.

SetId=194

[10] The motion of a bomb dropped from a plane does is not a uniform motion as it follows a parabolic path and not a straight line path.

[11] Displacement is the shortest distance between initial and final points with direction specified.

[12] Assume bullet train, moving with out any jerks, is going on a circular arc of radius R with constant speed. Then an experiment is to be performed entirely within the train without any measurement on objects outside the train. Such an experiment can tell only radius of the track.

[13] When a moving car hits a parked lorry and causes the parked lorry to move ,energy is transferred from moving the car to the lorry and the total energy of the lorry and the car is conserved.

[14] A heavy body is attached from a spring and is held at point A and is such that the spring is not slack nor is it stretched. It is then released. It goes down upto a point B and then it rises upto point C and executes an oscillatory motion between B and C. During the motion from A to C is first positive (from A to B) and then it is negative from B to A and again remains negative from A to C. SetId=194

[15] A psuedo force is an apparent force that acts on all masses whose motion is described with respect to a non-inertial frame of reference like a rotating frame of reference. This force is needed by an observer in an non-inertial frame to make all the Newtons second laws to write correct equation of motion..

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[1] If P and Q are the initial and the final points of a path of a particle, displacement is a vector whose direction is along PQ and has magnitude is equal to the length of line PQ

SetId=195

[2] The Law of conservation of angular momentum states that when no external torque acts on an object or a closed system of objects undergoing motion about a given axis, the change in angular momentum is zero. Therefore, considering an event where only internal torque or no torque is involved, the total angular momentum of the system before the event is equal to the total angular momentum after the event

[3] The total angular momentum of a body remains constant of motion when the net torque of the external forces acting on the body is zero.
In general, we have a system of particles such that the net torque of the external forces on the system, w.r.t. some axes K, is zero, the total angular momentum may not remain conserved, because the torque due to the internal forces may not be zero.

[4] For the motion of earth around sun, the angular momentum of the earth about the center of mass of the sun + earth system and perpendicular to the plane of motion of earth is conserved.

[5] Only the z component of the angular momentum of a conical pendulum is conserved w.r.t. the origin fixed at the point of suspension. SetId=195

[6] Example where law of conservation of angular momentum does not hold:If a particle undergoes conical motion and the only force acting on particle is central force like tension of the string.Then total external torque about fixed point A is zero,yet angular momentum is not conserved,as angular momentum keeps on changing direction.

[7] In a system of a canon and a canon ball, total momentum of the system is zero before canon ball is fired. After firing the canon ball, the momentum of the system seems to be conserved as the ball moves forward and the canon moves backward.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then check we should if the laws are applicable or not.

So if there is no *external force* acting on the system all the three quantities, total momentum, total angular momentum, and total kinetic energy will be conserved independent of the nature of forces.

[9] The force whose work depends on path taken is called a non conservative force.friction for example does less work on a book dragged across a table if the book is dragged straight across than if the book is dragged in a curved path.

SetId=195

[10] A wagon sliding on a roller coaster designed in such a way that the wagon covers equal distances in equal times. As the motion of the wagon is uniform, there will be no net force acting on it.

[11] Displacements, being vector quantity can not compared with, a scalar quantity such as distance.

[12] Assume bullet train, moving with out any jerks, is going on a circular arc of radius R with constant speed. Then an experiment is to be performed entirely within the train without any measurement on objects outside the train. Such an experiment can tell both speed of the train and radius of the track.

[13] When a bomb explodes the total mechanical energy is not conserved. But the total chemical energy and the mechanical energy is conserved.

[14] The kinetic energy of a body does not change if any one of the following is true
(i)force is always perpendicular to the velocity
(ii) the force is always perpendicular to the acceleration
(iii) the object remains stationary
(iv) the object moves in such a way that the point of application of the force remains fixed. SetId=195

[15] One indication that pseudo forces are NON-NEWTONIAN is that they violate Newton's III law and violate the Newton's third law.

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SetId=196

[1] If P and Q are the initial and the final points of a path of a particle,the displacement is the vector $\overrightarrow{PQ}$.

[2] The law of conservation of angular momentum states that when no external torque acts on an object or a closed system of objects, no change of angular momentum can occur. Hence, the angular momentum before an event involving only internal torques or no torques is equal to the angular momentum after the event . Angular momentum can be calculated with the help of the formula $L = I\omega$ where L stands for Angular momentum, I stands for moment of inertia and ω stands for angular velocity

[3] An example where law of conservation of angular momentum holds:
The Law of conservation of angular momentum holds in the case of a ballet dancer performing a pirouette.

When the dancer extends her arms outward, the angular velocity of her rotation decreases whereas when she keeps her arms close to her body, the angular velocity increases. This is because her moment of inertia changes as she moves her arms outward and inward. It can be noted that she as a system has no external torque acting upon her.

[4] In the Sun Earth system the angular momentum of the Earth about the pole star is conserved

[5] The z component of angular momentum of a conical pendulum is not conserved w.r.t. the origin fixed at the point of suspension; but the x and y components are conserved.

SetId=196

[6] A nonzero torque always causes the angular velocity to change, because a change in angular momentum means a change in angular velocity $L = I\omega$

[7] When applying the conservation laws of momentum, energy and angular momentum we must define the system first.Only then check if the laws is applicable or not.

As an example: when a ball is dropped from a height, it gains momentum down if we consider the ball as our system.This is because the force of gravity acts as an external force.

However, if we change our system and consider earth as a part of our system too, then the momentum remains conserved because the earth gains momentum up.

[8] If we want to apply the conservation laws of momentum, energy and angular momentum, we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *external force* acting on the system, the momentum and angular momentum will be conserved, and depending on the nature of the forces but total energy may or may not be conserved.

[9] ** Nonconservative force is a force in which the amount of work done by the force is dependent of the path taken to change a state of a system.

SetId=196

[10] A simple pendulum moves along a circular arc and does not have constant speed and therefore its motion is not uniform.

[11] Distance depends on the path where as the displacement depends on the end point only

[12] Assume bullet train, moving with out any jerks, is going on a circular arc of radius R with constant speed. Then an experiment is to be performed entirely within the train without any measurement on objects outside the train. Such an experiment can tell only speed of the track.

[13] When a ball rolls over a rough surface, it comes to stop after some time. This is because transational and rotational kinetic energy initially present in the ball continuosly gets converted to heat due to friction. When all the kinetic energy changes to heat, the ball stops. The total mechanical energy of the ball is not conserved.

[14] The total work done on a particle is always equal to the change in kinetic energy. SetId=196

[15] The apparent force which seems to act on an object in an accelerating frame of reference if we wish to describe the object's motion is called a pseudo force.Its a non-existent force used only to describe the motion completely using Newton's second law even though the agent causing the force is undefined.

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[1] If two bodies starting from a point A reach a point B, following different paths, their displacement will be, in general different, but the distances covered will always be the same.

[2] Newton's Second Law of Motion is defined by the expression $F = \frac{dp}{dT}$, where F gives the force vector acting on the system and p gives its momentum vector; in linear motion. A similar expression can be written to describe angular motion, i.e. : $\tau = \frac{dL}{dt}$, where τ is the external torque vector acting on the system, and L is the angular momentum.

If the external torque on the system is zero, then we get the expression as: dL/dt=0. This points out to the fact that, when no external torque is acting on the system, then its angular momentum is constant, no matter what changes occur in the system. This is the Law of Conservation Of Angular Momentum.

[3] In case of a skater, who can be considered an isolated system, so no torue will be acting on him/her. When the arms are extended, the moment of inertia is more. When his hands are closely held, the moment of inertia is lesser. Since the angular momentum is same, the angular acceleration changes accordingly.

[4] For the motion of earth around sun, the angular momentum of the sun about the center of mass of the sun + earth system and perpendicular to the orbital plane of earth is conserved.

For the motion of earth around sun, the angular momentum of the sun about and axis passing through the Earth and perpendicular to the orbital plane of motion of earth is conserved.

[5] Only the z component of angular momentum of a conical pendulum is conserved w.r.t. the origin fixed at the point of suspension.

SetId=197

[6] A nonzero torque always implies change in angular momentum and may not give rise to a change in magnitude of angular velocity. A non zero torque may mean change only the direction of the angular momentum and not the angular velocity.

[7] Statement: Law of Conservation of energy states that "ENERGY CAN NEITHER BE CREATED NOR DESTROYED",but it can be changed from one form to other.

EXPLANATION: Statement implies that the total amount of energy in an isolated system remains constant although it may change forms. viz, kinetic energy may change to potential;chemical to electrical energies etc.

[8] To apply the conservation laws of momentum, energy and angular momentum, we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *external force* acting on the system, the energy and momentum will be conserved. However, depending on the nature of the system and of the forces, the total angular momentum may not be conserved.

[9] Nonconservative force is any force where the work done by the force on the object depends on the path of motion of the object.the work done by the frictional force results in to loss of the energy of the system in the form of heat or other form of energy.

SetId=197

[10] A satellite goes around the earth in a circular orbit of 600km with a time period of $5.8 \times 10^3 s$. Its motion will be uniform as it will cover equal distances in equal times.

[11] Distance equal to zero $\Rightarrow$ displacement=0; but Displacement=0

[12] A particle is observed from two frames S_1 and S_2. The frame S_2 moves with respect to S_1 with an acceleration a. If F_1 and F_2 be the pseudoforces when seen from S_1 and S_2 respectively it is not possible to have $F_1 = F_2 = 0$

[13] Let us consider that a pendulum is oscillating moving in a vertical plane. Mean while let another bob which is attached to a spring and is executing a simple harmonic motion in horizontal direction comes and hits the pendulum. Here conservation of momentum does not hold good as tension(external force) is acting on the system.(pendulum)

[14] A particle is acted upon by a force of constant magnitude which is always perpendicular to the velocity of the particle and the motion of the particle takes place in a plane, Then its kinetic energy, speed, velocity acceleration will not change.

SetId=197

[15] The physically apparent, but nonexistent, force needed by an observer in a noninertial frame to make Newton's laws of motion hold true is called pseudoforce.

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SetId=198

[1] Displacement is equal to the vector difference $\vec{r}_f - \vec{r}_i$ of the position vectors of initial and final points. The distance covered will be $|\vec{r}_f - \vec{r}_i|$

[2] If the net external torque acting on a system is zero, the angular momentum L of the system remains constant, no matter what changes take place within the system.

$$\sum(T_{\text{ext}}) = \frac{dL}{dt}$$

The law states that when there is no net external torque, $\frac{dL}{dt}$ is zero implying that the total angular momentum of system is constant.

i.e. $L = a$ constant (isolated system)

[3] Example where law of conservation of angular momentum holds:
Let us assume a student seated on a stool that can rotate freely about a vertical axis. The student has been set into rotation at a modest initial angular speed ω . He holds two dumbbells in his outstretched hands. His angular momentum vector L lies along the vertical rotation axis, pointing upwards. Now he pulls in his arms;this action reduces his rotational inertia from its value I_{initial} to a final value I_{final} because he moves the mass closer to the rotational axis. His rate of rotation increases markedly, from ω_{initial} to ω_{final}. The student can then slow down by extending his arms once more,moving the dumbbells outward. No external torque acts on the system consisting of the student, stool and the dumbbells. Thus the angular momentum of the system about the rotational axis remains constant. $I_{\text{initial}} * \omega_{\text{initial}} = I_{\text{final}} * \omega_{\text{final}}$.

[4] For the motion of earth around sun, the sum of angular momenta of the Sun and the Earth about the center of mass of the sun + earth system is conserved.

[5] The projection of angular momentum of a conical pendulum in the horizontal plane is a constant of motion when the origin is chosen to be at fixed at the point of suspension. SetId=198

[6] In the example of a rotating skew rod the torque due to the external gravitational forces is zero , but the angular momentum is not constant Therefore the law of conservation of angular momentum is violated.

[7] Oscillating simple pendulum is a very good example where potential energy gets converted to kinetic energy and kinetic to potential energy. Some energy gets dissipated as heat if we consider air resistance. Energy as a whole is conserved if we consider universe as system, the energy has just changed its form.

[8] In order to apply the law of conservation of momentum we must first identify the system. If there is no *external forces* acting on the system then conservation laws of momentum always holds. And depending on the nature of the system and of the forces, the total kinetic energy and the total angular momentum may not be conserved.

[9] nonconservative force is any force ,where the work done by the force depends on the path of motion of the body.The work done by such a force is equal to the change in mechanical energy of the system.Energy mostly observed to be lost in form of heat, by the action of non conservative force.

SetId=198

[10] A uniform motion is defined to be the one in which a body covers equal distances in equal time intervals.

[11] If P and Q are the initial and the final points of a path of a particle, displacement is a vector whose direction is along PQ and has magnitude is equal to the length of line PQ

[12] A particle is observed from two frames S_1 and S_2. The frame S_2 moves with respect to S_1 with an acceleration a. If F_1 and F_2 be the pseudoforces when seen from S_1 and S_2 respectively and if $F_1 = 0$ then we must have $F_2 \neq 0$

[13] The law of conservation of momentum does not hold in relativistic situations, i.e., where the speeds of the masses involved are close to the speed of light.

[14] The kinetic energy of a particle is continuously increasing with time, then the angle bewteen the net force and the velocity cannot be greater than or equal to 90^{o} at any time.

SetId=198

[15] Pseudo forces come into picture when Newton's laws of motion have to be applied to describe the motion of bodies in non-inertial frames. These forces have no real existence.

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SetId=199

[1] Distance is equal to the length of the path covered. Displacement is the shortest distance between initial and final points.

[2] When the net external torque acting on a body or a system of bodies is zero about a particular axis, then the angular momentum of each body is conserved about that axis.

[3] A bob is attached to ceiling by a string and moves in a horizontal circular plane is an example. In this case the law of conservation of angular momentum does not hold.

[4] For the motion of the Earth around the sun, the total of angular momenta of the Earth and the Sun, about in a reference frame fixed in the pole star, is conserved.

[5] The law of angular momentum of a is not applicable for the conical pendulum conserved w.r.t. the origin fixed at the point of suspension. SetId=199

[6] In the example of skew rod, the angular momentum changes with time and there is a non zero torque coming from action of forces other than gravitational forces. Hence the law of conservation of angular momentum dos not apply.

[7] Law of conservation of momentum does not hold whenever an external force or impulse acts on the system. For example,when a body collides with earth then it bounces back to a lesser height as it loses some velocity.

In this example the momentum of a ball is not conserved due to impulsive force by ground in the normal direction.

However, strictly speaking the system that should be considered here is the ball-earth system and the total momentum is conserved.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then check if the laws is applicable or not.

So if there is no *net external force* acting on the system all the three conservation laws will hold.

[9] The work done by a "non-conservative" force does depend on the path taken. Non-conservative forces cannot be associated with a potential energy. If some of the internal forces of a system are non-conservative, the mechanical energy of the system is not constant.Work-energy theorem is valid even in the presence of some non-conservative forces.

SetId=199

[10] A particle moves on a circular path. Then its speed, direction of force, velocity and acceleration must always change with time.

[11] If P and Q are the initial and the final points of a path of a particle,the displacement is the vector $\overrightarrow{PQ}$.

[12] If K is an inertial frame, any frame that moves w.r.t. the frame K with uniform velocity is also an inertial frame.

[13] when we are in accelerating frame if we observe any collision between two bodies then the law of conservation of momentum does not hold in that frame of reference.

[14] A heavy body is attached from a spring and is held at point A and is such that the spring is not slack nor is it stretched. It is then released. It goes down upto a point B and then it rises upto point C and executes an oscillatory motion between B and C. During the motion from A to C is first positive (from A to B) and then it is negative from B to A and again remains negative from A to C. SetId=199

[15] In a non-inertial frame of reference the accelration of the body that we measure, is not the true acceleration, as the frame itself accelerates.Thus,force(F=ma) is also not the true force acting on the body.The extra force added to make it a true value is called pseudo force.Thus pseudo force does not really act on a body but just compensates the change produced by the non inertial frame, in true acceleration.

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SetId=200

[1] Distance is a scalar quantity where as the displacement is a vector quantity.

[2] The law of conservation of angular momentum states that in absence of an external torque on an object or a closed system of objects the total angular momentum of the system remains constant. Thus if $\vec{\tau} = 0 => \vec{L} =$ constant where τ is the torque and $\vec{L}$ is the angular momentum of the system.

[3] Consider a disc rotating about an axis perpendicular to its plane. On placing a smaller disc with its surface parallel to the surface of the rotating disc, the angular momentum of the system of two discs remains constant as there is no external torque.

[4] For the motion of the Earth around the sun, the total of angular momenta of the Earth and the Sun, is conserved in every inertial frame of reference; but the angular momentum of the Earth (or of the sun)is not conserved in every inertial frame.

[5] The law of angular momentum of a is not applicable for the conical pendulum conserved when the origin is chosen to be at the pendulum bob itself. SetId=200

[6] In the example of conical pendulum, the z- component of angular momentum does not change. This follows from the angular momentum conservation as there is no external torque.

[7] If a bullet hits a wooden board and gets embedded in the board, the total energy and the total momentum of the bullet and the board are conserved.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then check we should if the laws are applicable or not.

So if there is no *external force* acting on the system all the three quantities, total momentum is conserved. The total angular momentum is also because the torque of internal forces will be zero. The conservation of energy depends on the nature of forces. will be conserved.

[9] Non conservative forces are forces with the property that the work done by the force in moving a particle between two points is dependent on the path taken.Also the work done over a closed loop is not zero.Defining of scalar potential is not possible in case of non conservative forces because the change in potential energy between two points will depend on path taken.

SetId=200

[10] A particle moves on a circular path. Then its speed, direction offorce, can remain constant by velocity and acceleration must always change with time.

[11] If two bodies starting from a point A reach a point B, following different paths, their displacement will be, in general different, but the distances covered will always be the same.

[12] If K is an inertial frame, any frame that moves w.r.t. the frame K with uniform speed is also an inertial frame.

[13] Give an example where law of conservation of momentum does not hold all cases when seen from non inertial frame of references for example when we see two cars collide from a moving bus there momentum is not conserved

[14] The kinetic energy of a body does not change if any one of the following is true
(i)force is always perpendicular to the velocity
(ii) the force is always perpendicular to the acceleration
(iii) the object remains stationary
(iv) the object moves in such a way that the point of application of the force remains fixed. SetId=200

[15] A force is any interaction which tends to change the motion of an object. It is *equal to* the rate of change of momentum by Newton's second law.

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SetId=201

[1] The speed is rate of change of distance and the velocity is the rate of change of displacement.

[2] If no net external torque acts on a system, the total angular momentum of the system remains constant.

[3] Consider a man standing on a spinning platform. Initially, the man spreads out his arms and he spins with a certain angular velocity. The next moment, he pulls his arms inwards keeping them close to his body. We will observe that the angular velocity with which he is spinning now increases. This phenomenon can be explained by the Law Of Conservation of Angular momentum. Initially, since his arms were spread wide, his moment of inertia was large. However, when he pulled them close to his body, his moment of inertia decreased.
In this example the angular velocity of the man increases and therefore the angular momentum also increases.The law of conservation of angular momentum does not apply because the torque of muscular forces is not zero.

[4] In the Sun Earth system the angular momentum of the Earth is conserved in every frame of reference

[5] The three components of angular momentum of a conical pendulum is conserved w.r.t. the origin at the position of the center of mass of the pendulum. SetId=201

[6] In the example of conical pendulum, the x and$y$ components of angular momentum change. This follows from the angular momentum conservation as the z components external torque is zero and horizontal components of torque are non zero.

[7] If a bullet hits a wooden board and gets embedded in the board, the total energy of the bullet and the board system is conserved but the total momentum is not conserved.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *net external force* acting on the system, the momentum is conserved. The definition of angular momentum and torque depends on the choice of axes, and therefore it may not be be conserved. The conservation of total energy holds only for conservative forces.

When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *net external force* acting on the system, the energy and momentum will be conserved. However, the total angular momentum may not be conserved because the torque may not be zero.

[9] A non conservative force is the force with the property that the work done in moving a particle between two points is dependent of the path taken.If a particle travels in a closed path, the net work done(the some of the forces acting along the path multiplied by the distance travelled) by a non conservative force is non zero. When an object moves from one location to another, the force changes the potential energy of the object by an amount that depends on the path taken.Non conservative force depends only on the path followed by the object.

SetId=201

[10] A particle moves on a circular path. Then under suitable conditions its speed may remain constant, but the force, velocity and acceleration must always change with time.

[11] Distance is equal to the length of the path covered. Displacement is the shortest distance between initial and final points.

[12] A frame rotating w.r.t K with uniform angular velocity is also an inertial frame.

[13] When a tennis ball hits the ground at an oblique angle, the angle of reflection is equal to the angle of incidence. This is a simple consequence of conservation of horizontal component of momentum.

[14] The total work done on a particle is always equal to the change in kinetic energy. SetId=201

[15] Newton's laws are not valid on non-inertial frame of reference. So to validate Newton's laws of motion pseudo force (fictious or virtual force) is introduced.
Pseudo force acts in non-inertial frame. Its magnitude is always mass of the body multiplied by acceleration of the frame. It is always in direction opposite to the acceleration of the frame of reference. The resultant of pseudo forces and real forces is always zero.

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SetId=202

[1] For any type of translational motion of a body, the displacement cannot be zero, where as the distance travelled can be zero.

[2] The law of conservation of angular momentum states that when no external torque is applied on an object or a closed system of objects about an axis, the angular momentum about that axis remains constant.

[3] In the Sun-Earth system, angular momentum of the earth is not conserved but the total angular momentum of the sun and the earth is constant of motion.

[4] In the motion of earth around sun, the angular momentum of the earth about an axis passing through the sun and perpendicular to the plane of motion of earth is conserved.

[5] Only the z component of the angular momentum of a conical pendulum is conserved w.r.t. the origin fixed at the point of suspension. SetId=202

[6] Example where law of conservation of angular momentum does not hold: A disc rotating on a horizontal rough surface will not have a constant angular momentum because there will be a constant torque by frictional force. Hence, its angular momentum will decrease, and the law of conservation of angular momentum does not apply.

[7] If a bullet hits a wooden board and gets embedded in the board, both total energy and the total momentum of the bullet and the board are not conserved.

[8] In order to apply the law of conservation of momentum we must first identify the system. If there is no *net external forces* acting on the system then conservation laws of momentum always holds. The total energy and the total angular momentum may not be conserved.

SetId=202

[9] In this type of force the work done depends on the path taken by the body.Mechanical energy is not conserved in the system if non conservative force acts on it.

[10] A particle moves on a circular path. Then under suitable conditions its speed and acceleration may remain constant, but the force, and velocity must always change with time.

[11] Distance is a scalar quantity where as the displacement is a vector quantity.

[12] The Newton's Laws of motion will hold in all frames which are at rest w.r.t. K but do not remain valid in a frame that move with respect to K.

[13] when a ball is dropped from a height, it gains momentum down if we consider the ball as our system.This is because the force of gravity acts as an external force.

However, if we change our system and consider earth as a part of our system too, then the momentum remains conserved because the earth gains momentum up.

[14] A particle is acted upon by a force of constant magnitude which is always perpendicular to the velocity of the particle and the motion of the particle takes place in a plane, Then its kinetic energy, speed, velocity acceleration will not change. SetId=202

[15] These forces are non-real forces but must be taken into account while applying Newton's Law's of Motion in accelerating frame of reference as compared to an inertial frame of reference.

The centrifugal and centripetal forces are examples of pesudo-forces.

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Sem-I 2014-15 Mechanics Waves and Oscillations MM:15

ASSIGNMENT-II **Due On : Nov 18, 2014**

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SetId=203

[1] Displacements, being vector quantity can not compared with, a scalar quantity such as distance.

[2] The angular momentum of a given system of bodies shall remain conserved unless acted upon by an external unbalanced torque.

[3] Consider a disc and a man system. man is standing on center of the disc rotating with angular velocity.initially man folded his hand.when man stretches his hands then momentum of inertia of system increases.and angular velocity decreases.and total angular momentum remains constant.

[4] For the motion of earth around sun, the angular momentum of the earth about the center of mass of the sun + earth system and perpendicular to the plane of motion of earth is conserved.

[5] The z component of angular momentum of a conical pendulum is not conserved w.r.t. the origin fixed at the point of suspension; but the x and y components are conserved. SetId=203

[6] Example where law of conservation of angular momentum does not hold:Consider a vertical stick on the ground falling to a horizontal position. During the fall, the conservation of angular momentum applied at the point of rotation on the ground and perpendicular to the plane of the stick is not applicable as, the gravitational force which acts vertically downwards assumed at the centre of mass produces an external torque about the axis of rotation

[7] There are certain situations where it appears that the law of conservation of linear momentum does not hold. For example if we take some amount of a substance like construction putty, cement, cake batter, playing dough,etc and drop it on the ground, it does not bounce back like a rubber ball would and hence the momentum it had before striking the ground seems to have been lost. Hence it appears that the law of conservation of linear momentum does not hold.

[8] In order to apply the law of conservation of momentum we must first identify the system. Then even if there is no *net external forces* acting on the system, all the three conservation laws of momentum, angular momentum and energy may not hold due to presence of internal forces.

[9] A force is said to be a non-conservative force if the work done by the force in a closed path is non-zero;(i.e) the cyclic integral of the work done is non-zero.

Work done by a non-conservative force is equal to change in total energy of the system.Work-Energy theorem is not applicable in the case of a non-conservative force.Work done by conservative force depends on the path.It differs with the paths

SetId=203

taken by the partical even if the initial and final points are same.In case of non-conservative forces,the total mechanical energy is not constant as the energy is dissipated in various forms such as heat energy,sound energy,etc and cannot be recovered.

[10] When the force is kept constant as function of time, it is possible for a particle to move on a circular path in such a way that its speed remains constant, but the velocity and acceleration must always change with time.

[11] Both displacement and distance tell us about the motion of a body but their study does not tell much about the forces on the body

[12] Staying inside a bullet train moving with constant velocity (no jerks etc) an experiment can always be performed which will tell us the numerical velocity of the bullet train

[13] There is no known exception to the law of conservation of momentum in classical mechanics however when two bodies collide and their mass converts to energy, an exception in nuclear physics is observed. In real life this is observed in nuclear reactions at atomic level.

[14] The kinetic energy of a particle is continuously increasing with time, then the angle bewteen the net force and the velocity cannot be greater than or equal to 90^o at any time. SetId=203

[15] When observing our system from a reference frame which is accelerating compared to an inertial frame,in order to make it easier to apply newtons laws, we can apply a pseudo force on all objects in the universe proportional to their mass capable of causing an acceleration equal and opposite to that of our reference frame. Hence serving to in a way "stop"(or make inertial) our reference frame, and making it easier for us to investigate the motion.

This application of pseudo force doesn't change the motion of the object because just as we can choose an arbitrary reference frame, we can choose an arbitrary force to cause the same acceleration in every object in the whole universe without changing the relative motions of objects. (as all motion is truly relative, we will still get correct answers for our investigations.

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SetId=204

[1] Distance depends on the path where as the displacement depends on the end point only.

[2] When the net external torque acting on a system about a given axis is zero, the total angular momentum of the system about that axis remains consant.

[3] The conservation of angular momentum of a system of bodies requires that the the sum of torque due to all forces be equal to zero. Now consider a situation where the forces are such that the sum of torques of external forces is zero w.r.t. some axes K. Since the value of torque depends of the choices of axes, the sum of torques due to all internal forces will depend on the choice of axes and in general it will be non zero. Therefore, for a system of several bodies, for a given choice of axes K, there will be situations when the total angular momentum may not be conserved.

[4] In the Sun Earth system the angular momentum of the Earth about the pole star is conserved

[5] Only the z component of angular momentum of a conical pendulum is conserved w.r.t. the origin fixed at the point of suspension. SetId=204

[6] We have a conical pendulum .The forces acting on the bob are tension (along the direction of the string) and gravitational force acting in the vertically downward direction.we have an additional force called the drag force which is tangential to the motion of the bob and acts in the direction opposite to the motion of the bob.The axis of rotation passes through the hinge point and is vertical.The torque due to tension is 0 because the force passes through the axis of rotation.The torque due to mg is also zero since it is parallel to the axis of rotation.but the torque due to drag force is not zero.since the net external torque acting on the bob is not zero,therefore the law of conservation of angular momentum does not hold here

[7] A tennis ball is dropped from height h and after hitting the ground and it bounces back and rises to the same height. In this case the momentum of the ball is conserved because (under ideal conditions) the momentum after it hits the ground will be equal to the momentum it had before hitting the ground.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then check we should if the laws are applicable or not.

So if there is no *external force* acting on the system all the three quantities, total momentum, total angular momentum, and total kinetic energy will be conserved independent of the nature of forces.

SetId=204

[9] A non conservative force is a force where work done in moving a particle between two points depends on the path through which it is taken.Friction is an example of non conservative force.Mechanical energy is not conserved in case of a non conservative force

[10] It is not possible for a particle to move on a circular path in such a way that its speed and force remains constant, and only the velocity and acceleration may (or may not) always change with time.

[11] Displacement is the shortest distance between initial and final points with direction specified.

[12] Staying inside a bullet train moving with constant velocity (no jerks etc) an experiment can always be performed which will tell us the numerical value of the acceleration of the bullet train

[13] When there is no external forces act on a system of many particles, and there are only internal forces acting on the particles. The third law gives that the internal forces are pairwise equal and opposite.Thus the sum of internal forces is zero and the momentum of each particle is conserved.

[14] A heavy body is attached from a spring and is held at point A and is such that the spring is not slack nor is it stretched. It is then released. It goes down upto a point B and then it rises upto point C and executes an oscillatory motion between B and C. During the motion from A to C is first positive (from A to B) and then it is negative from B to A and again remains negative from A to C. SetId=204

[15] Various types of forces in nature can be grouped in four categories:
(a)Gravitational; (b)Electromagnetic; (c)Nuclear; (d)Weak
There are also some non-fundamental forces such as:
(i)Normal reaction on bodies in contact with surfaces , (ii) Friction,(iii) Tension,(iv)Elastic force.

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SetId=205

[1] Distance equal to zero implies displacement=0; and Displacement=0 also implies distance = 0

[2] This law sates that when no net torque of all forces acts on a object or a system of objects then total angular momentum of system is conserved.The angular momentum before an event is equal to angular momentum after that event.mathematically explained by when, net torque=0 ;then, total angular momentum(L)=constant.

[3] Example where law of conservation of angular momentum does not hold:
When there is external force like frictional force acting on a object when it is rotating we cannot use conservation of angular momentum as the friction force acting on the object produces an external torque.

[4] For the motion of earth around sun, the angular momentum of the sun about the center of mass of the sun + earth system and perpendicular to the orbital plane of earth is conserved.

For the motion of earth around sun, the angular momentum of the sun about and axis passing through the Earth and perpendicular to the orbital plane of motion of earth is conserved.

[5] The projection of angular momentum of a conical pendulum in the horizontal plane is a constant of motion when the origin is chosen to be at fixed at the point of suspension.

SetId=205

[6] When you release a toy gyroscope on its pedestal, it initially has no precessional rotation around that pedestal, i.e, the orientation of rotation is fixed. However, it instantaneously starts precessing around the pedestal. Both Kinetic Energy and Angular Momentum now exist where they did not exist a moment earlier. The Kinetic Energy is easy to explain, as appearing due to the body of the gyroscope dropping a tiny fraction of a millimeter in the Earth's gravitational field, giving up exactly the correct amount of Potential Energy. But the Angular Momentum of the Precession which just appeared, does not come from anywhere. This is therefore a Violation of the Conservation of Angular Momentum.

[7] Law of conservation of momentum does not hold when Newton's laws are not valid, e.g. in a non-inertial frame of reference. For example, when we consider collision between two bodies in a non-inertial frame of reference, the law of conservation of momentum cannot be applied because there will be a pseudo force acting on the frame itself.

[8] If we want to apply the conservation laws of momentum, energy and angular momentum, we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *external force* acting on the system, the momentum and angular momentum will be conserved, and depending on the nature of the forces but total energy may or may not be conserved.

[9] A force:A force is said to be a *non-//**conservative force* if the*/ work done by it in a closed path is/*/ non-zero./For such forces,potential energy cannot be defined. SetId=205

[10] For a particle moving on circle the acceleration is always constant in magnitude and directed towards the centre of the circle.

[11] Displacements, being vector quantity can not compared with, a scalar quantity such as distance.

[12] Assume bullet train, moving with out any jerks, is going on a circular arc of radius R with constant speed. Then an experiment is to be performed entirely within the train without any measurement on objects outside the train. Such an experiment can tell only radius of the track.

[13] During collision of billiard balls momentum is conserved. During explosion of a bomb also momentum is conserved and the total momentum of the fragments of bomb will be zero. This is because all the forces are only internal forces.

[14] The kinetic energy of a body does not change if any one of the following is true
(i)force is always perpendicular to the velocity
(ii) the force is always perpendicular to the acceleration
(iii) the object remains stationary
(iv) the object moves in such a way that the point of application of the force remains fixed. SetId=205

[15] A force is agency that which changes or tends to change the state of rest or motion of a body.

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[1] If P and Q are the initial and the final points of a path of a particle, displacement is a vector whose direction is along PQ and has magnitude is equal to the length of line PQ

SetId=206

[2] Statement of Law of Conservation of Angular Momentum:
Differentiating $\vec{L} = \vec{r} \times \vec{p}$ w.r.t, time,

$$\begin{aligned} \frac{dL}{dt} &= \frac{d\vec{r} \times \vec{p}}{dt} = \frac{d\vec{r}}{dt} \times \vec{p} + \vec{r} \times \frac{d\vec{p}}{dt} = \vec{v} \times (m\vec{v}) + \vec{r} \times \vec{F} \\ &= \vec{r} \times \vec{F} (\because v \times v = 0) \\ &= \vec{\tau} \end{aligned}$$

here $\vec{\tau}$ represents the net torque acting on a rigid body rotating about a fixed axis.This torque must take into account of all the forces, be it external or internal forces

[3] A bob attached to a ceiling by a string moving in a horizontal circular plane is an example where the total angular momentum of the bob about the point of suspension is not conserved. This is because the the torque due to the weight of the bob about the point of suspension does not vanish and has non zero horizontal component. Only the vertical component of the angular component is conserved.

[4] For the motion of earth around sun, the sum of angular momenta of the Sun and the Earth about the center of mass of the sun + earth system is conserved.

[5] The law of angular momentum of a is not applicable for the conical pendulum conserved w.r.t. the origin fixed at the point of suspension. SetId=206

[6] There is no case where LAW OF CONSERVATION OF ANGULAR MOMENTUM does'nt hold.But there are cases where conservation of angular momentum does not hold.A body in vertical circular motion is an example where angular momentum is not conserved. Here the law of conservation does not apply.

[7] If I throw a ball upward, it's speed decreases as it rises upwards. There is an external force (gravity) acting on the ball, so the momentum conservation law does not apply. Momentum of the ball is not conserved, however the momentum of the Earth-ball system is conserved as gravity will become an internal force in this case.

[8] To apply the conservation laws of momentum, energy and angular momentum, we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *external force* acting on the system, the energy and momentum will be conserved. However, depending on the nature of the system and of the forces, the total angular momentum may not be conserved.

[9] A force that is not conservative is nonconservative force. The work done by a noconservative force cannot be represented by a potential energy function. That is work done by a nonconservative force is dependent on the path through which the system is moved. Some nonconservative forces cause the mechanical energy to be lost or dissipiated. Such forces are called dissipiative forces. There is no way to get back the lost mechanical energy. Nonconservative forces can also increase the mechanical energy. This is arrived from the concept of irreversible process.

SetId=206

[10] The motion of a bomb dropped from a plane does is not a uniform motion as it follows a parabolic path and not a straight line path.

[11] Distance depends on the path where as the displacement depends on the end point only

[12] Assume bullet train, moving with out any jerks, is going on a circular arc of radius R with constant speed. Then an experiment is to be performed entirely within the train without any measurement on objects outside the train. Such an experiment can tell both speed of the train and radius of the track.

[13] Give an example where law of conservation of momentum holds: A mass exploding into several pieces in a conservative field like gravitational field(if air resistance is neglected), obeys law of conservation of momentum. If air resistance cannot be neglected then the law of conservation of momentum will not hold.

[14] The total work done on a particle is always equal to the change in kinetic energy. SetId=206

[15] The forces may be of the following two types - *Contact forces* (those that act when bodies are in physical contact) eg. friction, normal reaction, bouyancy etc. and*Action-at-a-distance forces* (those that act when bodies are not in contact) eg. Gravity, electostatic forces, magnetic forces etc. There At the root level, forces are of the following fundamental types :- (a) *Gravitational forces* - weakest of all forces, always attractive
(b) *Electromagnetic forces* - stronger than gravitational forces, can be attractive or repulsive,
(c) *Nuclear forces* - exist at atomic level, have very short range,
(d) *Weak nuclear forces* associated with beta particle emission

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SetId=207

[1] If P and Q are the initial and the final points of a path of a particle,the displacement is the vector $\overrightarrow{PQ}$.

[2] Statement of Law of Conservation of Angular Momentum: For a system of many particles The net torque due all the forces, be it external or internal forces. But as the torque due to all the internal forces cancel out, it sufficient to consider the external forces acting on the system.

[3] Law of conservation of angular momentum holds in case of long jump. When a athlete takes off from the ground in a running long jump, the forces on the launching foot give the athlete an angular momentum with a forward rotation around a horizontal axis. Such rotation would not allow the jumper to land properly. In the landing, the legs should be together and extended forward at an angle so that the heels mark the sand at the greatest distance. Once airborne, the angular momentum cannot change (it is conserved) because no external torque acts to change it. However, the jumper can shift most of the angular momentum to the arms by rotating them in windmill fashion. Then the body remains upright in the proper orientation of landing.

[4] For the motion of the Earth around the sun, the total of angular momenta of the Earth and the Sun, about in a reference frame fixed in the pole star, is conserved.

[5] The law of angular momentum of a is not applicable for the conical pendulum conserved when the origin is chosen to be at the pendulum bob itself. SetId=207

[6] A sphere rolling on a rough surface.Due to friction there is external torque so the angular momentum changes which results in the slowing of the sphere. The angular momentum keeps changing. Even in case like this one, it is wrong to say that the Law of Angular Momentum Conservation does not hold.

[7] A soldier accelerating away, after detonating a bomb, will find that the total momentum of the fragments of the bomb is zero. This is an example where the law of conservation of momentum holds as the forces on the fragments are internal forces only and sum of all such forces is zero.

[8] In order to apply the law of conservation of momentum we must first identify the system. If there is no *external forces* acting on the system then conservation laws of momentum always holds. And depending on the nature of the system and of the forces, the total kinetic energy and the total angular momentum may not be conserved.

[9] Nonconservative forces are forces, such that the work done by these forces are path dependent. Work done by these forces around a close path is not necessarily equal

to zero. Hence if a particle is acted on by a non-conservative force and that particle returns to its original position, that particle will experience a net loss of energy. Energy will thus not be conserved for particle. Potential Energy can not be defined for these type of forces. SetId=207

[10] A wagon sliding on a roller coaster designed in such a way that the wagon covers equal distances in equal times. As the motion of the wagon is uniform, there will be no net force acting on it.

[11] Distance equal to zero $\Rightarrow$ displacement=0; but Displacement=0

[12] Assume bullet train, moving with out any jerks, is going on a circular arc of radius R with constant speed. Then an experiment is to be performed entirely within the train without any measurement on objects outside the train. Such an experiment can tell only speed of the track.

[13] Also a good example of law of conservation momentum can be seen when a bullet from a rifle is fired.As the bullet is fired and gets out of the rifle, the rifle gives a backward jerk due to the phenomenon of conservation of momentum.

[14] A particle is acted upon by a force of constant magnitude which is always perpendicular to the velocity of the particle and the motion of the particle takes place in a plane, Then its kinetic energy, speed, velocity acceleration will not change. SetId=207

[15] The main differences between force and pseudo force are -
(1) Forces have a real presence while pseudo forces don't.
(2) Forces can be accounted for by Newton's laws.
(3) Pseudo forces are only taken into account when the reference frame is accelerated.

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ASSIGNMENT-II **Due On : Nov 18, 2014**

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SetId=208

[1] If two bodies starting from a point A reach a point B, following different paths, their displacement will be, in general different, but the distances covered will always be the same.

[2] Depending on the torques acting on a system, the angular momentum can be conserved only in one or two directions, but may not be conserved in all. For instance, if an isolated body has no torque acting on it only in the direction along the Z axis, then the angular momentum is conserved only in that direction.

[3] The total angular momentum of a body remains constant of motion when the net torque of the external forces acting on the body is zero.
In general, we have a system of particles such that the net torque of the external forces on the system, w.r.t. some axes K, is zero, the total angular momentum may not remain conserved, because the torque due to the internal forces may not be zero.

[4] For the motion of the Earth around the sun, the total of angular momenta of the Earth and the Sun, is conserved in every inertial frame of reference; but the angular momentum of the Earth (or of the sun)is not conserved in every inertial frame.

[5] The three components of angular momentum of a conical pendulum is conserved w.r.t. the origin at the position of the center of mass of the pendulum. SetId=208

[6] Consider a rod of length l. Let us give an impulse to one end . Now the angular momentum about the oposite end is not zero since the impulse provides some torque . So the angular momentum is not conserved .

$$\text{torque} = \text{impulse} * \ell.$$

$d\ell/dt$ is not equal to zero and the law of conservation of angular momentum does not hold.

[7] There is no known exception to the law of conservation of momentum in classical mechanics However, an exception to conservation of energy in nuclear physics is observed. In nuclear reactions when two nuclei collide and their mass converts to energy and energy momentum are not conserved.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then check if the laws is applicable or not.

So if there is no *net external force* acting on the system all the three conservation laws will hold.

[9] Non Conservative force is a force with the property that workdone in moving an object from one point to another is dependent on the path taken .

Non Conservative Force can arise in classical physics due to neglected degrees of freedom or time dependent potentials.

Friction may be treated without resorting the use of non conservative forces by considering the motion of individual molecules.

SetId=208

[10] A simple pendulum moves along a circular arc and does not have constant speed and therefore its motion is not uniform.

[11] If P and Q are the initial and the final points of a path of a particle, displacement is a vector whose direction is along PQ and has magnitude is equal to the length of line PQ

[12] A particle is observed from two frames S_1 and S_2. The frame S_2 moves with respect to S_1 with an acceleration a. If F_1 and F_2 be the pseudoforces when seen from S_1 and S_2 respectively it is not possible to have $F_1 = F_2 = 0$

[13] when a man walks on the ice slab where friction does not exist between the ice block and the floor but between the feet of the man and the slab the slab moves back as per the law of conservation of momentum

[14] The kinetic energy of a particle is continuously increasing with time, then the angle bewteen the net force and the velocity cannot be greater than or equal to 90° at any time.

SetId=208

[15] A force is any interaction which tends to change the motion of an object. It is also *defined* as rate of change of momentum. It is a vector quantity.

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Assignment-II **Due On : Nov 18, 2014**

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SetId=209

[1] Displacement is equal to the vector difference $\vec{r}_f - \vec{r}_i$ of the position vectors of initial and final points. The distance covered will be $|\vec{r}_f - \vec{r}_i|$

[2] According to Law of Conservation of Angular momentum,if no external torque acts on an object or system of objects,angular momentum of an object or system of objects remains CONSTANT or no change in angular momentum can occur.

Also it states that,only external torque can change angular momentm of the system where as the torque produced by internal forces can not change the angular momentum of the system

[3] An example where law of conservation of angular momentum holds:
The Law of conservation of angular momentum holds in the case of a ballet dancer performing a pirouette.

When the dancer extends her arms outward, the angular velocity of her rotation decreases whereas when she keeps her arms close to her body, the angular velocity increases. This is because her moment of inertia changes as she moves her arms outward and inward. It can be noted that she as a system has no external torque acting upon her.

[4] In the Sun Earth system the angular momentum of the Earth is conserved in every frame of reference

[5] Only the z component of the angular momentum of a conical pendulum is conserved w.r.t. the origin fixed at the point of suspension. SetId=209

[6] Let us consider a rotating skew rod. In the absence of friction or any other drag force, the rod should continuously spin without stopping. Here the net torque about the axis of rotation is 0 and hence angular momentum is conserved. It therefore follows from law of conservation of angular momentum that a spinning skew rod will keep rotating with constant angular velocity if there is no external torque. So law of conservation of angular momentum does not hold.

[7] In a system of a canon and a canon ball, total momentum of the system is zero before canon ball is fired. After firing the canon ball, the momentum of the system seems to be conserved as the ball moves forward and the canon moves backward.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then check we should if the laws are applicable or not.

So if there is no *external force* acting on the system all the three quantities, total momentum is conserved. The total angular momentum is also because the torque of internal forces will be zero. The conservation of energy depends on the nature of forces. will be conserved.

[9] A non-conservative force is a force with the property that the work done in moving a particle between two points is dependent of the path taken . Mostly the enery of the particle in a non conservative force field dissipates in the form of heat or sound . Since the lost energy cannot be bought back ,conservation of mechanical energy does not hold true .

SetId=209

[10] A satellite goes around the earth in a circular orbit of 600km with a time period of $5.8 \times 10^3 s$. Its motion will be uniform as it will cover equal distances in equal times.

[11] If P and Q are the initial and the final points of a path of a particle,the displacement is the vector $\overrightarrow{PQ}$.

[12] A particle is observed from two frames S_1 and S_2. The frame S_2 moves with respect to S_1 with an acceleration a. If F_1 and F_2 be the pseudoforces when seen from S_1 and S_2 respectively and if $F_1 = 0$ then we must have $F_2 \neq 0$

[13] When a freely falling rigid body collides another body in its path momentum the system of two particles is not conserved in the collision as there is external force mg acting on the system.

[14] A heavy body is attached from a spring and is held at point A and is such that the spring is not slack nor is it stretched. It is then released. It goes down upto a point B and then it rises upto point C and executes an oscillatory motion between B and C. During the motion from A to C is first positive (from A to B) and then it is negative from B to A and again remains negative from A to C.

SetId=209

[15] Explain Pseudo Force: While applying Newton's laws of motion in non-inertial frame of reference it gives answers which contradict observations. Thus, to account for this,using Newton's Laws, we introduce a "fake" or pseudo force which gives answers that match the observations in a non-inertial frame.

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SetId=210

[1] Distance is equal to the length of the path covered. Displacement is the shortest distance between initial and final points.

[2] The law of conservation of angular momentum states that when the net external torque acting on the system is zero, then the angular momentum of the system remains constant.both the initial and final momentum should be taken from a fixed inertial frame of reference provided.

[3] In case of a skater, who can be considered an isolated system, so no torue will be acting on him/her. When the arms are extended, the moment of inertia is more. When his hands are closely held, the moment of inertia is lesser. Since the angular momentum is same, the angular acceleration changes accordingly.

[4] In the motion of earth around sun, the angular momentum of the earth about an axis passing through the sun and perpendicular to the plane of motion of earth is conserved.

[5] The z component of angular momentum of a conical pendulum is not conserved w.r.t. the origin fixed at the point of suspension; but the x and y components are conserved. SetId=210

[6] In the example of skew rod the angular velocity does not change even though the torque applied is nonzero. However there is no contradiction as in this case the law of conservation of momentum is not applicable. conservation is violated.

[7] When applying the conservation laws of momentum, energy and angular momentum we must define the system first.Only then check if the laws is applicable or not.

As an example: when a ball is dropped from a height, it gains momentum down if we consider the ball as our system.This is because the force of gravity acts as an external force.

However, if we change our system and consider earth as a part of our system too, then the momentum remains conserved because the earth gains momentum up.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *net external force* acting on the system, the momentum is conserved. The definition of angular momentum and torque depends on the choice of axes, and therefore it may not be be conserved. The conservation of total energy holds only for conservative forces.

When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *net external force* acting on the system, the energy and momentum will be conserved. However, the total angular momentum may not be conserved because the torque may not be zero.

[9] If the work done by a force depends on the path followed by the particle, it is called a Non conservative force. Work done by a non conservative force is not zero in round trip.

SetId=210

[10] A uniform motion is defined to be the one in which a body covers equal distances in equal time intervals.

[11] If two bodies starting from a point A reach a point B, following different paths, their displacement will be, in general different, but the distances covered will always be the same.

[12] If K is an inertial frame, any frame that moves w.r.t. the frame K with uniform velocity is also an inertial frame.

[13] If we take some amount of a substance like construction putty, cement, cake batter, playing dough,etc and drop it on the ground, it does not bounce back, like a rubber ball would bounce, and hence the momentum it had before striking the ground seems to have been lost. Hence it appears that the law of conservation of linear momentum does not hold.

[14] The kinetic energy of a body does not change if any one of the following is true
(i)force is always perpendicular to the velocity
(ii) the force is always perpendicular to the acceleration
(iii) the object remains stationary
(iv) the object moves in such a way that the point of application of the force remains fixed.

SetId=210

[15] When a train is at rest and a ball is hung from the ceiling with a string, an observer in the train sees that the string is vertical. But when the train starts moving, the observer sees that the string makes an angle with the vertical and is tilted in forward direction . This means that some force other than gravity and tension must act on the ball. That force is the pseudo force.

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SetId=211

[1] Distance is a scalar quantity where as the displacement is a vector quantity.

[2] The law of conservation of angular momentum states that The total angular momentum of a system is constant in both magnitude and direction if the resultant torque, of the external forces acting on the system, is zero.

[3] Example where law of conservation of angular momentum holds:
Let us assume a student seated on a stool that can rotate freely about a vertical axis. The student has been set into rotation at a modest initial angular speed ω . He holds two dumbbells in his outstretched hands. His angular momentum vector L lies along the vertical rotation axis, pointing upwards. Now he pulls in his arms;this action reduces his rotational inertia from its value I_{initial} to a final value I_{final} because he moves the mass closer to the rotational axis. His rate of rotation increases markedly, from ω_{initial} to ω_{final}. The student can then slow down by extending his arms once more,moving the dumbbells outward. No external torque acts on the system consisting of the student, stool and the dumbbells. Thus the angular momentum of the system about the rotational axis remains constant. $I_{\text{initial}} * \omega_{\text{initial}} = I_{\text{final}} * \omega_{\text{final}}$.

[4] For the motion of earth around sun, the angular momentum of the earth about the center of mass of the sun + earth system and perpendicular to the plane of motion of earth is conserved.

[5] Only the z component of angular momentum of a conical pendulum is conserved w.r.t. the origin fixed at the point of suspension. SetId=211

[6] Example where law of conservation of angular momentum does not hold:If a particle undergoes conical motion and the only force acting on particle is central force like tension of the string.Then total external torque about fixed point A is zero,yet angular momentum is not conserved,as angular momentum keeps on changing direction.

[7] Statement: Law of Conservation of energy states that "ENERGY CAN NEITHER BE CREATED NOR DESTROYED",but it can be changed from one form to other.

EXPLANATION: Statement implies that the total amount of energy in an isolated system remains constant although it may change forms. viz, kinetic energy may change to potential;chemical to electrical energies etc.

[8] In order to apply the law of conservation of momentum we must first identify the system. If there is no *net external forces* acting on the system then conservation laws of momentum always holds. The total energy and the total angular momentum may not be conserved.

SetId=211

[9] The workdone by a non conservative force is dependant on its path. the work varies as the path varies.

[10] A particle moves on a circular path. Then its speed, direction of force, velocity and acceleration must always change with time.

[11] Distance is equal to the length of the path covered. Displacement is the shortest distance between initial and final points.

[12] If K is an inertial frame, any frame that moves w.r.t. the frame K with uniform speed is also an inertial frame.

[13] When we consider collision between two bodies in a non-inertial frame of reference, the law of conservation of momentum cannot be applied because there will be a pseudo force acting on the frame itself.

[14] The total work done on a particle is always equal to the change in kinetic energy. SetId=211

[15] Since newton's laws are not valid in non-inertial frames, pseudoforces (which do not exist in reality) are used to help us formualate and use Newton's laws of motion in non-inertial frames.

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SetId=212

[1] The speed is rate of change of distance and the velocity is the rate of change of displacement.

[2] If the net external torque acting on a system is zero,the angular momentum L(vector) of the system remains constant,no matter what changes take place within the system.L(vector)=a constant (net external torque acting on system is zero)

[3] A bob is attached to ceiling by a string and moves in a horizontal circular plane is an example. In this case the law of conservation of angular momentum does not hold.

[4] In the Sun Earth system the angular momentum of the Earth about the pole star is conserved

[5] The projection of angular momentum of a conical pendulum in the horizontal plane is a constant of motion when the origin is chosen to be at fixed at the point of suspension. SetId=212

[6] A nonzero torque always causes the angular velocity to change, because a change in angular momentum means a change in angular velocity $L = I\omega$

[7] Oscillating simple pendulum is a very good example where potential energy gets converted to kinetic energy and kinetic to potential energy. Some energy gets dissipated as heat if we consider air resistance. Energy as a whole is conserved if we consider universe as system, the energy has just changed its form.

[8] In order to apply the law of conservation of momentum we must first identify the system. Then even if there is no *net external forces* acting on the system, all the three conservation laws of momentum, angular momentum and energy may not hold due to presence of internal forces.

SetId=212

[9] A non conservative force is a force with the property that the work done in moving a particle between two points is dependent on the path followed.

[10] A particle moves on a circular path. Then its speed, direction offorce, can remain constant by velocity and acceleration must always change with time.

[11] Distance is a scalar quantity where as the displacement is a vector quantity.

[12] A frame rotating w.r.t K with uniform angular velocity is also an inertial frame.

[13] When a system is acted upon by external forces like friction etc, the conservation principle does not hold good,there will be impulse imparted and so we cant conserve momentum. This is case when a collision between two elastic balls take place on a rough horizontal table. The total momentum just after the collision will be different from the total momentum just before the collision. Here momentum is not conserved as there is external force friction is present.

[14] A particle is acted upon by a force of constant magnitude which is always perpendicular to the velocity of the particle and the motion of the particle takes place in a plane, Then its kinetic energy, speed, velocity acceleration will not change. SetId=212

[15] Force is defined as the rate of change of linear momentum. In other words it is the agency which changes or tends to change the (a) State of rest; (b)State of uniform motion (c) Direction of body's motion; (d) Shape of the body

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SetId=213

[1] For any type of translational motion of a body, the displacement cannot be zero, where as the distance travelled can be zero.

[2] The Law of conservation of angular momentum states that when no external torque acts on an object or a closed system of objects undergoing motion about a given axis, the change in angular momentum is zero. Therefore, considering an event where only internal torque or no torque is involved, the total angular momentum of the system before the event is equal to the total angular momentum after the event

[3] Consider a disc rotating about an axis perpendicular to its plane. On placing a smaller disc with its surface parallel to the surface of the rotating disc, the angular momentum of the system of two discs remains constant as there is no external torque.

[4] For the motion of earth around sun, the angular momentum of the sun about the center of mass of the sun + earth system and perpendicular to the orbital plane of earth is conserved.

For the motion of earth around sun, the angular momentum of the sun about and axis passing through the Earth and perpendicular to the orbital plane of motion of earth is conserved.

[5] The law of angular momentum of a is not applicable for the conical pendulum conserved w.r.t. the origin fixed at the point of suspension. SetId=213

[6] A nonzero torque always implies change in angular momentum and may not give rise to a change in magnitude of angular velocity. A non zero torque may mean change only the direction of the angular momentum and not the angular velocity.

[7] Law of conservation of momentum does not hold whenever an external force or impulse acts on the system. For example,when a body collides with earth then it bounces back to a lesser height as it loses some velocity.

In this example the momentum of a ball is not conserved due to impulsive force by ground in the normal direction.

However, strictly speaking the system that should be considered here is the ball-earth system and the total momentum is conserved.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then check we should if the laws are applicable or not.

So if there is no *external force* acting on the system all the three quantities, total momentum, total angular momentum, and total kinetic energy will be conserved independent of the nature of forces.

[9] A non conservative force is a force with the property that the work done in moving a particle between two points is dependent of the taken path.

Friction, for example, does less work on a book dragged across a table if the book is dragged straight across than if the book is dragged in a curved path.

To write the equation for conservation of energy for non conservative forces we need to include the work done by the non conservative force also.This is because forces like friction liberate heat which are not included in the mechanical energy.

SetId=213

[10] A particle moves on a circular path. Then under suitable conditions its speed may remain constant, but the force, velocity and acceleration must always change with time.

[11] Both displacement and distance tell us about the motion of a body but their study does not tell much about the forces on the body

[12] The Newton's Laws of motion will hold in all frames which are at rest w.r.t. K but do not remain valid in a frame that move with respect to K.

[13] When we are in accelerating frame if we observe any collision between two bodies then the law of conservation of momentum does not hold in that frame of reference. On the other hand the law of conservation of momentum holds in all inertial frames.

[14] The kinetic energy of a particle is continuously increasing with time, then the angle bewteen the net force and the velocity cannot be greater than or equal to 90° at any time. SetId=213

[15] Real forces have their origin in matter such as electricity, gravitation etc., while pseudo forces are caused by inertial motion.

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SetId=214

[1] Displacements, being vector quantity can not compared with, a scalar quantity such as distance.

[2] The law of conservation of angular momentum states that when no external torque acts on an object or a closed system of objects, no change of angular momentum can occur. Hence, the angular momentum before an event involving only internal torques or no torques is equal to the angular momentum after the event . Angular momentum can be calculated with the help of the formula $L = I\omega$ where L stands for Angular momentum, I stands for moment of inertia and ω stands for angular velocity

[3] Consider a man standing on a spinning platform. Initially, the man spreads out his arms and he spins with a certain angular velocity. The next moment, he pulls his arms inwards keeping them close to his body. We will observe that the angular velocity with which he is spinning now increases. This phenomenon can be explained by the Law Of Conservation of Angular momentum. Initially, since his arms were spread wide, his moment of inertia was large. However, when he pulled them close to his body, his moment of inertia decreased.
In this example the angular velocity of the man increases and therefore the angular momentum also increases.The law of conservation of angular momentum does not apply because the torque of muscular forces is not zero.

[4] For the motion of earth around sun, the sum of angular momenta of the Sun and the Earth about the center of mass of the sun + earth system is conserved.

[5] The law of angular momentum of a is not applicable for the conical pendulum conserved when the origin is chosen to be at the pendulum bob itself. SetId=214

[6] In the example of a rotating skew rod the torque due to the external gravitational forces is zero , but the angular momentum is not constant Therefore the law of conservation of angular momentum is violated.

[7] If a bullet hits a wooden board and gets embedded in the board, the total energy and the total momentum of the bullet and the board are conserved.

[8] If we want to apply the conservation laws of momentum, energy and angular momentum, we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *external force* acting on the system, the momentum and angular momentum will be conserved, and depending on the nature of the forces but total energy may or may not be conserved.

[9] A non conservative force is a force with the property that the work done in moving a particle between two points is dependent of the taken path.

Friction, for example, does less work on a book dragged across a table if the book is dragged straight across than if the book is dragged in a curved path.

To write the equation for conservation of energy for nonconservative forces we need toinclude the work done by the non conservative force also.This is because forces like friction liberate heat which are not included in the mechanical energy.

SetId=214

[10] A particle moves on a circular path. Then under suitable conditions its speed and acceleration may remain constant, but the force, and velocity must always change with time.

[11] Displacement is the shortest distance between initial and final points with direction specified.

[12] Staying inside a bullet train moving with constant velocity (no jerks etc) an experiment can always be performed which will tell us the numerical velocity of the bullet train

[13] When a freely falling body hits another rigid body in its path then momentum is not conserved as external force mg acts on both the bodies. The total momentum after the collision will be different from the total momentum before the hit.

[14] A heavy body is attached from a spring and is held at point A and is such that the spring is not slack nor is it stretched. It is then released. It goes down upto a point B and then it rises upto point C and executes an oscillatory motion between B and C. During the motion from A to C is first positive (from A to B) and then it is negative from B to A and again remains negative from A to C. SetId=214

[15] 1)When we start rolling a body on a rough ground, it stops rolling after certain period because of frictional force.
2)When we leave a body from a certain height, it falls due to the act of gravitational force.

1)When a body is rotating in a circular path due to the centrifugal force which is the pseudo force. 2) When the lift is accelerating upwards, the upwards force felt by passengers a pseudo force.

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SetId=215

[1] Distance depends on the path where as the displacement depends on the end point only.

[2] Newton's Second Law of Motion is defined by the expression $F = \frac{dp}{dT}$, where F gives the force vector acting on the system and p gives its momentum vector; in linear motion. A similar expression can be written to describe angular motion, i.e. : $\tau = \frac{dL}{dt}$, where τ is the external torque vector acting on the system, and L is the angular momentum.

If the external torque on the system is zero, then we get the expression as: dL/dt=0. This points out to the fact that, when no external torque is acting on the system, then its angular momentum is constant, no matter what changes occur in the system. This is the Law of Conservation Of Angular Momentum.

[3] In the Sun-Earth system, angular momentum of the earth is not conserved but the total angular momentum of the sun and the earth is constant of motion.

[4] For the motion of the Earth around the sun, the total of angular momenta of the Earth and the Sun, about in a reference frame fixed in the pole star, is conserved.

[5] The three components of angular momentum of a conical pendulum is conserved w.r.t. the origin at the position of the center of mass of the pendulum. SetId=215

[6] In the example of skew rod, the angular momentum changes with time and there is a non zero torque coming from action of forces other than gravitational forces. Hence the law of conservation of angular momentum dos not apply.

[7] If a bullet hits a wooden board and gets embedded in the board, the total energy of the bullet and the board system is conserved but the total momentum is not conserved.

[8] To apply the conservation laws of momentum, energy and angular momentum, we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *external force* acting on the system, the energy and momentum will be conserved. However, depending on the nature of the system and of the forces, the total angular momentum may not be conserved.

[9] The non conservative force is a force with a property thet the work done between two points depends on path taken. If a particle moves along a curve path, to know about the work done by a non conservative force we should have the equation of the path along which the particle had move.The work done would be

WORK = INTEGRAL (F.dx)

The equation of conservation of mechanical energy for a non conservative force would be

SetId=215

$$KE_{\text{final}} + PE_{final} = KE_{initial} + PE_{initial} + W_{nc}$$

[10] When the force is kept constant as function of time, it is possible for a particle to move on a circular path in such a way that its speed remains constant, but the velocity and acceleration must always change with time.

[11] Displacements, being vector quantity can not compared with, a scalar quantity such as distance.

[12] Staying inside a bullet train moving with constant velocity (no jerks etc) an experiment can always be performed which will tell us the numerical value of the acceleration of the bullet train

[13] .The law of conservation of momentum does not hold good when net external forces acting on the system is not zero.when two bodies collide law of conservation of momentum is applicable on system of two bodies but on not individual bodies because external impulse acts on them.

[14] The kinetic energy of a body does not change if any one of the following is true
(i)force is always perpendicular to the velocity
(ii) the force is always perpendicular to the acceleration
(iii) the object remains stationary
(iv) the object moves in such a way that the point of application of the force remains fixed. SetId=215

[15] Newton's first law defines inertial frame. An inertial frame is a frame in which the first law hold. It also makes it possible to compare and tell two force being equal or not. The second law defines the force.

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SetId=216

[1] Distance equal to zero implies displacement=0; and Displacement=0 also implies distance = 0

[2] If the net external torque acting on a system is zero, the angular momentum L of the system remains constant, no matter what changes take place within the system.

$$\sum(T_{\text{ext}}) = \frac{dL}{dt}$$

The law states that when there is no net external torque, $\frac{dL}{dt}$ is zero implying that the total angular momentum of system is constant.

i.e. $L = a$ constant (isolated system)

[3] Consider a disc and a man system. man is standing on center of the disc rotating with angular velocity.initially man folded his hand.when man stretches his hands then momentum of inertia of system increases.and angular velocity decreases.and total angular momentum remains constant.

[4] For the motion of the Earth around the sun, the total of angular momenta of the Earth and the Sun, is conserved in every inertial frame of reference; but the angular momentum of the Earth (or of the sun)is not conserved in every inertial frame.

[5] Only the z component of the angular momentum of a conical pendulum is conserved w.r.t. the origin fixed at the point of suspension. SetId=216

[6] In the example of conical pendulum, the z- component of angular momentum does not change. This follows from the angular momentum conservation as there is no external torque.

[7] If a bullet hits a wooden board and gets embedded in the board, both total energy and the total momentum of the bullet and the board are not conserved.

[8] In order to apply the law of conservation of momentum we must first identify the system. If there is no *external forces* acting on the system then conservation laws of momentum always holds. And depending on the nature of the system and of the forces, the total kinetic energy and the total angular momentum may not be conserved.

[9] Nonconservative forces arise due to neglected degrees of freedom or from time dependent potentials. The work done by a nonconservative force depends upon the path taken. It causes a change in the mechanical energy of the system. It adds or removes mechanical energy from a system.

SetId=216

[10] It is not possible for a particle to move on a circular path in such a way that its speed and force remains constant, and only the velocity and acceleration may (or may not) always change with time.

[11] Distance depends on the path where as the displacement depends on the end point only

[12] Assume bullet train, moving with out any jerks, is going on a circular arc of radius R with constant speed. Then an experiment is to be performed entirely within the train without any measurement on objects outside the train. Such an experiment can tell only radius of the track.

[13] A block moving in the air breaks up into two parts and the parts separate, then the total momentum must be the same before and after the break.

[14] The total work done on a particle is always equal to the change in kinetic energy. SetId=216

[15] The magnitude of the pseudo force arising in a non-inertial frame is always equal to the mass of the body under consideration multiplied by the acceleration of the frame of reference and the direction of pseudoforce is always opposite to the direction of acceleration of the frame.

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[1] If P and Q are the initial and the final points of a path of a particle, displacement is a vector whose direction is along PQ and has magnitude is equal to the length of line PQ

SetId=217

[2] When the net external torque acting on a body or a system of bodies is zero about a particular axis, then the angular momentum of each body is conserved about that axis.

[3] The conservation of angular momentum of a system of bodies requires that the the sum of torque due to <u>all forces</u> be equal to zero. Now consider a situation where the forces are such that the sum of torques of external forces is zero w.r.t. some axes K. Since the value of torque depends of the choices of axes, the sum of torques due to all <u>internal forces</u> will depend on the choice of axes and in general it will be non zero. Therefore, for a system of several bodies, for a given choice of axes K, there will be situations when the total angular momentum may not be conserved.

[4] In the Sun Earth system the angular momentum of the Earth is conserved in every frame of reference

[5] The z component of angular momentum of a conical pendulum is not conserved w.r.t. the origin fixed at the point of suspension; but the x and y components are conserved.

SetId=217

[6] In the example of conical pendulum, the x and$y$ components of angular momentum change. This follows from the angular momentum conservation as the z components external torque is zero and horizontal components of torque are non zero.

[7] There are certain situations where it appears that the law of conservation of linear momentum does not hold. For example if we take some amount of a substance like construction putty, cement, cake batter, playing dough,etc and drop it on the ground, it does not bounce back like a rubber ball would and hence the momentum it had before striking the ground seems to have been lost. Hence it appears that the law of conservation of linear momentum does not hold.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then check if the laws is applicable or not.

So if there is no *net external force* acting on the system all the three conservation laws will hold.

[9] The work done by a *Nonconservative Force *is not recoverable*.*The work done by a *Non Conservative force* is usually dissipated in the form of Heat and Sound.

SetId=217

Non conservative force *cannot* be expressed in the form of *Potential Energy*.

[10] For a particle moving on circle the acceleration is always constant in magnitude and directed towards the centre of the circle.

[11] Distance equal to zero $\Rightarrow$ displacement=0; but Displacement=0

[12] Assume bullet train, moving with out any jerks, is going on a circular arc of radius R with constant speed. Then an experiment is to be performed entirely within the train without any measurement on objects outside the train. Such an experiment can tell both speed of the train and radius of the track.

[13] A ball hits the floor and rebounds after an inelastic collision. In this case the total momentum of the ball before and after the collsion is conserved. Also the total enrgy of the ball and the earth remains the same

[14] A particle is acted upon by a force of constant magnitude which is always perpendicular to the velocity of the particle and the motion of the particle takes place in a plane, Then its kinetic energy, speed, velocity acceleration will not change. SetId=217

[15] A force is any interaction which tends to change the motion of an object. It is also *defined* as rate of change of momentum.It is a vector quantity.
A physically apparent but nonexistent force felt by an observer in a noninertial frame (that is, a frame undergoing acceleration).

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SetId=218

[1] If P and Q are the initial and the final points of a path of a particle,the displacement is the vector $\overrightarrow{PQ}$.

[2] The law of conservation of angular momentum states that in absence of an external torque on an object or a closed system of objects the total angular momentum of the system remains constant. Thus if $\vec{\tau} = 0 => \vec{L} =$ constant where τ is the torque and $\vec{L}$ is the angular momentum of the system.

[3] Example where law of conservation of angular momentum does not hold:
When there is external force like frictional force acting on a object when it is rotating we cannot use conservation of angular momentum as the friction force acting on the object produces an external torque.

[4] In the motion of earth around sun, the angular momentum of the earth about an axis passing through the sun and perpendicular to the plane of motion of earth is conserved.

[5] Only the z component of angular momentum of a conical pendulum is conserved w.r.t. the origin fixed at the point of suspension. SetId=218

[6] Example where law of conservation of angular momentum does not hold: A disc rotating on a horizontal rough surface will not have a constant angular momentum because there will be a constant torque by frictional force. Hence, its angular momentum will decrease, and the law of conservation of angular momentum does not apply.

[7] A tennis ball is dropped from height h and after hitting the ground and it bounces back and rises to the same height. In this case the momentum of the ball is conserved because (under ideal conditions) the momentum after it hits the ground will be equal to the momentum it had before hitting the ground.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then check we should if the laws are applicable or not.

So if there is no *external force* acting on the system all the three quantities, total momentum is conserved. The total angular momentum is also because the torque of internal forces will be zero. The conservation of energy depends on the nature of forces. will be conserved.

[9] * A non conservative force is a force that acts on a particle(or point), such that the work done by this force in moving this particle from one point to another is */dependent of path taken/* that is the work done depends on the path itself. * For example frictional force is non conservative because the work done by friction

always acts in the direction of travel and therefore depends on length L of the path
SetId=218 taken.

[10] The motion of a bomb dropped from a plane does is not a uniform motion as it follows a parabolic path and not a straight line path.

[11] If P and Q are the initial and the final points of a path of a particle, displacement is a vector whose direction is along PQ and has magnitude is equal to the length of line PQ

[12] Assume bullet train, moving with out any jerks, is going on a circular arc of radius R with constant speed. Then an experiment is to be performed entirely within the train without any measurement on objects outside the train. Such an experiment can tell only speed of the track.

[13] In a head on elastic collision of two identical bodies of equal masses the velocities, the speeds, the momenta and the kinetic energy are all exchanged.

[14] The kinetic energy of a particle is continuously increasing with time, then the angle bewteen the net force and the velocity cannot be greater than or equal to 90° at any time. SetId=218

[15] Psuedo Force is defined as an apparent force that acts in only non-inertial frames. Pseudo Forces are also called Fictitious Forces. It is an Imaginary force. It is independent of mass.

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SetId=219

[1] If two bodies starting from a point A reach a point B, following different paths, their displacement will be, in general different, but the distances covered will always be the same.

[2] If no net external torque acts on a system, the total angular momentum of the system remains constant.

[3] A bob attached to a ceiling by a string moving in a horizontal circular plane is an example where the total angular momentum of the bob about the point of suspension is not conserved. This is because the the torque due to the weight of the bob about the point of suspension does not vanish and has non zero horizontal component. Only the vertical component of the angular component is conserved.

[4] For the motion of earth around sun, the angular momentum of the earth about the center of mass of the sun + earth system and perpendicular to the plane of motion of earth is conserved.

[5] The projection of angular momentum of a conical pendulum in the horizontal plane is a constant of motion when the origin is chosen to be at fixed at the point of suspension.

SetId=219

[6] Example where law of conservation of angular momentum does not hold:Consider a vertical stick on the ground falling to a horizontal position. During the fall, the conservation of angular momentum applied at the point of rotation on the ground and perpendicular to the plane of the stick is not applicable as, the gravitational force which acts vertically downwards assumed at the centre of mass produces an external torque about the axis of rotation

[7] Law of conservation of momentum does not hold when Newton's laws are not valid, e.g. in a non-inertial frame of reference. For example, when we consider collision between two bodies in a non-inertial frame of reference, the law of conservation of momentum cannot be applied because there will be a pseudo force acting on the frame itself.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *net external force* acting on the system, the momentum is conserved. The definition of angular momentum and torque depends on the choice of axes, and therefore it may not be be conserved. The conservation of total energy holds only for conservative forces.

When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *net external force* acting on the system, the energy and momentum will be conserved. However, the total angular momentum may not be conserved because the torque may not be zero.

[9] A force with the property that the work done in moving a particle is dependent on the path followed. The work done by a conservative force in moving a body from an initial location to a final location is dependent on the path taken between the two points

SetId=219

[10] A wagon sliding on a roller coaster designed in such a way that the wagon covers equal distances in equal times. As the motion of the wagon is uniform, there will be no net force acting on it.

[11] If P and Q are the initial and the final points of a path of a particle,the displacement is the vector $\overrightarrow{PQ}$.

[12] A particle is observed from two frames S_1 and S_2. The frame S_2 moves with respect to S_1 with an acceleration a. If F_1 and F_2 be the pseudoforces when seen from S_1 and S_2 respectively it is not possible to have $F_1 = F_2 = 0$

[13] For a system of several particles the conservation of total linear momentum is equivalent to the statement that their centre of mass moves like a free particle.

[14] A heavy body is attached from a spring and is held at point A and is such that the spring is not slack nor is it stretched. It is then released. It goes down upto a point B and then it rises upto point C and executes an oscillatory motion between B and C. During the motion from A to C is first positive (from A to B) and then it is negative from B to A and again remains negative from A to C.

SetId=219

[15] Psuedo Force is defined as an apparent force that acts in only non-inertial frames. Pseudo Forces are also called Fictious Forces. It is an Imaginary force. It is always proportional to mass. It is sometimes dependent on speed.

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[1] Displacement is equal to the vector difference $\vec{r}_f - \vec{r}_i$ of the position vectors of initial and final points. The distance covered will be $|\vec{r}_f - \vec{r}_i|$

[2] The law of conservation of angular momentum states that when no external torque is applied on an object or a closed system of objects about an axis, the angular momentum about that axis remains constant.

[3] Law of conservation of angular momentum holds in case of long jump. When a athlete takes off from the ground in a running long jump, the forces on the launching foot give the athlete an angular momentum with a forward rotation around a horizontal axis. Such rotation would not allow the jumper to land properly. In the landing, the legs should be together and extended forward at an angle so that the heels mark the sand at the greatest distance. Once airborne, the angular momentum cannot change (it is conserved) because no external torque acts to change it. However, the jumper can shift most of the angular momentum to the arms by rotating them in windmill fashion. Then the body remains upright in the proper orientation of landing.

[4] In the Sun Earth system the angular momentum of the Earth about the pole star is conserved

[5] The law of angular momentum of a is not applicable for the conical pendulum conserved w.r.t. the origin fixed at the point of suspension. SetId=220

[6] We have a conical pendulum .The forces acting on the bob are tension (along the direction of the string) and gravitational force acting in the vertically downward direction.we have an additional force called the drag force which is tangential to the motion of the bob and acts in the direction opposite to the motion of the bob.The axis of rotation passes through the hinge point and is vertical.The torque due to tension is 0 because the force passes through the axis of rotation.The torque due to mg is also zero since it is parallel to the axis of rotation.but the torque due to drag force is not zero.since the net external torque acting on the bob is not zero,therefore the law of conservation of angular momentum does not hold here

[7] If I throw a ball upward, it's speed decreases as it rises upwards. There is an external force (gravity) acting on the ball, so the momentum conservation law does not apply. Momentum of the ball is not conserved, however the momentum of the Earth-ball system is conserved as gravity will become an internal force in this case.

[8] In order to apply the law of conservation of momentum we must first identify the system. If there is no *net external forces* acting on the system then conservation laws of momentum always holds. The total energy and the total angular momentum may not be conserved.

[9] The work done by non conservative force is dependent on the path taken by the particle in reaching final position from initial position. Non conservative force depends on the distance travelled by the particle

SetId=220

[10] A simple pendulum moves along a circular arc and does not have constant speed and therefore its motion is not uniform.

[11] If two bodies starting from a point A reach a point B, following different paths, their displacement will be, in general different, but the distances covered will always be the same.

[12] A particle is observed from two frames S_1 and S_2. The frame S_2 moves with respect to S_1 with an acceleration a. If F_1 and F_2 be the pseudoforces when seen from S_1 and S_2 respectively and if $F_1 = 0$ then we must have $F_2 \neq 0$

[13] The total mechanical energy of a system may not be conserved if there are no external forces and the internal forces are conservative.

[14] The kinetic energy of a body does not change if any one of the following is true
(i)force is always perpendicular to the velocity
(ii) the force is always perpendicular to the acceleration
(iii) the object remains stationary
(iv) the object moves in such a way that the point of application of the force remains fixed.

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[15] Since pseudo forces are not real forces, they do not affect the conservation laws and all the three conservation laws hold in noninertial frames.

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[1] Distance is equal to the length of the path covered. Displacement is the shortest distance between initial and final points.

[2] The angular momentum of a given system of bodies shall remain conserved unless acted upon by an external unbalanced torque.

[3] The total angular momentum of a body remains constant of motion when the net torque of the external forces acting on the body is zero.
In general, we have a system of particles such that the net torque of the external forces on the system, w.r.t. some axes K, is zero, the total angular momentum may not remain conserved, because the torque due to the internal forces may not be zero.

[4] For the motion of earth around sun, the angular momentum of the sun about the center of mass of the sun + earth system and perpendicular to the orbital plane of earth is conserved.

For the motion of earth around sun, the angular momentum of the sun about and axis passing through the Earth and perpendicular to the orbital plane of motion of earth is conserved.

[5] The law of angular momentum of a is not applicable for the conical pendulum conserved when the origin is chosen to be at the pendulum bob itself. SetId=221

[6] When you release a toy gyroscope on its pedestal, it initially has no precessional rotation around that pedestal, i.e, the orientation of rotation is fixed. However, it instantaneously starts precessing around the pedestal. Both Kinetic Energy and Angular Momentum now exist where they did not exist a moment earlier. The Kinetic Energy is easy to explain, as appearing due to the body of the gyroscope dropping a tiny fraction of a millimeter in the Earth's gravitational field, giving up exactly the correct amount of Potential Energy. But the Angular Momentum of the Precession which just appeared, does not come from anywhere. This is therefore a Violation of the Conservation of Angular Momentum.

[7] A soldier accelerating away, after detonating a bomb, will find that the total momentum of the fragments of the bomb is zero. This is an example where the law of conservation of momentum holds as the forces on the fragments are internal forces only and sum of all such forces is zero.

[8] In order to apply the law of conservation of momentum we must first identify the system. Then even if there is no *net external forces* acting on the system, all the three conservation laws of momentum, angular momentum and energy may not hold due to presence of internal forces.

SetId=221

[9] The work done by non conservative force is dependent on the path taken by the particle in reaching final position from initial position. Non conservative force depends on the distance travelled by the particle

[10] A satellite goes around the earth in a circular orbit of 600km with a time period of $5.8 \times 10^3 s$. Its motion will be uniform as it will cover equal distances in equal times.

[11] Distance is equal to the length of the path covered. Displacement is the shortest distance between initial and final points.

[12] If K is an inertial frame, any frame that moves w.r.t. the frame K with uniform velocity is also an inertial frame.

[13] When a bullet fired on a wooden block, some energy is transferred to the block and the total mechanical energy of the block and the bullet is conserved.

[14] The total work done on a particle is always equal to the change in kinetic energy. SetId=221

[15] A force is any interaction which tends to change the motion of an object. Newtons' second tell us that it is *equal* to the rate of change of momentum.It is a vector quantity. Real forces can be distinguished from pseudo forces because the pseudo forces always proportional to the mass of the body. All real forces, except the gravitational force, do not depend on the mass of the body.

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[1] Distance is a scalar quantity where as the displacement is a vector quantity.

[2] When the net external torque acting on a system about a given axis is zero, the total angular momentum of the system about that axis remains consant.

[3] An example where law of conservation of angular momentum holds:
The Law of conservation of angular momentum holds in the case of a ballet dancer performing a pirouette.

When the dancer extends her arms outward, the angular velocity of her rotation decreases whereas when she keeps her arms close to her body, the angular velocity increases. This is because her moment of inertia changes as she moves her arms outward and inward. It can be noted that she as a system has no external torque acting upon her.

[4] For the motion of earth around sun, the sum of angular momenta of the Sun and the Earth about the center of mass of the sun + earth system is conserved.

[5] The three components of angular momentum of a conical pendulum is conserved w.r.t. the origin at the position of the center of mass of the pendulum. SetId=222

[6] There is no case where LAW OF CONSERVATION OF ANGULAR MOMENTUM does'nt hold.But there are cases where conservation of angular momentum does not hold.A body in vertical circular motion is an example where angular momentum is not conserved. Here the law of conservation does not apply.

[7] There is no known exception to the law of conservation of momentum in classical mechanics However, an exception to conservation of energy in nuclear physics is observed. In nuclear reactions when two nuclei collide and their mass converts to energy and energy momentum are not conserved.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then check we should if the laws are applicable or not.

So if there is no *external force* acting on the system all the three quantities, total momentum, total angular momentum, and total kinetic energy will be conserved independent of the nature of forces.

[9] Nonconservative forces are those forces in which the work done in moving a particle is dependant on the path taken to cover the distance. Some energy woul be lost to the environment in the form of heat, sound, etc. The energy in the final state is less than that in the initial state.

SetId=222

[10] A uniform motion is defined to be the one in which a body covers equal distances in equal time intervals.

[11] Distance is a scalar quantity where as the displacement is a vector quantity.

[12] If K is an inertial frame, any frame that moves w.r.t. the frame K with uniform speed is also an inertial frame.

[13] When a moving car hits a parked lorry and causes the parked lorry to move ,energy is transferred from moving the car to the lorry and the total energy of the lorry and the car is conserved.

[14] A particle is acted upon by a force of constant magnitude which is always perpendicular to the velocity of the particle and the motion of the particle takes place in a plane, Then its kinetic energy, speed, velocity acceleration will not change. SetId=222

[15] Examples of pseudoforce are Coriolis Force, Centrifugal Force, and magnetic force on currents.
Psuedo force also called as fictitious force is an apparent force that are needed for masses whose their motion is described using a non inertial frame of reference.

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[1] The speed is rate of change of distance and the velocity is the rate of change of displacement.

[2] This law sates that when no net torque of all forces acts on a object or a system of objects then total angular momentum of system is conserved.The angular momentum before an event is equal to angular momentum after that event.mathematically explained by when, net torque=0 ;then, total angular momentum(L)=constant.

[3] In case of a skater, who can be considered an isolated system, so no torue will be acting on him/her. When the arms are extended, the moment of inertia is more. When his hands are closely held, the moment of inertia is lesser. Since the angular momentum is same, the angular acceleration changes accordingly.

[4] For the motion of the Earth around the sun, the total of angular momenta of the Earth and the Sun, about in a reference frame fixed in the pole star, is conserved.

[5] Only the z component of the angular momentum of a conical pendulum is conserved w.r.t. the origin fixed at the point of suspension. SetId=223

[6] A sphere rolling on a rough surface.Due to friction there is external torque so the angular momentum changes which results in the slowing of the sphere. The angular momentum keeps changing. Even in case like this one, it is wrong to say that the Law of Angular Momentum Conservation does not hold.

[7] In a system of a canon and a canon ball, total momentum of the system is zero before canon ball is fired. After firing the canon ball, the momentum of the system seems to be conserved as the ball moves forward and the canon moves backward.

[8] If we want to apply the conservation laws of momentum, energy and angular momentum, we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *external force* acting on the system, the momentum and angular momentum will be conserved, and depending on the nature of the forces but total energy may or may not be conserved.

SetId=223

[9] The work done by such forces depends on the path taken. The work done cannot be represented as a potential energy function.Work done by such forces is always negative.

[10] A particle moves on a circular path. Then its speed, direction of force, velocity and acceleration must always change with time.

[11] Both displacement and distance tell us about the motion of a body but their study does not tell much about the forces on the body

[12] A frame rotating w.r.t K with uniform angular velocity is also an inertial frame.

[13] When a bomb explodes the total mechanical energy is not conserved. But the total chemical energy and the mechanical energy is conserved.

[14] The kinetic energy of a particle is continuously increasing with time, then the angle bewteen the net force and the velocity cannot be greater than or equal to 90^o at any time.

SetId=223

[15] Examples of pseudo-force are Coriolis Force, Centrifugal Force, Centripetal force and magnetic force on currents. The pseudo forces do not obey Newton's third law and therefore the total momentum does not appear to be conserved in a non-inertial frame.

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[1] For any type of translational motion of a body, the displacement cannot be zero, where as the distance travelled can be zero.

[2] Statement of Law of Conservation of Angular Momentum:
Differentiating $\vec{L} = \vec{r} \times \vec{p}$ w.r.t, time,

$$\begin{aligned} \frac{dL}{dt} &= \frac{d\vec{r} \times \vec{p}}{dt} = \frac{d\vec{r}}{dt} \times \vec{p} + \vec{r} \times \frac{d\vec{p}}{dt} = \vec{v} \times (m\vec{v}) + \vec{r} \times \vec{F} \\ &= \vec{r} \times \vec{F} (\because v \times v = 0) \\ &= \vec{\tau} \end{aligned}$$

here $\vec{\tau}$ represents the net torque acting on a rigid body rotating about a fixed axis.This torque must take into account of all the forces, be it external or internal forces

[3] Example where law of conservation of angular momentum holds:
Let us assume a student seated on a stool that can rotate freely about a vertical axis. The student has been set into rotation at a modest initial angular speed ω . He holds two dumbbells in his outstretched hands. His angular momentum vector L lies along the vertical rotation axis, pointing upwards. Now he pulls in his arms;this action reduces his rotational inertia from its value I_{initial} to a final value I_{final} because he moves the mass closer to the rotational axis. His rate of rotation increases markedly, from ω_{initial} to ω_{final}. The student can then slow down by extending his arms once more,moving the dumbbells outward. No external torque acts on the system consisting of the student, stool and the dumbbells. Thus the angular momentum of the system about the rotational axis remains constant. $I_{\text{initial}} * \omega_{\text{initial}} = I_{\text{final}} * \omega_{\text{final}}$.

[4] For the motion of the Earth around the sun, the total of angular momenta of the Earth and the Sun, is conserved in every inertial frame of reference; but the angular momentum of the Earth (or of the sun)is not conserved in every inertial frame.

[5] The z component of angular momentum of a conical pendulum is not conserved w.r.t. the origin fixed at the point of suspension; but the x and y components are conserved. SetId=224

[6] Consider a rod of length l. Let us give an impulse to one end . Now the angular momentum about the oposite end is not zero since the impulse provides some torque . So the angular momentum is not conserved .

$$\text{torque} = \text{impulse} * \ell.$$

$d\ell/dt$ is not equal to zero and the law of conservation of angular momentum does not hold.

[7] When applying the conservation laws of momentum, energy and angular momentum we must define the system first.Only then check if the laws is applicable or not.

As an example: when a ball is dropped from a height, it gains momentum down if we consider the ball as our system.This is because the force of gravity acts as an external force.

However, if we change our system and consider earth as a part of our system too, then the momentum remains conserved because the earth gains momentum up.

[8] To apply the conservation laws of momentum, energy and angular momentum, we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *external force* acting on the system, the energy and momentum will be conserved. However, depending on the nature of the system and of the forces, the total angular momentum may not be conserved.

[9] A nonconservative force is a force with the property that the work done in moving a particle depends on the path taken.Also, the net work done in a closed loop is non zero.

SetId=224

[10] A particle moves on a circular path. Then its speed, direction offorce, can remain constant by velocity and acceleration must always change with time.

[11] Displacement is the shortest distance between initial and final points with direction specified.

[12] The Newton's Laws of motion will hold in all frames which are at rest w.r.t. K but do not remain valid in a frame that move with respect to K.

[13] When a ball rolls over a rough surface, it comes to stop after some time. This is because transational and rotational kinetic energy initially present in the ball continuosly gets converted to heat due to friction. When all the kinetic energy changes to heat, the ball stops. The total mechanical energy of the ball is not conserved.

[14] A heavy body is attached from a spring and is held at point A and is such that the spring is not slack nor is it stretched. It is then released. It goes down upto a point B and then it rises upto point C and executes an oscillatory motion between B and C. During the motion from A to C is first positive (from A to B) and then it is negative from B to A and again remains negative from A to C. SetId=224

[15] FORCE is any interaction which tends to change the motion of an object.It has both magnitude and direction,making it a vector quantity.

A psuedo force is an apparent force that acts on all masses whose motion is described with respect to a non-inertial frame of reference like a rotating frame of reference.This force is needed by an observer in an non-inertial frame to make all the Newtons Laws of motion hold true.

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[1] Displacements, being vector quantity can not compared with, a scalar quantity such as distance.

[2] Statement of Law of Conservation of Angular Momentum: For a system of many particles The net torque due all the forces, be it external or internal forces. But as the torque due to all the internal forces cancel out, it sufficient to consider the external forces acting on the system.

[3] A bob is attached to ceiling by a string and moves in a horizontal circular plane is an example. In this case the law of conservation of angular momentum does not hold.

[4] In the Sun Earth system the angular momentum of the Earth is conserved in every frame of reference

[5] Only the z component of angular momentum of a conical pendulum is conserved w.r.t. the origin fixed at the point of suspension. SetId=225

[6] Let us consider a rotating skew rod. In the absence of friction or any other drag force, the rod should continuously spin without stopping. Here the net torque about the axis of rotation is 0 and hence angular momentum is conserved. It therefore follows from law of conservation of angular momentum that a spinning skew rod will keep rotating with constant angular velocity if there is no external torque. So law of conservation of angular momentum does not hold.

[7] Statement: Law of Conservation of energy states that "ENERGY CAN NEITHER BE CREATED NOR DESTROYED",but it can be changed from one form to other.

EXPLANATION: Statement implies that the total amount of energy in an isolated system remains constant although it may change forms. viz, kinetic energy may change to potential;chemical to electrical energies etc.

[8] In order to apply the law of conservation of momentum we must first identify the system. If there is no *external forces* acting on the system then conservation laws of momentum always holds. And depending on the nature of the system and of the forces, the total kinetic energy and the total angular momentum may not be conserved.

[9] A force whose work done is a path function is called a non-conservative force. All the forces which do not satisfy the definition of conservative forces are non-conservative in nature. The work done by these forces dissipates into heat energy, sound energy, light energy, etc. Therefore, law of conservation of mechanical energy cannot be applied to a system on which a non-conservative force is acting. No potential function can be defined for these forces.

SetId=225

[10] A particle moves on a circular path. Then under suitable conditions its speed may remain constant, but the force, velocity and acceleration must always change with time.

[11] Displacements, being vector quantity can not compared with, a scalar quantity such as distance.

[12] Staying inside a bullet train moving with constant velocity (no jerks etc) an experiment can always be performed which will tell us the numerical velocity of the bullet train

[13] Let us consider that a pendulum is oscillating moving in a vertical plane. Mean while let another bob which is attached to a spring and is executing a simple harmonic motion in horizontal direction comes and hits the pendulum. Here conservation of momentum does not hold good as tension(external force) is acting on the system.(pendulum)

[14] The kinetic energy of a body does not change if any one of the following is true
(i)force is always perpendicular to the velocity
(ii) the force is always perpendicular to the acceleration
(iii) the object remains stationary
(iv) the object moves in such a way that the point of application of the force remains fixed. SetId=225

[15] FORCE is any interaction which tends to change the motion of an object.It has both magnitude and direction,making it a vector quantity. A pseudo-force F doesn't arise from any physical interaction between two objects, but rather from the acceleration 'a' of the non-inertial reference frame itself. These forces have no real existence but must be taken into account in an accelerating frame of reference to make all the three Newton's Laws of motion applicable to the system

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[1] Distance depends on the path where as the displacement depends on the end point only.

[2] Depending on the torques acting on a system, the angular momentum can be conserved only in one or two directions, but may not be conserved in all. For instance, if an isolated body has no torque acting on it only in the direction along the Z axis, then the angular momentum is conserved only in that direction.

[3] Consider a disc rotating about an axis perpendicular to its plane. On placing a smaller disc with its surface parallel to the surface of the rotating disc, the angular momentum of the system of two discs remains constant as there is no external torque.

[4] In the motion of earth around sun, the angular momentum of the earth about an axis passing through the sun and perpendicular to the plane of motion of earth is conserved.

[5] The projection of angular momentum of a conical pendulum in the horizontal plane is a constant of motion when the origin is chosen to be at fixed at the point of suspension.

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[6] In the example of skew rod the angular velocity does not change even though the torque applied is nonzero. However there is no contradiction as in this case the law of conservation of momentum is not applicable. conservation is violated.

[7] Oscillating simple pendulum is a very good example where potential energy gets converted to kinetic energy and kinetic to potential energy. Some energy gets dissipated as heat if we consider air resistance. Energy as a whole is conserved if we consider universe as system, the energy has just changed its form.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then check if the laws is applicable or not.

So if there is no *net external force* acting on the system all the three conservation laws will hold.

SetId=226

[9] *Non conservative forces* are the type of forces in which the work done by the forces is purely dependent on the path taken by the body.Thus the net work done by the forces in cyclic path is never equal to zero.

[10] A particle moves on a circular path. Then under suitable conditions its speed and acceleration may remain constant, but the force, and velocity must always change with time.

[11] Distance depends on the path where as the displacement depends on the end point only

[12] Staying inside a bullet train moving with constant velocity (no jerks etc) an experiment can always be performed which will tell us the numerical value of the acceleration of the bullet train

[13] The law of conservation of momentum does not hold in relativistic situations, i.e., where the speeds of the masses involved are close to the speed of light.

[14] The total work done on a particle is always equal to the change in kinetic energy. SetId=226

[15] FORCE is any interaction which tends to change the motion of an object.It has both magnitude and direction,making it a vector quantity.
A pseudo-force results from acceleration of the frame of reference in which the objects reside. It is taken into account so that Newton's second law isn't invalidated. The pseudo force acting on an object can always be mathematically expressed as the product of the mass of the object and the acceleration of the frame of reference.

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[1] Distance equal to zero implies displacement=0; and Displacement=0 also implies distance = 0

[2] According to Law of Conservation of Angular momentum,if no external torque acts on an object or system of objects,angular momentum of an object or system of objects remains CONSTANT or no change in angular momentum can occur.

Also it states that,only external torque can change angular momentm of the system where as the torque produced by internal forces can not change the angular momentum of the system

[3] Consider a man standing on a spinning platform. Initially, the man spreads out his arms and he spins with a certain angular velocity. The next moment, he pulls his arms inwards keeping them close to his body. We will observe that the angular velocity with which he is spinning now increases. This phenomenon can be explained by the Law Of Conservation of Angular momentum. Initially, since his arms were spread wide, his moment of inertia was large. However, when he pulled them close to his body, his moment of inertia decreased.
In this example the angular velocity of the man increases and therefore the angular momentum also increases.The law of conservation of angular momentum does not apply because the torque of muscular forces is not zero.

[4] For the motion of earth around sun, the angular momentum of the earth about the center of mass of the sun + earth system and perpendicular to the plane of motion of earth is conserved.

[5] The law of angular momentum of a is not applicable for the conical pendulum conserved w.r.t. the origin fixed at the point of suspension. SetId=227

[6] Example where law of conservation of angular momentum does not hold:If a particle undergoes conical motion and the only force acting on particle is central force like tension of the string.Then total external torque about fixed point A is zero,yet angular momentum is not conserved,as angular momentum keeps on changing direction.

[7] Law of conservation of momentum does not hold whenever an external force or impulse acts on the system. For example,when a body collides with earth then it bounces back to a lesser height as it loses some velocity.

In this example the momentum of a ball is not conserved due to impulsive force by ground in the normal direction.

However, strictly speaking the system that should be considered here is the ball-earth system and the total momentum is conserved.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then check we should if the laws are applicable or not.

So if there is no *external force* acting on the system all the three quantities, total momentum is conserved. The total angular momentum is also because the torque of internal forces will be zero. The conservation of energy depends on the nature of forces. will be conserved.

[9] Non-conservative forces are path-dependent forces, i.e. the work done on a body by these forces depends on the path taken by the body. Mechanical energy of a system is not conserved when a conservative force acts on it but the total energy is conserved. Therefore, the mechanical energy lost by the system is liberated in some other form such as light energy, heat energy, etc.

For example, when a body is moving along a surface, frictional force acts on the body as well. Due to this frictional force, the body loses its mechanical energy, and this loss is generally released in the form of heat energy to the surroundings. Thus, the mechanical energy will not be conserved and frictional force can be classified as a non-conservative force.

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[10] When the force is kept constant as function of time, it is possible for a particle to move on a circular path in such a way that its speed remains constant, but the velocity and acceleration must always change with time.

[11] Distance equal to zero $\Rightarrow$ displacement=0; but Displacement=0

[12] Assume bullet train, moving with out any jerks, is going on a circular arc of radius R with constant speed. Then an experiment is to be performed entirely within the train without any measurement on objects outside the train. Such an experiment can tell only radius of the track.

[13] when we are in accelerating frame if we observe any collision between two bodies then the law of conservation of momentum does not hold in that frame of reference.

[14] A particle is acted upon by a force of constant magnitude which is always perpendicular to the velocity of the particle and the motion of the particle takes place in a plane, Then its kinetic energy, speed, velocity acceleration will not change.

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[15] Explain Force:FORCE is any interaction which tends to change the motion of an object.It has both magnitude and direction,making it a vector quantity.
In the case of a non inertial frame, we can use the second law of motion by adding a pseudo force to the system which makes it an inertial frame of reference.

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[1] If P and Q are the initial and the final points of a path of a particle, displacement is a vector whose direction is along PQ and has magnitude is equal to the length of line PQ

SetId=228

[2] The law of conservation of angular momentum states that when the net external torque acting on the system is zero, then the angular momentum of the system remains constant.both the initial and final momentum should be taken from a fixed inertial frame of reference provided.

[3] In the Sun-Earth system, angular momentum of the earth is not conserved but the total angular momentum of the sun and the earth is constant of motion.

[4] In the Sun Earth system the angular momentum of the Earth about the pole star is conserved

[5] The law of angular momentum of a is not applicable for the conical pendulum conserved when the origin is chosen to be at the pendulum bob itself.

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[6] A nonzero torque always causes the angular velocity to change, because a change in angular momentum means a change in angular velocity $L = I\omega$

[7] If a bullet hits a wooden board and gets embedded in the board, the total energy and the total momentum of the bullet and the board are conserved.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *net external force* acting on the system, the momentum is conserved. The definition of angular momentum and torque depends on the choice of axes, and therefore it may not be be conserved. The conservation of total energy holds only for conservative forces.

When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *net external force* acting on the system, the energy and momentum will be conserved. However, the total angular momentum may not be conserved because the torque may not be zero.

[9] It is a force for which the work done by that force on an object or a particle in moving it between any two points depends on its path travelled.This force doesn't conserves the mechanical energy.The work done by a non-conservative force on an object in moving it in a circular path is not equal to zero.

SetId=228

[10] It is not possible for a particle to move on a circular path in such a way that its speed and force remains constant, and only the velocity and acceleration may (or may not) always change with time.

[11] If P and Q are the initial and the final points of a path of a particle, displacement is a vector whose direction is along PQ and has magnitude is equal to the length of line PQ

[12] Assume bullet train, moving with out any jerks, is going on a circular arc of radius R with constant speed. Then an experiment is to be performed entirely within the train without any measurement on objects outside the train. Such an experiment can tell both speed of the train and radius of the track.

[13] Give an example where law of conservation of momentum does not hold all cases when seen from non inertial frame of references for example when we see two cars collide from a moving bus there momentum is not conserved

[14] The kinetic energy of a particle is continuously increasing with time, then the angle bewteen the net force and the velocity cannot be greater than or equal to 90^o at any time.

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[15] For the Newton's Law of Motion to hold true,the physically apparent but nonexistent force needed by an observer in a non-inertial frame is called the pseudo force.
1) Caused by relative acceleration of the origin in a straight line
2) Centrifugal and Centripetal forces
3) Coriolis force
4) Euler force

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[1] If P and Q are the initial and the final points of a path of a particle,the displacement is the vector $\overrightarrow{PQ}$.

[2] The law of conservation of angular momentum states that The total angular momentum of a system is constant in both magnitude and direction if the resultant torque, of the external forces acting on the system, is zero.

[3] Consider a disc and a man system. man is standing on center of the disc rotating with angular velocity.initially man folded his hand.when man stretches his hands then momentum of inertia of system increases.and angular velocity decreases.and total angular momentum remains constant.

[4] For the motion of earth around sun, the angular momentum of the sun about the center of mass of the sun + earth system and perpendicular to the orbital plane of earth is conserved.

For the motion of earth around sun, the angular momentum of the sun about and axis passing through the Earth and perpendicular to the orbital plane of motion of earth is conserved.

[5] The three components of angular momentum of a conical pendulum is conserved w.r.t. the origin at the position of the center of mass of the pendulum. SetId=229

[6] A nonzero torque always implies change in angular momentum and may not give rise to a change in magnitude of angular velocity. A non zero torque may mean change only the direction of the angular momentum and not the angular velocity.

[7] If a bullet hits a wooden board and gets embedded in the board, the total energy of the bullet and the board system is conserved but the total momentum is not conserved.

[8] In order to apply the law of conservation of momentum we must first identify the system. If there is no *net external forces* acting on the system then conservation laws of momentum always holds. The total energy and the total angular momentum may not be conserved.

[9] Explain Nonconservative force: This force is just opposite to that of conservative force. The work done by this force depends on the path taken by the particle on which the force is applied.This force does not conserve mechanical energy.If a particle
SetId=229 travels in a closed loop, the net work done by a non consevative force is non zero.

[10] For a particle moving on circle the acceleration is always constant in magnitude and directed towards the centre of the circle.

[11] If P and Q are the initial and the final points of a path of a particle,the displacement is the vector $\overrightarrow{PQ}$.

[12] Assume bullet train, moving with out any jerks, is going on a circular arc of radius R with constant speed. Then an experiment is to be performed entirely within the train without any measurement on objects outside the train. Such an experiment can tell only speed of the track.

[13] When a tennis ball hits the ground at an oblique angle, the angle of reflection is equal to the angle of incidence. This is a simple consequence of conservation of horizontal component of momentum.

[14] A heavy body is attached from a spring and is held at point A and is such that the spring is not slack nor is it stretched. It is then released. It goes down upto a point B and then it rises upto point C and executes an oscillatory motion between B and C. During the motion from A to C is first positive (from A to B) and then it is negative from B to A and again remains negative from A to C. SetId=229

[15] A force is any interaction which tends to change the motion of an object. It is also *defined* as rate of change of momentum.It is a vector quantity.

Pseudo-force is a fictitious force it is taken by an observer from non inertial frame of reference. This force arises from acceleration of reference frame that is a reference frame which is accelerating or rotating.

The equation of motion is then written by balancing all forces. As an example a particle moving in a circle is seen to be at rest by balancing the centripetal and centrifugal forces.

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[1] If two bodies starting from a point A reach a point B, following different paths, their displacement will be, in general different, but the distances covered will always be the same.

[2] If the net external torque acting on a system is zero,the angular momentum L(vector) of the system remains constant,no matter what changes take place within the system.L(vector)=a constant (net external torque acting on system is zero)

[3] The conservation of angular momentum of a system of bodies requires that the the sum of torque due to all forces be equal to zero. Now consider a situation where the forces are such that the sum of torques of external forces is zero w.r.t. some axes K. Since the value of torque depends of the choices of axes, the sum of torques due to all internal forces will depend on the choice of axes and in general it will be non zero. Therefore, for a system of several bodies, for a given choice of axes K, there will be situations when the total angular momentum may not be conserved.

[4] For the motion of earth around sun, the sum of angular momenta of the Sun and the Earth about the center of mass of the sun + earth system is conserved.

[5] Only the z component of the angular momentum of a conical pendulum is conserved w.r.t. the origin fixed at the point of suspension. SetId=230

[6] In the example of a rotating skew rod the torque due to the external gravitational forces is zero , but the angular momentum is not constant Therefore the law of conservation of angular momentum is violated.

[7] If a bullet hits a wooden board and gets embedded in the board, both total energy and the total momentum of the bullet and the board are not conserved.

[8] In order to apply the law of conservation of momentum we must first identify the system. Then even if there is no *net external forces* acting on the system, all the three conservation laws of momentum, angular momentum and energy may not hold due to presence of internal forces.

[9] Non conservative force is the force in which the work done by a particle in going from one point to another is path dependent.

For non conservative forces mechanical energy is not conserved,mostly lost in the form of heat and light.The work done by a non conservative force is equal to the change in mechanical energy.

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For non conservative force $E_{\text{initial}} > E_{\text{final}}$

[10] The motion of a bomb dropped from a plane does is not a uniform motion as it follows a parabolic path and not a straight line path.

[11] If two bodies starting from a point A reach a point B, following different paths, their displacement will be, in general different, but the distances covered will always be the same.

[12] A particle is observed from two frames S_1 and S_2. The frame S_2 moves with respect to S_1 with an acceleration a. If F_1 and F_2 be the pseudoforces when seen from S_1 and S_2 respectively it is not possible to have $F_1 = F_2 = 0$

[13] when a ball is dropped from a height, it gains momentum down if we consider the ball as our system.This is because the force of gravity acts as an external force.

However, if we change our system and consider earth as a part of our system too, then the momentum remains conserved because the earth gains momentum up.

[14] The kinetic energy of a body does not change if any one of the following is true
(i)force is always perpendicular to the velocity
(ii) the force is always perpendicular to the acceleration
(iii) the object remains stationary
(iv) the object moves in such a way that the point of application of the force remains fixed.

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[15] A psuedo force is an apparent force that acts on all masses whose motion is described with respect to a non-inertial frame of reference like a rotating frame of reference. This force is needed by an observer in an non-inertial frame to make all the Newtons second laws to write correct equation of motion..

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[1] Displacement is equal to the vector difference $\vec{r}_f - \vec{r}_i$ of the position vectors of initial and final points. The distance covered will be $|\vec{r}_f - \vec{r}_i|$

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[2] The Law of conservation of angular momentum states that when no external torque acts on an object or a closed system of objects undergoing motion about a given axis, the change in angular momentum is zero. Therefore, considering an event where only internal torque or no torque is involved, the total angular momentum of the system before the event is equal to the total angular momentum after the event

[3] Example where law of conservation of angular momentum does not hold:
When there is external force like frictional force acting on a object when it is rotating we cannot use conservation of angular momentum as the friction force acting on the object produces an external torque.

[4] For the motion of the Earth around the sun, the total of angular momenta of the Earth and the Sun, about in a reference frame fixed in the pole star, is conserved.

[5] The z component of angular momentum of a conical pendulum is not conserved w.r.t. the origin fixed at the point of suspension; but the x and y components are conserved.

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[6] In the example of skew rod, the angular momentum changes with time and there is a non zero torque coming from action of forces other than gravitational forces. Hence the law of conservation of angular momentum dos not apply.

[7] There are certain situations where it appears that the law of conservation of linear momentum does not hold. For example if we take some amount of a substance like construction putty, cement, cake batter, playing dough,etc and drop it on the ground, it does not bounce back like a rubber ball would and hence the momentum it had before striking the ground seems to have been lost. Hence it appears that the law of conservation of linear momentum does not hold.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then check we should if the laws are applicable or not.

So if there is no *external force* acting on the system all the three quantities, total momentum, total angular momentum, and total kinetic energy will be conserved independent of the nature of forces.

[9] A force is said to be non-conservative, if the work done by the force is dependent on the path taken. It could also be defined as a force for which the work done during a cyclic process is non-zero.

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[10] A wagon sliding on a roller coaster designed in such a way that the wagon covers equal distances in equal times. As the motion of the wagon is uniform, there will be no net force acting on it.

[11] Distance is equal to the length of the path covered. Displacement is the shortest distance between initial and final points.

[12] A particle is observed from two frames S_1 and S_2. The frame S_2 moves with respect to S_1 with an acceleration a. If F_1 and F_2 be the pseudoforces when seen from S_1 and S_2 respectively and if $F_1 = 0$ then we must have $F_2 \neq 0$

[13] There is no known exception to the law of conservation of momentum in classical mechanics however when two bodies collide and their mass converts to energy, an exception in nuclear physics is observed. In real life this is observed in nuclear reactions at atomic level.

[14] The total work done on a particle is always equal to the change in kinetic energy. SetId=231

[15] One indication that pseudo forces are NON-NEWTONIAN is that they violate Newton's III law and violate the Newton's third law.

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[1] Distance is equal to the length of the path covered. Displacement is the shortest distance between initial and final points.

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[2] The law of conservation of angular momentum states that when no external torque acts on an object or a closed system of objects, no change of angular momentum can occur. Hence, the angular momentum before an event involving only internal torques or no torques is equal to the angular momentum after the event . Angular momentum can be calculated with the help of the formula $L = I\omega$ where L stands for Angular momentum, I stands for moment of inertia and ω stands for angular velocity

[3] A bob attached to a ceiling by a string moving in a horizontal circular plane is an example where the total angular momentum of the bob about the point of suspension is not conserved. This is because the the torque due to the weight of the bob about the point of suspension does not vanish and has non zero horizontal component. Only the vertical component of the angular component is conserved.

[4] For the motion of the Earth around the sun, the total of angular momenta of the Earth and the Sun, is conserved in every inertial frame of reference; but the angular momentum of the Earth (or of the sun)is not conserved in every inertial frame.

[5] Only the z component of angular momentum of a conical pendulum is conserved w.r.t. the origin fixed at the point of suspension.

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[6] In the example of conical pendulum, the z- component of angular momentum does not change. This follows from the angular momentum conservation as there is no external torque.

[7] A tennis ball is dropped from height h and after hitting the ground and it bounces back and rises to the same height. In this case the momentum of the ball is conserved because (under ideal conditions) the momentum after it hits the ground will be equal to the momentum it had before hitting the ground.

[8] If we want to apply the conservation laws of momentum, energy and angular momentum, we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *external force* acting on the system, the momentum and angular momentum will be conserved, and depending on the nature of the forces but total energy may or may not be conserved.

[9] a force is said to be non conservative if work done is dependent on the path of the particle.potential cannot be defined in the case of non conservative forces.work done in closed loop is not equal to zero.

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[10] A simple pendulum moves along a circular arc and does not have constant speed and therefore its motion is not uniform.

[11] Distance is a scalar quantity where as the displacement is a vector quantity.

[12] If K is an inertial frame, any frame that moves w.r.t. the frame K with uniform velocity is also an inertial frame.

[13] When there is no external forces act on a system of many particles, and there are only internal forces acting on the particles. The third law gives that the internal forces are pairwise equal and opposite.Thus the sum of internal forces is zero and the momentum of each particle is conserved.

[14] A particle is acted upon by a force of constant magnitude which is always perpendicular to the velocity of the particle and the motion of the particle takes place in a plane, Then its kinetic energy, speed, velocity acceleration will not change. SetId=232

[15] The apparent force which seems to act on an object in an accelerating frame of reference if we wish to describe the object's motion is called a pseudo force.Its a non-existent force used only to describe the motion completely using Newton's second law even though the agent causing the force is undefined.

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[1] Distance is a scalar quantity where as the displacement is a vector quantity.

[2] Newton's Second Law of Motion is defined by the expression $F = \frac{dp}{dT}$, where F gives the force vector acting on the system and p gives its momentum vector; in linear motion. A similar expression can be written to describe angular motion, i.e. : $\tau = \frac{dL}{dt}$, where τ is the external torque vector acting on the system, and L is the angular momentum.

If the external torque on the system is zero, then we get the expression as: dL/dt=0. This points out to the fact that, when no external torque is acting on the system, then its angular momentum is constant, no matter what changes occur in the system. This is the Law of Conservation Of Angular Momentum.

[3] Law of conservation of angular momentum holds in case of long jump. When a athlete takes off from the ground in a running long jump, the forces on the launching foot give the athlete an angular momentum with a forward rotation around a horizontal axis. Such rotation would not allow the jumper to land properly. In the landing, the legs should be together and extended forward at an angle so that the heels mark the sand at the greatest distance. Once airborne, the angular momentum cannot change (it is conserved) because no external torque acts to change it. However, the jumper can shift most of the angular momentum to the arms by rotating them in windmill fashion. Then the body remains upright in the proper orientation of landing.

[4] In the Sun Earth system the angular momentum of the Earth is conserved in every frame of reference

[5] The projection of angular momentum of a conical pendulum in the horizontal plane is a constant of motion when the origin is chosen to be at fixed at the point of suspension. SetId=233

[6] In the example of conical pendulum, the x and$y$ components of angular momentum change. This follows from the angular momentum conservation as the z components external torque is zero and horizontal components of torque are non zero.

[7] Law of conservation of momentum does not hold when Newton's laws are not valid, e.g. in a non-inertial frame of reference. For example, when we consider collision between two bodies in a non-inertial frame of reference, the law of conservation of momentum cannot be applied because there will be a pseudo force acting on the frame itself.

[8] To apply the conservation laws of momentum, energy and angular momentum, we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *external force* acting on the system, the energy and momentum will be conserved. However, depending on the nature of the system and of the forces, the total angular momentum may not be conserved.

[9] Explain Nonconservative Forces:

The forces that depend on the path taken by the particle are called non-conservative forces.

Mechanical energy is not conserved during the action of a non conservative force, instead, it is lost as other forms of enery like heat, light, etc.

Potential energy is not defined for a non-conservative force.

The initial and final kinetic energy in a closed loop is not equal.

The work done by a non conservative force in a closed loop is non zero. In practice, the net work is invariably negative.

Work done by a non conservative force cannot be completely recovered.

For a non conservative force,

$/text(KE)//_f//+(\text{PE})//_f// = (\text{KE})_i+(\text{PE})_i//+//\text{Work Done})//\text{non-conservative force}//$

SetId=233

[10] A satellite goes around the earth in a circular orbit of 600km with a time period of $5.8 \times 10^3 s$. Its motion will be uniform as it will cover equal distances in equal times.

[11] Both displacement and distance tell us about the motion of a body but their study does not tell much about the forces on the body

[12] If K is an inertial frame, any frame that moves w.r.t. the frame K with uniform speed is also an inertial frame.

[13] During collision of billiard balls momentum is conserved. During explosion of a bomb also momentum is conserved and the total momentum of the fragments of bomb will be zero. This is because all the forces are only internal forces.

[14] The kinetic energy of a particle is continuously increasing with time, then the angle bewteen the net force and the velocity cannot be greater than or equal to 90^o at any time. SetId=233

[15] The physically apparent, but nonexistent, force needed by an observer in a noninertial frame to make Newton's laws of motion hold true is called pseudoforce.

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[1] The speed is rate of change of distance and the velocity is the rate of change of displacement.

[2] If the net external torque acting on a system is zero, the angular momentum L of the system remains constant, no matter what changes take place within the system.

$$\sum(T_{\text{ext}}) = \frac{dL}{dt}$$

The law states that when there is no net external torque, $\frac{dL}{dt}$ is zero implying that the total angular momentum of system is constant.

i.e. $L = a$ constant (isolated system)

[3] The total angular momentum of a body remains constant of motion when the net torque of the external forces acting on the body is zero.
In general, we have a system of particles such that the net torque of the external forces on the system, w.r.t. some axes K, is zero, the total angular momentum may not remain conserved, because the torque due to the internal forces may not be zero.

[4] In the motion of earth around sun, the angular momentum of the earth about an axis passing through the sun and perpendicular to the plane of motion of earth is conserved.

[5] The law of angular momentum of a is not applicable for the conical pendulum conserved w.r.t. the origin fixed at the point of suspension. SetId=234

[6] Example where law of conservation of angular momentum does not hold: A disc rotating on a horizontal rough surface will not have a constant angular momentum because there will be a constant torque by frictional force. Hence, its angular momentum will decrease, and the law of conservation of angular momentum does not apply.

[7] If I throw a ball upward, it's speed decreases as it rises upwards. There is an external force (gravity) acting on the ball, so the momentum conservation law does not apply. Momentum of the ball is not conserved, however the momentum of the Earth-ball system is conserved as gravity will become an internal force in this case.

[8] In order to apply the law of conservation of momentum we must first identify the system. If there is no *external forces* acting on the system then conservation laws of momentum always holds. And depending on the nature of the system and of the forces, the total kinetic energy and the total angular momentum may not be conserved.

[9] A non conservative force is one where the mechanical energy is not conserved.Here the work done is dependent on the path taken .Different amounts of work need to be done in different paths.Here potential energy would have no meaning as it would keep changing with the path.Here some amount of mechanical energy is lost as sound energy or heat energy and hence is not conserved.

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[10] A uniform motion is defined to be the one in which a body covers equal distances in equal time intervals.

[11] Displacement is the shortest distance between initial and final points with direction specified.

[12] A frame rotating w.r.t K with uniform angular velocity is also an inertial frame.

[13] Give an example where law of conservation of momentum holds: A mass exploding into several pieces in a conservative field like gravitational field(if air resistance is neglected), obeys law of conservation of momentum. If air resistance cannot be neglected then the law of conservation of momentum will not hold.

[14] A heavy body is attached from a spring and is held at point A and is such that the spring is not slack nor is it stretched. It is then released. It goes down upto a point B and then it rises upto point C and executes an oscillatory motion between B and C. During the motion from A to C is first positive (from A to B) and then it is negative from B to A and again remains negative from A to C.

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[15] Pseudo forces come into picture when Newton's laws of motion have to be applied to describe the motion of bodies in non-inertial frames. These forces have no real existence.

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[1] For any type of translational motion of a body, the displacement cannot be zero, where as the distance travelled can be zero.

[2] When the net external torque acting on a body or a system of bodies is zero about a particular axis, then the angular momentum of each body is conserved about that axis.

[3] An example where law of conservation of angular momentum holds:
The Law of conservation of angular momentum holds in the case of a ballet dancer performing a pirouette.

When the dancer extends her arms outward, the angular velocity of her rotation decreases whereas when she keeps her arms close to her body, the angular velocity increases. This is because her moment of inertia changes as she moves her arms outward and inward. It can be noted that she as a system has no external torque acting upon her.

[4] For the motion of earth around sun, the angular momentum of the earth about the center of mass of the sun + earth system and perpendicular to the plane of motion of earth is conserved.

[5] The law of angular momentum of a is not applicable for the conical pendulum conserved when the origin is chosen to be at the pendulum bob itself. SetId=235

[6] Example where law of conservation of angular momentum does not hold:Consider a vertical stick on the ground falling to a horizontal position. During the fall, the conservation of angular momentum applied at the point of rotation on the ground and perpendicular to the plane of the stick is not applicable as, the gravitational force which acts vertically downwards assumed at the centre of mass produces an external torque about the axis of rotation

[7] A soldier accelerating away, after detonating a bomb, will find that the total momentum of the fragments of the bomb is zero. This is an example where the law of conservation of momentum holds as the forces on the fragments are internal forces only and sum of all such forces is zero.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then check if the laws is applicable or not.

So if there is no *net external force* acting on the system all the three conservation laws will hold.

[9] The force whose work depends on path taken is called a non conservative force.friction for example does less work on a book dragged across a table if the book is dragged straight across than if the book is dragged in a curved path.

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[10] A particle moves on a circular path. Then its speed, direction of force, velocity and acceleration must always change with time.

[11] Displacements, being vector quantity can not compared with, a scalar quantity such as distance.

[12] The Newton's Laws of motion will hold in all frames which are at rest w.r.t. K but do not remain valid in a frame that move with respect to K.

[13] Also a good example of law of conservation momentum can be seen when a bullet from a rifle is fired.As the bullet is fired and gets out of the rifle, the rifle gives a backward jerk due to the phenomenon of conservation of momentum.

[14] The kinetic energy of a body does not change if any one of the following is true
(i)force is always perpendicular to the velocity
(ii) the force is always perpendicular to the acceleration
(iii) the object remains stationary
(iv) the object moves in such a way that the point of application of the force remains fixed. SetId=235

[15] In a non-inertial frame of reference the accelration of the body that we measure, is not the true acceleration, as the frame itself accelerates.Thus,force(F=ma) is also not the true force acting on the body.The extra force added to make it a true value is called pseudo force.Thus pseudo force does not really act on a body but just compensates the change produced by the non inertial frame, in true acceleration.

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ASSIGNMENT-II **Due On : Nov 18, 2014**

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[1] Displacements, being vector quantity can not compared with, a scalar quantity such as distance.

[2] The law of conservation of angular momentum states that in absence of an external torque on an object or a closed system of objects the total angular momentum of the system remains constant. Thus if $\vec{\tau} = 0 => \vec{L} =$ constant where τ is the torque and $\vec{L}$ is the angular momentum of the system.

[3] In case of a skater, who can be considered an isolated system, so no torue will be acting on him/her. When the arms are extended, the moment of inertia is more. When his hands are closely held, the moment of inertia is lesser. Since the angular momentum is same, the angular acceleration changes accordingly.

[4] In the Sun Earth system the angular momentum of the Earth about the pole star is conserved

[5] The three components of angular momentum of a conical pendulum is conserved w.r.t. the origin at the position of the center of mass of the pendulum.

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[6] We have a conical pendulum .The forces acting on the bob are tension (along the direction of the string) and gravitational force acting in the vertically downward direction.we have an additional force called the drag force which is tangential to the motion of the bob and acts in the direction opposite to the motion of the bob.The axis of rotation passes through the hinge point and is vertical.The torque due to tension is 0 because the force passes through the axis of rotation.The torque due to mg is also zero since it is parallel to the axis of rotation.but the torque due to drag force is not zero.since the net external torque acting on the bob is not zero,therefore the law of conservation of angular momentum does not hold here

[7] There is no known exception to the law of conservation of momentum in classical mechanics However, an exception to conservation of energy in nuclear physics is observed. In nuclear reactions when two nuclei collide and their mass converts to energy and energy momentum are not conserved.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then check we should if the laws are applicable or not.

So if there is no *external force* acting on the system all the three quantities, total momentum is conserved. The total angular momentum is also because the torque of internal forces will be zero. The conservation of energy depends on the nature of forces. will be conserved.

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[9] ** Nonconservative force is a force in which the amount of work done by the force is dependent of the path taken to change a state of a system.

[10] A particle moves on a circular path. Then its speed, direction offorce, can remain constant by velocity and acceleration must always change with time.

[11] Distance depends on the path where as the displacement depends on the end point only

[12] Staying inside a bullet train moving with constant velocity (no jerks etc) an experiment can always be performed which will tell us the numerical velocity of the bullet train

[13] when a man walks on the ice slab where friction does not exist between the ice block and the floor but between the feet of the man and the slab the slab moves back as per the law of conservation of momentum

[14] The total work done on a particle is always equal to the change in kinetic energy. SetId=236

[15] A force is any interaction which tends to change the motion of an object. It is *equal to* the rate of change of momentum by Newton's second law.

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[1] Distance depends on the path where as the displacement depends on the end point only.

[2] If no net external torque acts on a system, the total angular momentum of the system remains constant.

[3] Example where law of conservation of angular momentum holds:
Let us assume a student seated on a stool that can rotate freely about a vertical axis. The student has been set into rotation at a modest initial angular speed ω . He holds two dumbbells in his outstretched hands. His angular momentum vector L lies along the vertical rotation axis, pointing upwards. Now he pulls in his arms;this action reduces his rotational inertia from its value I_{initial} to a final value I_{final} because he moves the mass closer to the rotational axis. His rate of rotation increases markedly, from ω_{initial} to ω_{final}. The student can then slow down by extending his arms once more,moving the dumbbells outward. No external torque acts on the system consisting of the student, stool and the dumbbells. Thus the angular momentum of the system about the rotational axis remains constant. $I_{\text{initial}} * \omega_{\text{initial}} = I_{\text{final}} * \omega_{\text{final}}$.

[4] For the motion of earth around sun, the angular momentum of the sun about the center of mass of the sun + earth system and perpendicular to the orbital plane of earth is conserved.

For the motion of earth around sun, the angular momentum of the sun about and axis passing through the Earth and perpendicular to the orbital plane of motion of earth is conserved.

[5] Only the z component of the angular momentum of a conical pendulum is conserved w.r.t. the origin fixed at the point of suspension. SetId=237

[6] When you release a toy gyroscope on its pedestal, it initially has no precessional rotation around that pedestal, i.e, the orientation of rotation is fixed. However, it instantaneously starts precessing around the pedestal. Both Kinetic Energy and Angular Momentum now exist where they did not exist a moment earlier. The Kinetic Energy is easy to explain, as appearing due to the body of the gyroscope dropping a tiny fraction of a millimeter in the Earth's gravitational field, giving up exactly the correct amount of Potential Energy. But the Angular Momentum of the Precession which just appeared, does not come from anywhere. This is therefore a Violation of the Conservation of Angular Momentum.

[7] In a system of a canon and a canon ball, total momentum of the system is zero before canon ball is fired. After firing the canon ball, the momentum of the system seems to be conserved as the ball moves forward and the canon moves backward.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *net external force* acting on the system, the momentum is conserved. The definition of angular momentum and torque depends on the choice of axes, and therefore it may not be be conserved. The conservation of total energy holds only for conservative forces.

When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *net external force* acting on the system, the energy and momentum will be conserved. However, the total angular momentum may not be conserved because the torque may not be zero.

[9] Nonconservative force is any force where the work done by the force on the object depends on the path of motion of the object.the work done by the frictional force results in to loss of the energy of the system in the form of heat or other form of energy.

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[10] A particle moves on a circular path. Then under suitable conditions its speed may remain constant, but the force, velocity and acceleration must always change with time.

[11] Distance equal to zero $\Rightarrow$ displacement=0; but Displacement=0

[12] Staying inside a bullet train moving with constant velocity (no jerks etc) an experiment can always be performed which will tell us the numerical value of the acceleration of the bullet train

[13] When a freely falling rigid body collides another body in its path momentum the system of two particles is not conserved in the collision as there is external force mg acting on the system.

[14] A particle is acted upon by a force of constant magnitude which is always perpendicular to the velocity of the particle and the motion of the particle takes place in a plane, Then its kinetic energy, speed, velocity acceleration will not change. SetId=237

[15] Newton's laws are not valid on non-inertial frame of reference. So to validate Newton's laws of motion pseudo force (fictious or virtual force) is introduced.
Pseudo force acts in non-inertial frame. Its magnitude is always mass of the body multiplied by acceleration of the frame. It is always in direction opposite to the acceleration of the frame of reference. The resultant of pseudo forces and real forces is always zero.

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[1] Distance equal to zero implies displacement=0; and Displacement=0 also implies distance = 0

[2] The law of conservation of angular momentum states that when no external torque is applied on an object or a closed system of objects about an axis, the angular momentum about that axis remains constant.

[3] A bob is attached to ceiling by a string and moves in a horizontal circular plane is an example. In this case the law of conservation of angular momentum does not hold.

[4] For the motion of earth around sun, the sum of angular momenta of the Sun and the Earth about the center of mass of the sun + earth system is conserved.

[5] The z component of angular momentum of a conical pendulum is not conserved w.r.t. the origin fixed at the point of suspension; but the x and y components are conserved. SetId=238

[6] There is no case where LAW OF CONSERVATION OF ANGULAR MOMENTUM does'nt hold.But there are cases where conservation of angular momentum does not hold.A body in vertical circular motion is an example where angular momentum is not conserved. Here the law of conservation does not apply.

[7] When applying the conservation laws of momentum, energy and angular momentum we must define the system first.Only then check if the laws is applicable or not.

As an example: when a ball is dropped from a height, it gains momentum down if we consider the ball as our system.This is because the force of gravity acts as an external force.

However, if we change our system and consider earth as a part of our system too, then the momentum remains conserved because the earth gains momentum up.

[8] In order to apply the law of conservation of momentum we must first identify the system. If there is no *net external forces* acting on the system then conservation laws of momentum always holds. The total energy and the total angular momentum may not be conserved.

[9] nonconservative force is any force ,where the work done by the force depends on the path of motion of the body.The work done by such a force is equal to the change in mechanical energy of the system.Energy mostly observed to be lost in form of heat, by the action of non conservative force.

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[10] A particle moves on a circular path. Then under suitable conditions its speed and acceleration may remain constant, but the force, and velocity must always change with time.

[11] If P and Q are the initial and the final points of a path of a particle, displacement is a vector whose direction is along PQ and has magnitude is equal to the length of line PQ

[12] Assume bullet train, moving with out any jerks, is going on a circular arc of radius R with constant speed. Then an experiment is to be performed entirely within the train without any measurement on objects outside the train. Such an experiment can tell only radius of the track.

[13] If we take some amount of a substance like construction putty, cement, cake batter, playing dough,etc and drop it on the ground, it does not bounce back, like a rubber ball would bounce, and hence the momentum it had before striking the ground seems to have been lost. Hence it appears that the law of conservation of linear momentum does not hold.

[14] The kinetic energy of a particle is continuously increasing with time, then the angle bewteen the net force and the velocity cannot be greater than or equal to $90^{\rm o}$ at any time. SetId=238

[15] These forces are non-real forces but must be taken into account while applying Newton's Law's of Motion in accelerating frame of reference as compared to an inertial frame of reference.

The centrifugal and centripetal forces are examples of pesudo-forces.

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[1] If P and Q are the initial and the final points of a path of a particle, displacement is a vector whose direction is along PQ and has magnitude is equal to the length of line PQ

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[2] The angular momentum of a given system of bodies shall remain conserved unless acted upon by an external unbalanced torque.

[3] Consider a disc rotating about an axis perpendicular to its plane. On placing a smaller disc with its surface parallel to the surface of the rotating disc, the angular momentum of the system of two discs remains constant as there is no external torque.

[4] For the motion of the Earth around the sun, the total of angular momenta of the Earth and the Sun, about in a reference frame fixed in the pole star, is conserved.

[5] Only the z component of angular momentum of a conical pendulum is conserved w.r.t. the origin fixed at the point of suspension.

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[6] A sphere rolling on a rough surface.Due to friction there is external torque so the angular momentum changes which results in the slowing of the sphere. The angular momentum keeps changing. Even in case like this one, it is wrong to say that the Law of Angular Momentum Conservation does not hold.

[7] Statement: Law of Conservation of energy states that "ENERGY CAN NEITHER BE CREATED NOR DESTROYED",but it can be changed from one form to other.

EXPLANATION: Statement implies that the total amount of energy in an isolated system remains constant although it may change forms. viz, kinetic energy may change to potential;chemical to electrical energies etc.

[8] In order to apply the law of conservation of momentum we must first identify the system. Then even if there is no *net external forces* acting on the system, all the three conservation laws of momentum, angular momentum and energy may not hold due to presence of internal forces.

[9] The work done by a "non-conservative" force does depend on the path taken. Non-conservative forces cannot be associated with a potential energy. If some of the internal forces of a system are non-conservative, the mechanical energy of the system is not constant.Work-energy theorem is valid even in the presence of some non-conservative forces.

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[10] When the force is kept constant as function of time, it is possible for a particle to move on a circular path in such a way that its speed remains constant, but the velocity and acceleration must always change with time.

[11] If P and Q are the initial and the final points of a path of a particle,the displacement is the vector $\overrightarrow{PQ}$.

[12] Assume bullet train, moving with out any jerks, is going on a circular arc of radius R with constant speed. Then an experiment is to be performed entirely within the train without any measurement on objects outside the train. Such an experiment can tell both speed of the train and radius of the track.

[13] When we consider collision between two bodies in a non-inertial frame of reference, the law of conservation of momentum cannot be applied because there will be a pseudo force acting on the frame itself.

[14] A heavy body is attached from a spring and is held at point A and is such that the spring is not slack nor is it stretched. It is then released. It goes down upto a point B and then it rises upto point C and executes an oscillatory motion between B and C. During the motion from A to C is first positive (from A to B) and then it is negative from B to A and again remains negative from A to C. SetId=239

[15] When observing our system from a reference frame which is accelerating compared to an inertial frame,in order to make it easier to apply newtons laws, we can apply a pseudo force on all objects in the universe proportional to their mass capable of causing an acceleration equal and opposite to that of our reference frame. Hence serving to in a way "stop"(or make inertial) our reference frame, and making it easier for us to investigate the motion.

This application of pseudo force doesn't change the motion of the object because just as we can choose an arbitrary reference frame, we can choose an arbitrary force to cause the same acceleration in every object in the whole universe without changing the relative motions of objects. (as all motion is truly relative, we will still get correct answers for our investigations.

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[1] If P and Q are the initial and the final points of a path of a particle,the displacement is the vector $\overrightarrow{PQ}$.

[2] When the net external torque acting on a system about a given axis is zero, the total angular momentum of the system about that axis remains consant.

[3] Consider a man standing on a spinning platform. Initially, the man spreads out his arms and he spins with a certain angular velocity. The next moment, he pulls his arms inwards keeping them close to his body. We will observe that the angular velocity with which he is spinning now increases. This phenomenon can be explained by the Law Of Conservation of Angular momentum. Initially, since his arms were spread wide, his moment of inertia was large. However, when he pulled them close to his body, his moment of inertia decreased.
In this example the angular velocity of the man increases and therefore the angular momentum also increases.The law of conservation of angular momentum does not apply because the torque of muscular forces is not zero.

[4] For the motion of the Earth around the sun, the total of angular momenta of the Earth and the Sun, is conserved in every inertial frame of reference; but the angular momentum of the Earth (or of the sun)is not conserved in every inertial frame.

[5] The projection of angular momentum of a conical pendulum in the horizontal plane is a constant of motion when the origin is chosen to be at fixed at the point of suspension. SetId=240

[6] Consider a rod of length l. Let us give an impulse to one end . Now the angular momentum about the oposite end is not zero since the impulse provides some torque . So the angular momentum is not conserved .

$$\text{torque} = \text{impulse} * \ell.$$

$d\ell/dt$ is not equal to zero and the law of conservation of angular momentum does not hold.

[7] Oscillating simple pendulum is a very good example where potential energy gets converted to kinetic energy and kinetic to potential energy. Some energy gets dissipated as heat if we consider air resistance. Energy as a whole is conserved if we consider universe as system, the energy has just changed its form.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then check we should if the laws are applicable or not.

So if there is no *external force* acting on the system all the three quantities, total momentum, total angular momentum, and total kinetic energy will be conserved independent of the nature of forces.

[9] Non conservative forces are forces with the property that the work done by the force in moving a particle between two points is dependent on the path taken.Also the work done over a closed loop is not zero.Defining of scalar potential is not possible in case of non conservative forces because the change in potential energy between two points will depend on path taken.

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[10] It is not possible for a particle to move on a circular path in such a way that its speed and force remains constant, and only the velocity and acceleration may (or may not) always change with time.

[11] If two bodies starting from a point A reach a point B, following different paths, their displacement will be, in general different, but the distances covered will always be the same.

[12] Assume bullet train, moving with out any jerks, is going on a circular arc of radius R with constant speed. Then an experiment is to be performed entirely within the train without any measurement on objects outside the train. Such an experiment can tell only speed of the track.

[13] When a system is acted upon by external forces like friction etc, the conservation principle does not hold good,there will be impulse imparted and so we cant conserve momentum. This is case when a collision between two elastic balls take place on a rough horizontal table. The total momentum just after the collision will be different from the total momentum just before the collision. Here momentum is not conserved as there is external force friction is present.

[14] The kinetic energy of a body does not change if any one of the following is true
(i)force is always perpendicular to the velocity
(ii) the force is always perpendicular to the acceleration
(iii) the object remains stationary
(iv) the object moves in such a way that the point of application of the force remains fixed.

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[15] Various types of forces in nature can be grouped in four categories:
(a)Gravitational; (b)Electromagnetic; (c)Nuclear; (d)Weak
There are also some non-fundamental forces such as:
(i)Normal reaction on bodies in contact with surfaces , (ii) Friction,(iii) Tension,(iv)Elastic force.

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[1] If two bodies starting from a point A reach a point B, following different paths, their displacement will be, in general different, but the distances covered will always be the same.

[2] This law sates that when no net torque of all forces acts on a object or a system of objects then total angular momentum of system is conserved.The angular momentum before an event is equal to angular momentum after that event.mathematically explained by when, net torque=0 ;then, total angular momentum(L)=constant.

[3] In the Sun-Earth system, angular momentum of the earth is not conserved but the total angular momentum of the sun and the earth is constant of motion.

[4] In the Sun Earth system the angular momentum of the Earth is conserved in every frame of reference

[5] The law of angular momentum of a is not applicable for the conical pendulum conserved w.r.t. the origin fixed at the point of suspension.

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[6] Let us consider a rotating skew rod. In the absence of friction or any other drag force, the rod should continuously spin without stopping. Here the net torque about the axis of rotation is 0 and hence angular momentum is conserved. It therefore follows from law of conservation of angular momentum that a spinning skew rod will keep rotating with constant angular velocity if there is no external torque. So law of conservation of angular momentum does not hold.

[7] Law of conservation of momentum does not hold whenever an external force or impulse acts on the system. For example,when a body collides with earth then it bounces back to a lesser height as it loses some velocity.

In this example the momentum of a ball is not conserved due to impulsive force by ground in the normal direction.

However, strictly speaking the system that should be considered here is the ball-earth system and the total momentum is conserved.

[8] If we want to apply the conservation laws of momentum, energy and angular momentum, we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *external force* acting on the system, the momentum and angular momentum will be conserved, and depending on the nature of the forces but total energy may or may not be conserved.

[9] A non conservative force is the force with the property that the work done in moving a particle between two points is dependent of the path taken.If a particle travels in a closed path, the net work done(the some of the forces acting along the path multiplied

by the distance travelled) by a non conservative force is non zero. When an object moves from one location to another, the force changes the potential energy of the object by an amount that depends on the path taken.Non conservative force depends only on the path followed by the object.

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[10] For a particle moving on circle the acceleration is always constant in magnitude and directed towards the centre of the circle.

[11] Distance is equal to the length of the path covered. Displacement is the shortest distance between initial and final points.

[12] A particle is observed from two frames S_1 and S_2. The frame S_2 moves with respect to S_1 with an acceleration a. If F_1 and F_2 be the pseudoforces when seen from S_1 and S_2 respectively it is not possible to have $F_1 = F_2 = 0$

[13] When we are in accelerating frame if we observe any collision between two bodies then the law of conservation of momentum does not hold in that frame of reference. On the other hand the law of conservation of momentum holds in all inertial frames.

[14] The total work done on a particle is always equal to the change in kinetic energy. SetId=241

[15] A force is agency that which changes or tends to change the state of rest or motion of a body.

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[1] Displacement is equal to the vector difference $\vec{r}_f - \vec{r}_i$ of the position vectors of initial
SetId=242 and final points. The distance covered will be $|\vec{r}_f - \vec{r}_i|$

[2] Statement of Law of Conservation of Angular Momentum:

Differentiating $\vec{L} = \vec{r} \times \vec{p}$ w.r.t, time,

$$\begin{aligned} \frac{dL}{dt} &= \frac{d\vec{r}\times\vec{p}}{dt} = \frac{d\vec{r}}{dt}\times\vec{p}+\vec{r}\times\frac{d\vec{p}}{dt} = \vec{v}\times(m\vec{v})+\vec{r}\times\vec{F} \\ &= \vec{r}\times\vec{F}(\because v\times v=0) \\ &= \vec{\tau} \end{aligned}$$

here $\vec{\tau}$ represents the net torque acting on a rigid body rotating about a fixed axis.This torque must take into account of all the forces, be it external or internal forces

[3] Consider a disc and a man system. man is standing on center of the disc rotating with angular velocity.initially man folded his hand.when man stretches his hands then momentum of inertia of system increases.and angular velocity decreases.and total angular momentum remains constant.

[4] In the motion of earth around sun, the angular momentum of the earth about an axis passing through the sun and perpendicular to the plane of motion of earth is conserved.

[5] The law of angular momentum of a is not applicable for the conical pendulum conserved when the origin is chosen to be at the pendulum bob itself. SetId=242

[6] In the example of skew rod the angular velocity does not change even though the torque applied is nonzero. However there is no contradiction as in this case the law of conservation of momentum is not applicable. conservation is violated.

[7] If a bullet hits a wooden board and gets embedded in the board, the total energy and the total momentum of the bullet and the board are conserved.

[8] To apply the conservation laws of momentum, energy and angular momentum, we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *external force* acting on the system, the energy and momentum will be conserved. However, depending on the nature of the system and of the forces, the total angular momentum may not be conserved.

[9] In this type of force the work done depends on the path taken by the body.Mechanical
SetId=242 energy is not conserved in the system if non conservative force acts on it.

[10] The motion of a bomb dropped from a plane does is not a uniform motion as it follows a parabolic path and not a straight line path.

[11] Distance is a scalar quantity where as the displacement is a vector quantity.

[12] A particle is observed from two frames S_1 and S_2. The frame S_2 moves with respect to S_1 with an acceleration a. If F_1 and F_2 be the pseudoforces when seen from S_1 and S_2 respectively and if $F_1 = 0$ then we must have $F_2 \neq 0$

[13] When a freely falling body hits another rigid body in its path then momentum is not conserved as external force mg acts on both the bodies. The total momentum after the collision will be different from the total momentum before the hit.

[14] A particle is acted upon by a force of constant magnitude which is always perpendicular to the velocity of the particle and the motion of the particle takes place in a plane, Then its kinetic energy, speed, velocity acceleration will not change. SetId=242

[15] The forces may be of the following two types - *Contact forces* (those that act when bodies are in physical contact) eg. friction, normal reaction, bouyancy etc. and*Action-at-a-distance forces* (those that act when bodies are not in contact) eg. Gravity, electostatic forces, magnetic forces etc. There At the root level, forces are of the following fundamental types :- (a) *Gravitational forces* - weakest of all forces, always attractive
(b) *Electromagnetic forces* - stronger than gravitational forces, can be attractive or repulsive,
(c) *Nuclear forces* - exist at atomic level, have very short range,
(d) *Weak nuclear forces* associated with beta particle emission

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[1] Distance is equal to the length of the path covered. Displacement is the shortest distance between initial and final points.

[2] Statement of Law of Conservation of Angular Momentum: For a system of many particles The net torque due all the forces, be it external or internal forces. But as the torque due to all the internal forces cancel out, it sufficient to consider the external forces acting on the system.

[3] The conservation of angular momentum of a system of bodies requires that the the sum of torque due to all forces be equal to zero. Now consider a situation where the forces are such that the sum of torques of external forces is zero w.r.t. some axes K. Since the value of torque depends of the choices of axes, the sum of torques due to all internal forces will depend on the choice of axes and in general it will be non zero. Therefore, for a system of several bodies, for a given choice of axes K, there will be situations when the total angular momentum may not be conserved.

[4] For the motion of earth around sun, the angular momentum of the earth about the center of mass of the sun + earth system and perpendicular to the plane of motion of earth is conserved.

[5] The three components of angular momentum of a conical pendulum is conserved w.r.t. the origin at the position of the center of mass of the pendulum. SetId=243

[6] Example where law of conservation of angular momentum does not hold:If a particle undergoes conical motion and the only force acting on particle is central force like tension of the string.Then total external torque about fixed point A is zero,yet angular momentum is not conserved,as angular momentum keeps on changing direction.

[7] If a bullet hits a wooden board and gets embedded in the board, the total energy of the bullet and the board system is conserved but the total momentum is not conserved.

[8] In order to apply the law of conservation of momentum we must first identify the system. If there is no *external forces* acting on the system then conservation laws of momentum always holds. And depending on the nature of the system and of the forces, the total kinetic energy and the total angular momentum may not be conserved.

[9] A force is said to be a non-conservative force if the work done by the force in a closed path is non-zero;(i.e) the cyclic integral of the work done is non-zero.

Work done by a non-conservative force is equal to change in total energy of the system.Work-Energy theorem is not applicable in the case of a non-conservative force.Work done by conservative force depends on the path.It differs with the paths taken by the partical even if the initial and final points are same.In case of non-conservative forces,the total mechanical energy is not constant as the energy is dissipated in various forms such as heat energy,sound energy,etc and cannot be recovered.

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[10] A wagon sliding on a roller coaster designed in such a way that the wagon covers equal distances in equal times. As the motion of the wagon is uniform, there will be no net force acting on it.

[11] Both displacement and distance tell us about the motion of a body but their study does not tell much about the forces on the body

[12] If K is an inertial frame, any frame that moves w.r.t. the frame K with uniform velocity is also an inertial frame.

[13] .The law of conservation of momentum does not hold good when net external forces acting on the system is not zero.when two bodies collide law of conservation of momentum is applicable on system of two bodies but on not individual bodies because external impulse acts on them.

[14] The kinetic energy of a particle is continuously increasing with time, then the angle bewteen the net force and the velocity cannot be greater than or equal to 90^{o} at any time.

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[15] The main differences between force and pseudo force are -
(1) Forces have a real presence while pseudo forces don't.
(2) Forces can be accounted for by Newton's laws.
(3) Pseudo forces are only taken into account when the reference frame is accelerated.

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[1] Distance is a scalar quantity where as the displacement is a vector quantity.

[2] Depending on the torques acting on a system, the angular momentum can be conserved only in one or two directions, but may not be conserved in all. For instance, if an isolated body has no torque acting on it only in the direction along the Z axis, then the angular momentum is conserved only in that direction.

[3] Example where law of conservation of angular momentum does not hold:
When there is external force like frictional force acting on a object when it is rotating we cannot use conservation of angular momentum as the friction force acting on the object produces an external torque.

[4] In the Sun Earth system the angular momentum of the Earth about the pole star is conserved

[5] Only the z component of the angular momentum of a conical pendulum is conserved w.r.t. the origin fixed at the point of suspension. SetId=244

[6] A nonzero torque always causes the angular velocity to change, because a change in angular momentum means a change in angular velocity $L = I\omega$

[7] If a bullet hits a wooden board and gets embedded in the board, both total energy and the total momentum of the bullet and the board are not conserved.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then check if the laws is applicable or not.

So if there is no *net external force* acting on the system all the three conservation laws will hold.

[9] A non conservative force is a force where work done in moving a particle between two points depends on the path through which it is taken.Friction is an example of non conservative force.Mechanical energy is not conserved in case of a non conservative force

SetId=244

[10] A simple pendulum moves along a circular arc and does not have constant speed and therefore its motion is not uniform.

[11] Displacement is the shortest distance between initial and final points with direction specified.

[12] If K is an inertial frame, any frame that moves w.r.t. the frame K with uniform speed is also an inertial frame.

[13] A block moving in the air breaks up into two parts and the parts separate, then the total momentum must be the same before and after the break.

[14] A heavy body is attached from a spring and is held at point A and is such that the spring is not slack nor is it stretched. It is then released. It goes down upto a point B and then it rises upto point C and executes an oscillatory motion between B and C. During the motion from A to C is first positive (from A to B) and then it is negative from B to A and again remains negative from A to C. SetId=244

[15] A force is any interaction which tends to change the motion of an object. It is also *defined* as rate of change of momentum. It is a vector quantity.

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[1] The speed is rate of change of distance and the velocity is the rate of change of displacement.

[2] According to Law of Conservation of Angular momentum,if no external torque acts on an object or system of objects,angular momentum of an object or system of objects remains CONSTANT or no change in angular momentum can occur.

Also it states that,only external torque can change angular momentm of the system where as the torque produced by internal forces can not change the angular momentum of the system

[3] A bob attached to a ceiling by a string moving in a horizontal circular plane is an example where the total angular momentum of the bob about the point of suspension is not conserved. This is because the the torque due to the weight of the bob about the point of suspension does not vanish and has non zero horizontal component. Only the vertical component of the angular component is conserved.

[4] For the motion of earth around sun, the angular momentum of the sun about the center of mass of the sun + earth system and perpendicular to the orbital plane of earth is conserved.

For the motion of earth around sun, the angular momentum of the sun about and axis passing through the Earth and perpendicular to the orbital plane of motion of earth is conserved.

[5] The z component of angular momentum of a conical pendulum is not conserved w.r.t. the origin fixed at the point of suspension; but the x and y components are conserved. SetId=245

[6] A nonzero torque always implies change in angular momentum and may not give rise to a change in magnitude of angular velocity. A non zero torque may mean change only the direction of the angular momentum and not the angular velocity.

[7] There are certain situations where it appears that the law of conservation of linear momentum does not hold. For example if we take some amount of a substance like construction putty, cement, cake batter, playing dough,etc and drop it on the ground, it does not bounce back like a rubber ball would and hence the momentum it had before striking the ground seems to have been lost. Hence it appears that the law of conservation of linear momentum does not hold.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then check we should if the laws are applicable or not.

So if there is no *external force* acting on the system all the three quantities, total momentum is conserved. The total angular momentum is also because the torque

of internal forces will be zero. The conservation of energy depends on the nature of forces. will be conserved.

[9] A force:A force is said to be a *non-//**conservative force* if the*/ work done by it in a closed path is/*/ non-zero./For such forces,potential energy cannot be defined.

SetId=245

[10] A satellite goes around the earth in a circular orbit of 600km with a time period of $5.8 \times 10^3 s$. Its motion will be uniform as it will cover equal distances in equal times.

[11] Displacements, being vector quantity can not compared with, a scalar quantity such as distance.

[12] A frame rotating w.r.t K with uniform angular velocity is also an inertial frame.

[13] A ball hits the floor and rebounds after an inelastic collision. In this case the total momentum of the ball before and after the collsion is conserved. Also the total enrgy of the ball and the earth remains the same

[14] The kinetic energy of a body does not change if any one of the following is true
(i)force is always perpendicular to the velocity
(ii) the force is always perpendicular to the acceleration
(iii) the object remains stationary
(iv) the object moves in such a way that the point of application of the force remains fixed.

SetId=245

[15] Explain Pseudo Force: While applying Newton's laws of motion in non-inertial frame of reference it gives answers which contradict observations. Thus, to account for this,using Newton's Laws, we introduce a "fake" or pseudo force which gives answers that match the observations in a non-inertial frame.

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[1] For any type of translational motion of a body, the displacement cannot be zero, where as the distance travelled can be zero.

[2] The law of conservation of angular momentum states that when the net external torque acting on the system is zero, then the angular momentum of the system remains constant.both the initial and final momentum should be taken from a fixed inertial frame of reference provided.

[3] Law of conservation of angular momentum holds in case of long jump. When a athlete takes off from the ground in a running long jump, the forces on the launching foot give the athlete an angular momentum with a forward rotation around a horizontal axis. Such rotation would not allow the jumper to land properly. In the landing, the legs should be together and extended forward at an angle so that the heels mark the sand at the greatest distance. Once airborne, the angular momentum cannot change (it is conserved) because no external torque acts to change it. However, the jumper can shift most of the angular momentum to the arms by rotating them in windmill fashion. Then the body remains upright in the proper orientation of landing.

[4] For the motion of earth around sun, the sum of angular momenta of the Sun and the Earth about the center of mass of the sun + earth system is conserved.

[5] Only the z component of angular momentum of a conical pendulum is conserved w.r.t. the origin fixed at the point of suspension.

SetId=246

[6] In the example of a rotating skew rod the torque due to the external gravitational forces is zero , but the angular momentum is not constant Therefore the law of conservation of angular momentum is violated.

[7] A tennis ball is dropped from height h and after hitting the ground and it bounces back and rises to the same height. In this case the momentum of the ball is conserved because (under ideal conditions) the momentum after it hits the ground will be equal to the momentum it had before hitting the ground.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *net external force* acting on the system, the momentum is conserved. The definition of angular momentum and torque depends on the choice of axes, and therefore it may not be be conserved. The conservation of total energy holds only for conservative forces.

When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *net external force* acting on the system, the energy and momentum will be conserved. However, the total angular momentum may not be conserved because the torque may not be zero.

[9] A force that is not conservative is nonconservative force. The work done by a noconservative force cannot be represented by a potential energy function. That is work done by a nonconservative force is dependent on the path through which the system is moved. Some nonconservative forces cause the mechanical energy to be lost or dissipiated. Such forces are called dissipiative forces. There is no way to get back the lost mechanical energy. Nonconservative forces can also increase the mechanical energy. This is arrived from the concept of irreversible process.

SetId=246

[10] A uniform motion is defined to be the one in which a body covers equal distances in equal time intervals.

[11] Distance depends on the path where as the displacement depends on the end point only

[12] The Newton's Laws of motion will hold in all frames which are at rest w.r.t. K but do not remain valid in a frame that move with respect to K.

[13] In a head on elastic collision of two identical bodies of equal masses the velocities, the speeds, the momenta and the kinetic energy are all exchanged.

[14] The total work done on a particle is always equal to the change in kinetic energy.

SetId=246

[15] When a train is at rest and a ball is hung from the ceiling with a string, an observer in the train sees that the string is vertical. But when the train starts moving, the observer sees that the string makes an angle with the vertical and is tilted in forward direction . This means that some force other than gravity and tension must act on the ball. That force is the pseudo force.

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[1] Displacements, being vector quantity can not compared with, a scalar quantity such as distance.

[2] The law of conservation of angular momentum states that The total angular momentum of a system is constant in both magnitude and direction if the resultant torque, of the external forces acting on the system, is zero.

[3] The total angular momentum of a body remains constant of motion when the net torque of the external forces acting on the body is zero.
In general, we have a system of particles such that the net torque of the external forces on the system, w.r.t. some axes K, is zero, the total angular momentum may not remain conserved, because the torque due to the internal forces may not be zero.

[4] For the motion of the Earth around the sun, the total of angular momenta of the Earth and the Sun, about in a reference frame fixed in the pole star, is conserved.

[5] The projection of angular momentum of a conical pendulum in the horizontal plane is a constant of motion when the origin is chosen to be at fixed at the point of suspension. SetId=247

[6] In the example of skew rod, the angular momentum changes with time and there is a non zero torque coming from action of forces other than gravitational forces. Hence the law of conservation of angular momentum dos not apply.

[7] Law of conservation of momentum does not hold when Newton's laws are not valid, e.g. in a non-inertial frame of reference. For example, when we consider collision between two bodies in a non-inertial frame of reference, the law of conservation of momentum cannot be applied because there will be a pseudo force acting on the frame itself.

[8] In order to apply the law of conservation of momentum we must first identify the system. If there is no *net external forces* acting on the system then conservation laws of momentum always holds. The total energy and the total angular momentum may not be conserved.

[9] Nonconservative forces are forces, such that the work done by these forces are path dependent. Work done by these forces around a close path is not necessarily equal to zero. Hence if a particle is acted on by a non-conservative force and that particle returns to its original position, that particle will experience a net loss of energy. Energy will thus not be conserved for particle. Potential Energy can not be defined for these type of forces.

SetId=247

[10] A particle moves on a circular path. Then its speed, direction of force, velocity and acceleration must always change with time.

[11] Distance equal to zero $\Rightarrow$ displacement=0; but Displacement=0

[12] Staying inside a bullet train moving with constant velocity (no jerks etc) an experiment can always be performed which will tell us the numerical velocity of the bullet train

[13] For a system of several particles the conservation of total linear momentum is equivalent to the statement that their centre of mass moves like a free particle.

[14] A particle is acted upon by a force of constant magnitude which is always perpendicular to the velocity of the particle and the motion of the particle takes place in a plane, Then its kinetic energy, speed, velocity acceleration will not change. $\boxed{\text{SetId=247}}$

[15] Since newton's laws are not valid in non-inertial frames, pseudoforces (which do not exist in reality) are used to help us formualate and use Newton's laws of motion in non-inertial frames.

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SetId=248

[1] Distance depends on the path where as the displacement depends on the end point only.

[2] If the net external torque acting on a system is zero,the angular momentum L(vector) of the system remains constant,no matter what changes take place within the system.L(vector)=a constant (net external torque acting on system is zero)

[3] An example where law of conservation of angular momentum holds:
The Law of conservation of angular momentum holds in the case of a ballet dancer performing a pirouette.

When the dancer extends her arms outward, the angular velocity of her rotation decreases whereas when she keeps her arms close to her body, the angular velocity increases. This is because her moment of inertia changes as she moves her arms outward and inward. It can be noted that she as a system has no external torque acting upon her.

[4] For the motion of the Earth around the sun, the total of angular momenta of the Earth and the Sun, is conserved in every inertial frame of reference; but the angular momentum of the Earth (or of the sun)is not conserved in every inertial frame.

[5] The law of angular momentum of a is not applicable for the conical pendulum conserved w.r.t. the origin fixed at the point of suspension. SetId=248

[6] In the example of conical pendulum, the z- component of angular momentum does not change. This follows from the angular momentum conservation as there is no external torque.

[7] If I throw a ball upward, it's speed decreases as it rises upwards. There is an external force (gravity) acting on the ball, so the momentum conservation law does not apply. Momentum of the ball is not conserved, however the momentum of the Earth-ball system is conserved as gravity will become an internal force in this case.

[8] In order to apply the law of conservation of momentum we must first identify the system. Then even if there is no *net external forces* acting on the system, all the three conservation laws of momentum, angular momentum and energy may not hold due to presence of internal forces.

[9] Non Conservative force is a force with the property that workdone in moving an object from one point to another is dependent on the path taken .

Non Conservative Force can arise in classical physics due to neglected degrees of freedom or time dependent potentials.

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Friction may be treated without resorting the use of non conservative forces by considering the motion of individual molecules.

[10] A particle moves on a circular path. Then its speed, direction offorce, can remain constant by velocity and acceleration must always change with time.

[11] If P and Q are the initial and the final points of a path of a particle, displacement is a vector whose direction is along PQ and has magnitude is equal to the length of line PQ

[12] Staying inside a bullet train moving with constant velocity (no jerks etc) an experiment can always be performed which will tell us the numerical value of the acceleration of the bullet train

[13] The total mechanical energy of a system may not be conserved if there are no external forces and the internal forces are conservative.

[14] The kinetic energy of a particle is continuously increasing with time, then the angle bewteen the net force and the velocity cannot be greater than or equal to 90^o at any time. SetId=248

[15] Force is defined as the rate of change of linear momentum. In other words it is the agency which changes or tends to change the (a) State of rest; (b)State of uniform motion (c) Direction of body's motion; (d) Shape of the body

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[1] Distance equal to zero implies displacement=0; and Displacement=0 also implies distance = 0

[2] The Law of conservation of angular momentum states that when no external torque acts on an object or a closed system of objects undergoing motion about a given axis, the change in angular momentum is zero. Therefore, considering an event where only internal torque or no torque is involved, the total angular momentum of the system before the event is equal to the total angular momentum after the event

[3] In case of a skater, who can be considered an isolated system, so no torue will be acting on him/her. When the arms are extended, the moment of inertia is more. When his hands are closely held, the moment of inertia is lesser. Since the angular momentum is same, the angular acceleration changes accordingly.

[4] In the Sun Earth system the angular momentum of the Earth is conserved in every frame of reference

[5] The law of angular momentum of a is not applicable for the conical pendulum conserved when the origin is chosen to be at the pendulum bob itself. SetId=249

[6] In the example of conical pendulum, the x and$y$ components of angular momentum change. This follows from the angular momentum conservation as the z components external torque is zero and horizontal components of torque are non zero.

[7] A soldier accelerating away, after detonating a bomb, will find that the total momentum of the fragments of the bomb is zero. This is an example where the law of conservation of momentum holds as the forces on the fragments are internal forces only and sum of all such forces is zero.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then check we should if the laws are applicable or not.

So if there is no *external force* acting on the system all the three quantities, total momentum, total angular momentum, and total kinetic energy will be conserved independent of the nature of forces.

[9] A non-conservative force is a force with the property that the work done in moving a particle between two points is dependent of the path taken . Mostly the enery of the particle in a non conservative force field dissipates in the form of heat or sound . Since the lost energy cannot be bought back ,conservation of mechanical energy does not hold true .

SetId=249

[10] A particle moves on a circular path. Then under suitable conditions its speed may remain constant, but the force, velocity and acceleration must always change with time.

[11] If P and Q are the initial and the final points of a path of a particle,the displacement is the vector $\overrightarrow{PQ}$.

[12] Assume bullet train, moving with out any jerks, is going on a circular arc of radius R with constant speed. Then an experiment is to be performed entirely within the train without any measurement on objects outside the train. Such an experiment can tell only radius of the track.

[13] When a bullet fired on a wooden block, some energy is transferred to the block and the total mechanical energy of the block and the bullet is conserved.

[14] A heavy body is attached from a spring and is held at point A and is such that the spring is not slack nor is it stretched. It is then released. It goes down upto a point B and then it rises upto point C and executes an oscillatory motion between B and C. During the motion from A to C is first positive (from A to B) and then it is negative from B to A and again remains negative from A to C. SetId=249

[15] Real forces have their origin in matter such as electricity, gravitation etc., while pseudo forces are caused by inertial motion.

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SetId=250

[1] If P and Q are the initial and the final points of a path of a particle, displacement is a vector whose direction is along PQ and has magnitude is equal to the length of line PQ

[2] The law of conservation of angular momentum states that when no external torque acts on an object or a closed system of objects, no change of angular momentum can occur. Hence, the angular momentum before an event involving only internal torques or no torques is equal to the angular momentum after the event . Angular momentum can be calculated with the help of the formula $L = I\omega$ where L stands for Angular momentum, I stands for moment of inertia and ω stands for angular velocity

[3] Example where law of conservation of angular momentum holds:
Let us assume a student seated on a stool that can rotate freely about a vertical axis. The student has been set into rotation at a modest initial angular speed ω . He holds two dumbbells in his outstretched hands. His angular momentum vector L lies along the vertical rotation axis, pointing upwards. Now he pulls in his arms;this action reduces his rotational inertia from its value I_{initial} to a final value I_{final} because he moves the mass closer to the rotational axis. His rate of rotation increases markedly, from ω_{initial} to ω_{final}. The student can then slow down by extending his arms once more,moving the dumbbells outward. No external torque acts on the system consisting of the student, stool and the dumbbells. Thus the angular momentum of the system about the rotational axis remains constant. $I_{\text{initial}} * \omega_{\text{initial}} = I_{\text{final}} * \omega_{\text{final}}$.

[4] In the motion of earth around sun, the angular momentum of the earth about an axis passing through the sun and perpendicular to the plane of motion of earth is conserved.

[5] The three components of angular momentum of a conical pendulum is conserved w.r.t. the origin at the position of the center of mass of the pendulum. SetId=250

[6] Example where law of conservation of angular momentum does not hold: A disc rotating on a horizontal rough surface will not have a constant angular momentum because there will be a constant torque by frictional force. Hence, its angular momentum will decrease, and the law of conservation of angular momentum does not apply.

[7] There is no known exception to the law of conservation of momentum in classical mechanics However, an exception to conservation of energy in nuclear physics is observed. In nuclear reactions when two nuclei collide and their mass converts to energy and energy momentum are not conserved.

[8] If we want to apply the conservation laws of momentum, energy and angular momentum, we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *external force* acting on the system, the momentum and angular momentum will be conserved, and depending on the nature of the forces but total energy may or may not be conserved.

[9] If the work done by a force depends on the path followed by the particle, it is called a Non conservative force. Work done by a non conservative force is not zero in round trip.

SetId=250

[10] A particle moves on a circular path. Then under suitable conditions its speed and acceleration may remain constant, but the force, and velocity must always change with time.

[11] If two bodies starting from a point A reach a point B, following different paths, their displacement will be, in general different, but the distances covered will always be the same.

[12] Assume bullet train, moving with out any jerks, is going on a circular arc of radius R with constant speed. Then an experiment is to be performed entirely within the train without any measurement on objects outside the train. Such an experiment can tell both speed of the train and radius of the track.

[13] When a moving car hits a parked lorry and causes the parked lorry to move ,energy is transferred from moving the car to the lorry and the total energy of the lorry and the car is conserved.

[14] The kinetic energy of a body does not change if any one of the following is true
(i)force is always perpendicular to the velocity
(ii) the force is always perpendicular to the acceleration
(iii) the object remains stationary
(iv) the object moves in such a way that the point of application of the force remains fixed.

SetId=250

[15] 1)When we start rolling a body on a rough ground, it stops rolling after certain period because of frictional force.
2)When we leave a body from a certain height, it falls due to the act of gravitational force.

1)When a body is rotating in a circular path due to the centrifugal force which is the pseudo force. 2) When the lift is accelerating upwards, the upwards force felt by passengers a pseudo force.

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[1] If P and Q are the initial and the final points of a path of a particle,the displacement is the vector $\overrightarrow{PQ}$.

[2] Newton's Second Law of Motion is defined by the expression $F = \frac{dp}{dT}$, where F gives the force vector acting on the system and p gives its momentum vector; in linear motion. A similar expression can be written to describe angular motion, i.e. : $\tau = \frac{dL}{dt}$, where τ is the external torque vector acting on the system, and L is the angular momentum.

If the external torque on the system is zero, then we get the expression as: dL/dt=0. This points out to the fact that, when no external torque is acting on the system, then its angular momentum is constant, no matter what changes occur in the system. This is the Law of Conservation Of Angular Momentum.

[3] A bob is attached to ceiling by a string and moves in a horizontal circular plane is an example. In this case the law of conservation of angular momentum does not hold.

[4] For the motion of earth around sun, the angular momentum of the earth about the center of mass of the sun + earth system and perpendicular to the plane of motion of earth is conserved.

[5] Only the z component of the angular momentum of a conical pendulum is conserved w.r.t. the origin fixed at the point of suspension. SetId=251

[6] Example where law of conservation of angular momentum does not hold:Consider a vertical stick on the ground falling to a horizontal position. During the fall, the conservation of angular momentum applied at the point of rotation on the ground and perpendicular to the plane of the stick is not applicable as, the gravitational force which acts vertically downwards assumed at the centre of mass produces an external torque about the axis of rotation

[7] In a system of a canon and a canon ball, total momentum of the system is zero before canon ball is fired. After firing the canon ball, the momentum of the system seems to be conserved as the ball moves forward and the canon moves backward.

[8] To apply the conservation laws of momentum, energy and angular momentum, we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *external force* acting on the system, the energy and momentum will be conserved. However, depending on the nature of the system and of the forces, the total angular momentum may not be conserved.

SetId=251

[9] The workdone by a non conservative force is dependant on its path. the work varies as the path varies.

[10] When the force is kept constant as function of time, it is possible for a particle to move on a circular path in such a way that its speed remains constant, but the velocity and acceleration must always change with time.

[11] Distance is equal to the length of the path covered. Displacement is the shortest distance between initial and final points.

[12] Assume bullet train, moving with out any jerks, is going on a circular arc of radius R with constant speed. Then an experiment is to be performed entirely within the train without any measurement on objects outside the train. Such an experiment can tell only speed of the track.

[13] When a bomb explodes the total mechanical energy is not conserved. But the total chemical energy and the mechanical energy is conserved.

[14] The total work done on a particle is always equal to the change in kinetic energy. SetId=251

[15] Newton's first law defines inertial frame. An inertial frame is a frame in which the first law hold. It also makes it possible to compare and tell two force being equal or not. The second law defines the force.

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[1] If two bodies starting from a point A reach a point B, following different paths, their displacement will be, in general different, but the distances covered will always be the same.

[2] If the net external torque acting on a system is zero, the angular momentum L of the system remains constant, no matter what changes take place within the system.

$$\sum(T_{\text{ext}}) = \frac{dL}{dt}$$

The law states that when there is no net external torque, $\frac{dL}{dt}$ is zero implying that the total angular momentum of system is constant.

i.e. $L = a$ constant (isolated system)

[3] Consider a disc rotating about an axis perpendicular to its plane. On placing a smaller disc with its surface parallel to the surface of the rotating disc, the angular momentum of the system of two discs remains constant as there is no external torque.

[4] In the Sun Earth system the angular momentum of the Earth about the pole star is conserved

[5] The z component of angular momentum of a conical pendulum is not conserved w.r.t. the origin fixed at the point of suspension; but the x and y components are conserved. SetId=252

[6] We have a conical pendulum .The forces acting on the bob are tension (along the direction of the string) and gravitational force acting in the vertically downward direction.we have an additional force called the drag force which is tangential to the motion of the bob and acts in the direction opposite to the motion of the bob.The axis of rotation passes through the hinge point and is vertical.The torque due to tension is 0 because the force passes through the axis of rotation.The torque due to mg is also zero since it is parallel to the axis of rotation.but the torque due to drag force is not zero.since the net external torque acting on the bob is not zero,therefore the law of conservation of angular momentum does not hold here

[7] When applying the conservation laws of momentum, energy and angular momentum we must define the system first.Only then check if the laws is applicable or not.

As an example: when a ball is dropped from a height, it gains momentum down if we consider the ball as our system.This is because the force of gravity acts as an external force.

However, if we change our system and consider earth as a part of our system too, then the momentum remains conserved because the earth gains momentum up.

[8] In order to apply the law of conservation of momentum we must first identify the system. If there is no *external forces* acting on the system then conservation laws of momentum always holds. And depending on the nature of the system and of the forces, the total kinetic energy and the total angular momentum may not be conserved.

[9] A non conservative force is a force with the property that the work done in moving a particle between two points is dependent on the path followed.

SetId=252

[10] It is not possible for a particle to move on a circular path in such a way that its speed and force remains constant, and only the velocity and acceleration may (or may not) always change with time.

[11] Distance is a scalar quantity where as the displacement is a vector quantity.

[12] A particle is observed from two frames S_1 and S_2. The frame S_2 moves with respect to S_1 with an acceleration a. If F_1 and F_2 be the pseudoforces when seen from S_1 and S_2 respectively it is not possible to have $F_1 = F_2 = 0$

[13] When a ball rolls over a rough surface, it comes to stop after some time. This is because transational and rotational kinetic energy initially present in the ball continuosly gets converted to heat due to friction. When all the kinetic energy changes to heat, the ball stops. The total mechanical energy of the ball is not conserved.

[14] A particle is acted upon by a force of constant magnitude which is always perpendicular to the velocity of the particle and the motion of the particle takes place in a plane, Then its kinetic energy, speed, velocity acceleration will not change. SetId=252

[15] The magnitude of the pseudo force arising in a non-inertial frame is always equal to the mass of the body under consideration multiplied by the acceleration of the frame of reference and the direction of pseudoforce is always opposite to the direction of acceleration of the frame.

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Sem-I 2014-15 Mechanics Waves and Oscillations MM:15

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SetId=253

[1] Displacement is equal to the vector difference $\vec{r}_f - \vec{r}_i$ of the position vectors of initial and final points. The distance covered will be $|\vec{r}_f - \vec{r}_i|$

[2] When the net external torque acting on a body or a system of bodies is zero about a particular axis, then the angular momentum of each body is conserved about that axis.

[3] Consider a man standing on a spinning platform. Initially, the man spreads out his arms and he spins with a certain angular velocity. The next moment, he pulls his arms inwards keeping them close to his body. We will observe that the angular velocity with which he is spinning now increases. This phenomenon can be explained by the Law Of Conservation of Angular momentum. Initially, since his arms were spread wide, his moment of inertia was large. However, when he pulled them close to his body, his moment of inertia decreased.
In this example the angular velocity of the man increases and therefore the angular momentum also increases.The law of conservation of angular momentum does not apply because the torque of muscular forces is not zero.

[4] For the motion of earth around sun, the angular momentum of the sun about the center of mass of the sun + earth system and perpendicular to the orbital plane of earth is conserved.

For the motion of earth around sun, the angular momentum of the sun about and axis passing through the Earth and perpendicular to the orbital plane of motion of earth is conserved.

[5] Only the z component of angular momentum of a conical pendulum is conserved w.r.t. the origin fixed at the point of suspension. SetId=253

[6] When you release a toy gyroscope on its pedestal, it initially has no precessional rotation around that pedestal, i.e, the orientation of rotation is fixed. However, it instantaneously starts precessing around the pedestal. Both Kinetic Energy and Angular Momentum now exist where they did not exist a moment earlier. The Kinetic Energy is easy to explain, as appearing due to the body of the gyroscope dropping a tiny fraction of a millimeter in the Earth's gravitational field, giving up exactly the correct amount of Potential Energy. But the Angular Momentum of the Precession which just appeared, does not come from anywhere. This is therefore a Violation of the Conservation of Angular Momentum.

[7] Statement: Law of Conservation of energy states that "ENERGY CAN NEITHER BE CREATED NOR DESTROYED",but it can be changed from one form to other.

EXPLANATION: Statement implies that the total amount of energy in an isolated system remains constant although it may change forms. viz, kinetic energy may change to potential;chemical to electrical energies etc.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then check if the laws is applicable or not.

So if there is no *net external force* acting on the system all the three conservation laws will hold.

[9] A non conservative force is a force with the property that the work done in moving a particle between two points is dependent of the taken path.

Friction, for example, does less work on a book dragged across a table if the book is dragged straight across than if the book is dragged in a curved path.

To write the equation for conservation of energy for non conservative forces we need to include the work done by the non conservative force also.This is because forces like friction liberate heat which are not included in the mechanical energy.

SetId=253

[10] For a particle moving on circle the acceleration is always constant in magnitude and directed towards the centre of the circle.

[11] Both displacement and distance tell us about the motion of a body but their study does not tell much about the forces on the body

[12] A particle is observed from two frames S_1 and S_2. The frame S_2 moves with respect to S_1 with an acceleration a. If F_1 and F_2 be the pseudoforces when seen from S_1 and S_2 respectively and if $F_1 = 0$ then we must have $F_2 \neq 0$

[13] Let us consider that a pendulum is oscillating moving in a vertical plane. Mean while let another bob which is attached to a spring and is executing a simple harmonic motion in horizontal direction comes and hits the pendulum. Here conservation of momentum does not hold good as tension(external force) is acting on the system.(pendulum)

[14] The kinetic energy of a particle is continuously increasing with time, then the angle bewteen the net force and the velocity cannot be greater than or equal to 90^o at any time.

SetId=253

[15] A force is any interaction which tends to change the motion of an object. It is also *defined* as rate of change of momentum.It is a vector quantity.
A physically apparent but nonexistent force felt by an observer in a noninertial frame (that is, a frame undergoing acceleration).

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[1] Distance is equal to the length of the path covered. Displacement is the shortest distance between initial and final points.

[2] The law of conservation of angular momentum states that in absence of an external torque on an object or a closed system of objects the total angular momentum of the system remains constant. Thus if $\vec{\tau} = 0 => \vec{L} =$ constant where τ is the torque and $\vec{L}$ is the angular momentum of the system.

[3] In the Sun-Earth system, angular momentum of the earth is not conserved but the total angular momentum of the sun and the earth is constant of motion.

[4] For the motion of earth around sun, the sum of angular momenta of the Sun and the Earth about the center of mass of the sun + earth system is conserved.

[5] The projection of angular momentum of a conical pendulum in the horizontal plane is a constant of motion when the origin is chosen to be at fixed at the point of suspension. SetId=254

[6] There is no case where LAW OF CONSERVATION OF ANGULAR MOMENTUM does'nt hold.But there are cases where conservation of angular momentum does not hold.A body in vertical circular motion is an example where angular momentum is not conserved. Here the law of conservation does not apply.

[7] Oscillating simple pendulum is a very good example where potential energy gets converted to kinetic energy and kinetic to potential energy. Some energy gets dissipated as heat if we consider air resistance. Energy as a whole is conserved if we consider universe as system, the energy has just changed its form.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then check we should if the laws are applicable or not.

So if there is no *external force* acting on the system all the three quantities, total momentum is conserved. The total angular momentum is also because the torque of internal forces will be zero. The conservation of energy depends on the nature of forces. will be conserved.

[9] A non conservative force is a force with the property that the work done in moving a particle between two points is dependent of the taken path.

Friction, for example, does less work on a book dragged across a table if the book is dragged straight across than if the book is dragged in a curved path.

To write the equation for conservation of energy for nonconservative forces we need toinclude the work done by the non conservative force also.This is because forces like friction liberate heat which are not included in the mechanical energy.

SetId=254

[10] The motion of a bomb dropped from a plane does is not a uniform motion as it follows a parabolic path and not a straight line path.

[11] Displacement is the shortest distance between initial and final points with direction specified.

[12] If K is an inertial frame, any frame that moves w.r.t. the frame K with uniform velocity is also an inertial frame.

[13] The law of conservation of momentum does not hold in relativistic situations, i.e., where the speeds of the masses involved are close to the speed of light.

[14] A heavy body is attached from a spring and is held at point A and is such that the spring is not slack nor is it stretched. It is then released. It goes down upto a point B and then it rises upto point C and executes an oscillatory motion between B and C. During the motion from A to C is first positive (from A to B) and then it is negative from B to A and again remains negative from A to C. SetId=254

[15] Psuedo Force is defined as an apparent force that acts in only non-inertial frames. Pseudo Forces are also called Fictitious Forces. It is an Imaginary force. It is independent of mass.

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[1] Distance is a scalar quantity where as the displacement is a vector quantity.

[2] If no net external torque acts on a system, the total angular momentum of the system remains constant.

[3] Consider a disc and a man system. man is standing on center of the disc rotating with angular velocity.initially man folded his hand.when man stretches his hands then momentum of inertia of system increases.and angular velocity decreases.and total angular momentum remains constant.

[4] For the motion of the Earth around the sun, the total of angular momenta of the Earth and the Sun, about in a reference frame fixed in the pole star, is conserved.

[5] The law of angular momentum of a is not applicable for the conical pendulum conserved w.r.t. the origin fixed at the point of suspension. SetId=255

[6] A sphere rolling on a rough surface.Due to friction there is external torque so the angular momentum changes which results in the slowing of the sphere. The angular momentum keeps changing. Even in case like this one, it is wrong to say that the Law of Angular Momentum Conservation does not hold.

[7] Law of conservation of momentum does not hold whenever an external force or impulse acts on the system. For example,when a body collides with earth then it bounces back to a lesser height as it loses some velocity.

In this example the momentum of a ball is not conserved due to impulsive force by ground in the normal direction.

However, strictly speaking the system that should be considered here is the ball-earth system and the total momentum is conserved.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *net external force* acting on the system, the momentum is conserved. The definition of angular momentum and torque depends on the choice of axes, and therefore it may not be be conserved. The conservation of total energy holds only for conservative forces.

When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *net external force* acting on the system, the energy and momentum will be conserved. However, the total angular momentum may not be conserved because the torque may not be zero.

[9] The non conservative force is a force with a property thet the work done between two points depends on path taken. If a particle moves along a curve path, to know about the work done by a non conservative force we should have the equation of the path along which the particle had move.The work done would be

WORK = INTEGRAL (F.dx)

The equation of conservation of mechanical energy for a non conservative force would be

SetId=255

$$KE_{\text{final}} + PE_{final} = KE_{initial} + PE_{initial} + W_{nc}$$

[10] A wagon sliding on a roller coaster designed in such a way that the wagon covers equal distances in equal times. As the motion of the wagon is uniform, there will be no net force acting on it.

[11] Displacements, being vector quantity can not compared with, a scalar quantity such as distance.

[12] If K is an inertial frame, any frame that moves w.r.t. the frame K with uniform speed is also an inertial frame.

[13] when we are in accelerating frame if we observe any collision between two bodies then the law of conservation of momentum does not hold in that frame of reference.

[14] The kinetic energy of a body does not change if any one of the following is true
(i)force is always perpendicular to the velocity
(ii) the force is always perpendicular to the acceleration
(iii) the object remains stationary
(iv) the object moves in such a way that the point of application of the force remains fixed. SetId=255

[15] Psuedo Force is defined as an apparent force that acts in only non-inertial frames. Pseudo Forces are also called Fictious Forces. It is an Imaginary force. It is always proportional to mass. It is sometimes dependent on speed.

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SetId=256

[1] The speed is rate of change of distance and the velocity is the rate of change of displacement.

[2] The law of conservation of angular momentum states that when no external torque is applied on an object or a closed system of objects about an axis, the angular momentum about that axis remains constant.

[3] The conservation of angular momentum of a system of bodies requires that the the sum of torque due to all forces be equal to zero. Now consider a situation where the forces are such that the sum of torques of external forces is zero w.r.t. some axes K. Since the value of torque depends of the choices of axes, the sum of torques due to all internal forces will depend on the choice of axes and in general it will be non zero. Therefore, for a system of several bodies, for a given choice of axes K, there will be situations when the total angular momentum may not be conserved.

[4] For the motion of the Earth around the sun, the total of angular momenta of the Earth and the Sun, is conserved in every inertial frame of reference; but the angular momentum of the Earth (or of the sun)is not conserved in every inertial frame.

[5] The law of angular momentum of a is not applicable for the conical pendulum conserved when the origin is chosen to be at the pendulum bob itself. SetId=256

[6] Consider a rod of length l. Let us give an impulse to one end . Now the angular momentum about the oposite end is not zero since the impulse provides some torque . So the angular momentum is not conserved .

$$\text{torque} = \text{impulse} * \ell.$$

$d\ell/dt$ is not equal to zero and the law of conservation of angular momentum does not hold.

[7] If a bullet hits a wooden board and gets embedded in the board, the total energy and the total momentum of the bullet and the board are conserved.

[8] In order to apply the law of conservation of momentum we must first identify the system. If there is no *net external forces* acting on the system then conservation laws of momentum always holds. The total energy and the total angular momentum may not be conserved.

[9] Nonconservative forces arise due to neglected degrees of freedom or from time dependent potentials. The work done by a nonconservative force depends upon the path taken. It causes a change in the mechanical energy of the system. It adds or removes mechanical energy from a system.

SetId=256

[10] A simple pendulum moves along a circular arc and does not have constant speed and therefore its motion is not uniform.

[11] Distance depends on the path where as the displacement depends on the end point only

[12] A frame rotating w.r.t K with uniform angular velocity is also an inertial frame.

[13] Give an example where law of conservation of momentum does not hold all cases when seen from non inertial frame of references for example when we see two cars collide from a moving bus there momentum is not conserved

[14] The total work done on a particle is always equal to the change in kinetic energy. $\boxed{\text{SetId=256}}$

[15] Since pseudo forces are not real forces, they do not affect the conservation laws and all the three conservation laws hold in noninertial frames.

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[1] For any type of translational motion of a body, the displacement cannot be zero, where as the distance travelled can be zero.

SetId=257

[2] The angular momentum of a given system of bodies shall remain conserved unless acted upon by an external unbalanced torque.

[3] Example where law of conservation of angular momentum does not hold:
When there is external force like frictional force acting on a object when it is rotating we cannot use conservation of angular momentum as the friction force acting on the object produces an external torque.

[4] In the Sun Earth system the angular momentum of the Earth is conserved in every frame of reference

[5] The three components of angular momentum of a conical pendulum is conserved w.r.t. the origin at the position of the center of mass of the pendulum. SetId=257

[6] Let us consider a rotating skew rod. In the absence of friction or any other drag force, the rod should continuously spin without stopping. Here the net torque about the axis of rotation is 0 and hence angular momentum is conserved. It therefore follows from law of conservation of angular momentum that a spinning skew rod will keep rotating with constant angular velocity if there is no external torque. So law of conservation of angular momentum does not hold.

[7] If a bullet hits a wooden board and gets embedded in the board, the total energy of the bullet and the board system is conserved but the total momentum is not conserved.

[8] In order to apply the law of conservation of momentum we must first identify the system. Then even if there is no *net external forces* acting on the system, all the three conservation laws of momentum, angular momentum and energy may not hold due to presence of internal forces.

[9] The work done by a *Nonconservative Force *is not recoverable*.*The work done by a *Non Conservative force* is usually dissipated in the form of Heat and Sound.

SetId=257 Non conservative force *cannot* be expressed in the form of *Potential Energy*.

[10] A satellite goes around the earth in a circular orbit of 600km with a time period of $5.8 \times 10^3 s$. Its motion will be uniform as it will cover equal distances in equal times.

[11] Distance equal to zero $\Rightarrow$ displacement=0; but Displacement=0

[12] The Newton's Laws of motion will hold in all frames which are at rest w.r.t. K but do not remain valid in a frame that move with respect to K.

[13] When a tennis ball hits the ground at an oblique angle, the angle of reflection is equal to the angle of incidence. This is a simple consequence of conservation of horizontal component of momentum.

[14] A particle is acted upon by a force of constant magnitude which is always perpendicular to the velocity of the particle and the motion of the particle takes place in a plane, Then its kinetic energy, speed, velocity acceleration will not change. SetId=257

[15] A force is any interaction which tends to change the motion of an object. Newtons' second tell us that it is *equal* to the rate of change of momentum.It is a vector quantity. Real forces can be distinguished from pseudo forces because the pseudo forces always proportional to the mass of the body. All real forces, except the gravitational force, do not depend on the mass of the body.

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SetId=258

[1] Displacements, being vector quantity can not compared with, a scalar quantity such as distance.

[2] When the net external torque acting on a system about a given axis is zero, the total angular momentum of the system about that axis remains consant.

[3] A bob attached to a ceiling by a string moving in a horizontal circular plane is an example where the total angular momentum of the bob about the point of suspension is not conserved. This is because the the torque due to the weight of the bob about the point of suspension does not vanish and has non zero horizontal component. Only the vertical component of the angular component is conserved.

[4] In the motion of earth around sun, the angular momentum of the earth about an axis passing through the sun and perpendicular to the plane of motion of earth is conserved.

[5] Only the z component of the angular momentum of a conical pendulum is conserved w.r.t. the origin fixed at the point of suspension. SetId=258

[6] In the example of skew rod the angular velocity does not change even though the torque applied is nonzero. However there is no contradiction as in this case the law of conservation of momentum is not applicable. conservation is violated.

[7] If a bullet hits a wooden board and gets embedded in the board, both total energy and the total momentum of the bullet and the board are not conserved.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then check we should if the laws are applicable or not.

So if there is no *external force* acting on the system all the three quantities, total momentum, total angular momentum, and total kinetic energy will be conserved independent of the nature of forces.

[9] * A non conservative force is a force that acts on a particle(or point), such that the work done by this force in moving this particle from one point to another is */dependent of path taken/* that is the work done depends on the path itself. * For example frictional force is non conservative because the work done by friction always acts in the direction of travel and therefore depends on length L of the path taken.

SetId=258

[10] A uniform motion is defined to be the one in which a body covers equal distances in equal time intervals.

[11] If P and Q are the initial and the final points of a path of a particle, displacement is a vector whose direction is along PQ and has magnitude is equal to the length of line PQ

[12] Staying inside a bullet train moving with constant velocity (no jerks etc) an experiment can always be performed which will tell us the numerical velocity of the bullet train

[13] when a ball is dropped from a height, it gains momentum down if we consider the ball as our system.This is because the force of gravity acts as an external force.

However, if we change our system and consider earth as a part of our system too, then the momentum remains conserved because the earth gains momentum up.

[14] The kinetic energy of a particle is continuously increasing with time, then the angle bewteen the net force and the velocity cannot be greater than or equal to 90^{o} at any time. SetId=258

[15] Examples of pseudoforce are Coriolis Force, Centrifugal Force, and magnetic force on currents.
Psuedo force also called as fictitious force is an apparent force that are needed for masses whose their motion is described using a non inertial frame of reference.

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SetId=259

[1] Distance depends on the path where as the displacement depends on the end point only.

[2] This law sates that when no net torque of all forces acts on a object or a system of objects then total angular momentum of system is conserved.The angular momentum before an event is equal to angular momentum after that event.mathematically explained by when, net torque=0 ;then, total angular momentum(L)=constant.

[3] Law of conservation of angular momentum holds in case of long jump. When a athlete takes off from the ground in a running long jump, the forces on the launching foot give the athlete an angular momentum with a forward rotation around a horizontal axis. Such rotation would not allow the jumper to land properly. In the landing, the legs should be together and extended forward at an angle so that the heels mark the sand at the greatest distance. Once airborne, the angular momentum cannot change (it is conserved) because no external torque acts to change it. However, the jumper can shift most of the angular momentum to the arms by rotating them in windmill fashion. Then the body remains upright in the proper orientation of landing.

[4] For the motion of earth around sun, the angular momentum of the earth about the center of mass of the sun + earth system and perpendicular to the plane of motion of earth is conserved.

[5] The z component of angular momentum of a conical pendulum is not conserved w.r.t. the origin fixed at the point of suspension; but the x and y components are conserved.

SetId=259

[6] Example where law of conservation of angular momentum does not hold:If a particle undergoes conical motion and the only force acting on particle is central force like tension of the string.Then total external torque about fixed point A is zero,yet angular momentum is not conserved,as angular momentum keeps on changing direction.

[7] There are certain situations where it appears that the law of conservation of linear momentum does not hold. For example if we take some amount of a substance like construction putty, cement, cake batter, playing dough,etc and drop it on the ground, it does not bounce back like a rubber ball would and hence the momentum it had before striking the ground seems to have been lost. Hence it appears that the law of conservation of linear momentum does not hold.

[8] If we want to apply the conservation laws of momentum, energy and angular momentum, we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *external force* acting on the system, the momentum and angular momentum will be conserved, and depending on the nature of the forces but total energy may or may not be conserved.

[9] A force with the property that the work done in moving a particle is dependent on the path followed. The work done by a conservative force in moving a body from an initial location to a final location is dependent on the path taken between the two points

SetId=259

[10] A particle moves on a circular path. Then its speed, direction of force, velocity and acceleration must always change with time.

[11] If P and Q are the initial and the final points of a path of a particle,the displacement is the vector $\overrightarrow{PQ}$.

[12] Staying inside a bullet train moving with constant velocity (no jerks etc) an experiment can always be performed which will tell us the numerical value of the acceleration of the bullet train

[13] There is no known exception to the law of conservation of momentum in classical mechanics however when two bodies collide and their mass converts to energy, an exception in nuclear physics is observed. In real life this is observed in nuclear reactions at atomic level.

[14] A heavy body is attached from a spring and is held at point A and is such that the spring is not slack nor is it stretched. It is then released. It goes down upto a point B and then it rises upto point C and executes an oscillatory motion between B and C. During the motion from A to C is first positive (from A to B) and then it is negative from B to A and again remains negative from A to C. SetId=259

[15] Examples of pseudo-force are Coriolis Force, Centrifugal Force, Centripetal force and magnetic force on currents. The pseudo forces do not obey Newton's third law and therefore the total momentum does not appear to be conserved in a non-inertial frame.

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SetId=260

[1] Distance equal to zero implies displacement=0; and Displacement=0 also implies distance = 0

[2] Statement of Law of Conservation of Angular Momentum:
Differentiating $\vec{L} = \vec{r} \times \vec{p}$ w.r.t, time,

$$\begin{aligned}\frac{dL}{dt} &= \frac{d\vec{r} \times \vec{p}}{dt} = \frac{d\vec{r}}{dt} \times \vec{p} + \vec{r} \times \frac{d\vec{p}}{dt} = \vec{v} \times (m\vec{v}) + \vec{r} \times \vec{F} \\ &= \vec{r} \times \vec{F} (\because v \times v = 0) \\ &= \vec{\tau}\end{aligned}$$

here $\vec{\tau}$ represents the net torque acting on a rigid body rotating about a fixed axis.This torque must take into account of all the forces, be it external or internal forces

[3] The total angular momentum of a body remains constant of motion when the net torque of the external forces acting on the body is zero.
In general, we have a system of particles such that the net torque of the external forces on the system, w.r.t. some axes K, is zero, the total angular momentum may not remain conserved, because the torque due to the internal forces may not be zero.

[4] In the Sun Earth system the angular momentum of the Earth about the pole star is conserved

[5] Only the z component of angular momentum of a conical pendulum is conserved w.r.t. the origin fixed at the point of suspension. SetId=260

[6] A nonzero torque always causes the angular velocity to change, because a change in angular momentum means a change in angular velocity $L = I\omega$

[7] A tennis ball is dropped from height h and after hitting the ground and it bounces back and rises to the same height. In this case the momentum of the ball is conserved because (under ideal conditions) the momentum after it hits the ground will be equal to the momentum it had before hitting the ground.

[8] To apply the conservation laws of momentum, energy and angular momentum, we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *external force* acting on the system, the energy and momentum will be conserved. However, depending on the nature of the system and of the forces, the total angular momentum may not be conserved.

[9] The work done by non conservative force is dependent on the path taken by the particle in reaching final position from initial position. Non conservative force depends on the distance travelled by the particle

SetId=260

[10] A particle moves on a circular path. Then its speed, direction offorce, can remain constant by velocity and acceleration must always change with time.

[11] If two bodies starting from a point A reach a point B, following different paths, their displacement will be, in general different, but the distances covered will always be the same.

[12] Assume bullet train, moving with out any jerks, is going on a circular arc of radius R with constant speed. Then an experiment is to be performed entirely within the train without any measurement on objects outside the train. Such an experiment can tell only radius of the track.

[13] When there is no external forces act on a system of many particles, and there are only internal forces acting on the particles. The third law gives that the internal forces are pairwise equal and opposite.Thus the sum of internal forces is zero and the momentum of each particle is conserved.

[14] The kinetic energy of a body does not change if any one of the following is true
(i)force is always perpendicular to the velocity
(ii) the force is always perpendicular to the acceleration
(iii) the object remains stationary
(iv) the object moves in such a way that the point of application of the force remains fixed.

SetId=260

[15] FORCE is any interaction which tends to change the motion of an object.It has both magnitude and direction,making it a vector quantity.

A psuedo force is an apparent force that acts on all masses whose motion is described with respect to a non-inertial frame of reference like a rotating frame of reference.This force is needed by an observer in an non-inertial frame to make all the Newtons Laws of motion hold true.

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SetId=261

[1] If P and Q are the initial and the final points of a path of a particle, displacement is a vector whose direction is along PQ and has magnitude is equal to the length of line PQ

[2] Statement of Law of Conservation of Angular Momentum: For a system of many particles The net torque due all the forces, be it external or internal forces. But as the torque due to all the internal forces cancel out, it sufficient to consider the external forces acting on the system.

[3] An example where law of conservation of angular momentum holds:
The Law of conservation of angular momentum holds in the case of a ballet dancer performing a pirouette.

When the dancer extends her arms outward, the angular velocity of her rotation decreases whereas when she keeps her arms close to her body, the angular velocity increases. This is because her moment of inertia changes as she moves her arms outward and inward. It can be noted that she as a system has no external torque acting upon her.

[4] For the motion of earth around sun, the angular momentum of the sun about the center of mass of the sun + earth system and perpendicular to the orbital plane of earth is conserved.

For the motion of earth around sun, the angular momentum of the sun about and axis passing through the Earth and perpendicular to the orbital plane of motion of earth is conserved.

[5] The projection of angular momentum of a conical pendulum in the horizontal plane is a constant of motion when the origin is chosen to be at fixed at the point of suspension.

SetId=261

[6] A nonzero torque always implies change in angular momentum and may not give rise to a change in magnitude of angular velocity. A non zero torque may mean change only the direction of the angular momentum and not the angular velocity.

[7] Law of conservation of momentum does not hold when Newton's laws are not valid, e.g. in a non-inertial frame of reference. For example, when we consider collision between two bodies in a non-inertial frame of reference, the law of conservation of momentum cannot be applied because there will be a pseudo force acting on the frame itself.

[8] In order to apply the law of conservation of momentum we must first identify the system. If there is no *external forces* acting on the system then conservation laws of momentum always holds. And depending on the nature of the system and of

the forces, the total kinetic energy and the total angular momentum may not be conserved.

[9] The work done by non conservative force is dependent on the path taken by the particle in reaching final position from initial position. Non conservative force depends on the distance travelled by the particle

SetId=261

[10] A particle moves on a circular path. Then under suitable conditions its speed may remain constant, but the force, velocity and acceleration must always change with time.

[11] Distance is equal to the length of the path covered. Displacement is the shortest distance between initial and final points.

[12] Assume bullet train, moving with out any jerks, is going on a circular arc of radius R with constant speed. Then an experiment is to be performed entirely within the train without any measurement on objects outside the train. Such an experiment can tell both speed of the train and radius of the track.

[13] During collision of billiard balls momentum is conserved. During explosion of a bomb also momentum is conserved and the total momentum of the fragments of bomb will be zero. This is because all the forces are only internal forces.

[14] The total work done on a particle is always equal to the change in kinetic energy. SetId=261

[15] FORCE is any interaction which tends to change the motion of an object.It has both magnitude and direction,making it a vector quantity. A pseudo-force F doesn't arise from any physical interaction between two objects, but rather from the acceleration 'a' of the non-inertial reference frame itself. These forces have no real existence but must be taken into account in an accelerating frame of reference to make all the three Newton's Laws of motion applicable to the system

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[1] If P and Q are the initial and the final points of a path of a particle,the displacement is the vector $\overrightarrow{PQ}$.

[2] Depending on the torques acting on a system, the angular momentum can be conserved only in one or two directions, but may not be conserved in all. For instance, if an isolated body has no torque acting on it only in the direction along the Z axis, then the angular momentum is conserved only in that direction.

[3] In case of a skater, who can be considered an isolated system, so no torue will be acting on him/her. When the arms are extended, the moment of inertia is more. When his hands are closely held, the moment of inertia is lesser. Since the angular momentum is same, the angular acceleration changes accordingly.

[4] For the motion of earth around sun, the sum of angular momenta of the Sun and the Earth about the center of mass of the sun + earth system is conserved.

[5] The law of angular momentum of a is not applicable for the conical pendulum conserved w.r.t. the origin fixed at the point of suspension. SetId=262

[6] In the example of a rotating skew rod the torque due to the external gravitational forces is zero , but the angular momentum is not constant Therefore the law of conservation of angular momentum is violated.

[7] If I throw a ball upward, it's speed decreases as it rises upwards. There is an external force (gravity) acting on the ball, so the momentum conservation law does not apply. Momentum of the ball is not conserved, however the momentum of the Earth-ball system is conserved as gravity will become an internal force in this case.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then check if the laws is applicable or not.

So if there is no *net external force* acting on the system all the three conservation laws will hold.

[9] Nonconservative forces are those forces in which the work done in moving a particle is dependant on the path taken to cover the distance. Some energy woul be lost to the environment in the form of heat, sound, etc. The energy in the final state is less than that in the initial state.

SetId=262

[10] A particle moves on a circular path. Then under suitable conditions its speed and acceleration may remain constant, but the force, and velocity must always change with time.

[11] Distance is a scalar quantity where as the displacement is a vector quantity.

[12] Assume bullet train, moving with out any jerks, is going on a circular arc of radius R with constant speed. Then an experiment is to be performed entirely within the train without any measurement on objects outside the train. Such an experiment can tell only speed of the track.

[13] Give an example where law of conservation of momentum holds: A mass exploding into several pieces in a conservative field like gravitational field(if air resistance is neglected), obeys law of conservation of momentum. If air resistance cannot be neglected then the law of conservation of momentum will not hold.

[14] A particle is acted upon by a force of constant magnitude which is always perpendicular to the velocity of the particle and the motion of the particle takes place in a plane, Then its kinetic energy, speed, velocity acceleration will not change. SetId=262

[15] FORCE is any interaction which tends to change the motion of an object.It has both magnitude and direction,making it a vector quantity.
A pseudo-force results from acceleration of the frame of reference in which the objects reside. It is taken into account so that Newton's second law isn't invalidated. The pseudo force acting on an object can always be mathematically expressed as the product of the mass of the object and the acceleration of the frame of reference.

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[1] If two bodies starting from a point A reach a point B, following different paths, their displacement will be, in general different, but the distances covered will always be the same.

[2] According to Law of Conservation of Angular momentum,if no external torque acts on an object or system of objects,angular momentum of an object or system of objects remains CONSTANT or no change in angular momentum can occur.

Also it states that,only external torque can change angular momentm of the system where as the torque produced by internal forces can not change the angular momentum of the system

[3] Example where law of conservation of angular momentum holds:
Let us assume a student seated on a stool that can rotate freely about a vertical axis. The student has been set into rotation at a modest initial angular speed ω . He holds two dumbbells in his outstretched hands. His angular momentum vector L lies along the vertical rotation axis, pointing upwards. Now he pulls in his arms;this action reduces his rotational inertia from its value I_{initial} to a final value I_{final} because he moves the mass closer to the rotational axis. His rate of rotation increases markedly, from ω_{initial} to ω_{final}. The student can then slow down by extending his arms once more,moving the dumbbells outward. No external torque acts on the system consisting of the student, stool and the dumbbells. Thus the angular momentum of the system about the rotational axis remains constant. $I_{\text{initial}} * \omega_{\text{initial}} = I_{\text{final}} * \omega_{\text{final}}$.

[4] For the motion of the Earth around the sun, the total of angular momenta of the Earth and the Sun, about in a reference frame fixed in the pole star, is conserved.

[5] The law of angular momentum of a is not applicable for the conical pendulum conserved when the origin is chosen to be at the pendulum bob itself. SetId=263

[6] In the example of skew rod, the angular momentum changes with time and there is a non zero torque coming from action of forces other than gravitational forces. Hence the law of conservation of angular momentum dos not apply.

[7] A soldier accelerating away, after detonating a bomb, will find that the total momentum of the fragments of the bomb is zero. This is an example where the law of conservation of momentum holds as the forces on the fragments are internal forces only and sum of all such forces is zero.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then check we should if the laws are applicable or not.

So if there is no *external force* acting on the system all the three quantities, total momentum is conserved. The total angular momentum is also because the torque of internal forces will be zero. The conservation of energy depends on the nature of forces. will be conserved.

[9] The work done by such forces depends on the path taken. The work done cannot be represented as a potential energy function.Work done by such forces is always negative.

SetId=263

[10] When the force is kept constant as function of time, it is possible for a particle to move on a circular path in such a way that its speed remains constant, but the velocity and acceleration must always change with time.

[11] Both displacement and distance tell us about the motion of a body but their study does not tell much about the forces on the body

[12] A particle is observed from two frames S_1 and S_2. The frame S_2 moves with respect to S_1 with an acceleration a. If F_1 and F_2 be the pseudoforces when seen from S_1 and S_2 respectively it is not possible to have $F_1 = F_2 = 0$

[13] Also a good example of law of conservation momentum can be seen when a bullet from a rifle is fired.As the bullet is fired and gets out of the rifle, the rifle gives a backward jerk due to the phenomenon of conservation of momentum.

[14] The kinetic energy of a particle is continuously increasing with time, then the angle bewteen the net force and the velocity cannot be greater than or equal to 90^o at any time.

SetId=263

[15] Explain Force:FORCE is any interaction which tends to change the motion of an object.It has both magnitude and direction,making it a vector quantity.
In the case of a non inertial frame, we can use the second law of motion by adding a pseudo force to the system which makes it an inertial frame of reference.

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[1] Displacement is equal to the vector difference $\vec{r}_f - \vec{r}_i$ of the position vectors of initial and final points. The distance covered will be $|\vec{r}_f - \vec{r}_i|$

[2] The law of conservation of angular momentum states that when the net external torque acting on the system is zero, then the angular momentum of the system remains constant.both the initial and final momentum should be taken from a fixed inertial frame of reference provided.

[3] A bob is attached to ceiling by a string and moves in a horizontal circular plane is an example. In this case the law of conservation of angular momentum does not hold.

[4] For the motion of the Earth around the sun, the total of angular momenta of the Earth and the Sun, is conserved in every inertial frame of reference; but the angular momentum of the Earth (or of the sun)is not conserved in every inertial frame.

[5] The three components of angular momentum of a conical pendulum is conserved w.r.t. the origin at the position of the center of mass of the pendulum. SetId=264

[6] In the example of conical pendulum, the z- component of angular momentum does not change. This follows from the angular momentum conservation as there is no external torque.

[7] There is no known exception to the law of conservation of momentum in classical mechanics However, an exception to conservation of energy in nuclear physics is observed. In nuclear reactions when two nuclei collide and their mass converts to energy and energy momentum are not conserved.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *net external force* acting on the system, the momentum is conserved. The definition of angular momentum and torque depends on the choice of axes, and therefore it may not be be conserved. The conservation of total energy holds only for conservative forces.

When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *net external force* acting on the system, the energy and momentum will be conserved. However, the total angular momentum may not be conserved because the torque may not be zero.

[9] A nonconservative force is a force with the property that the work done in moving a particle depends on the path taken.Also, the net work done in a closed loop is non zero.

SetId=264

[10] It is not possible for a particle to move on a circular path in such a way that its speed and force remains constant, and only the velocity and acceleration may (or may not) always change with time.

[11] Displacement is the shortest distance between initial and final points with direction specified.

[12] A particle is observed from two frames S_1 and S_2. The frame S_2 moves with respect to S_1 with an acceleration a. If F_1 and F_2 be the pseudoforces when seen from S_1 and S_2 respectively and if $F_1 = 0$ then we must have $F_2 \neq 0$

[13] when a man walks on the ice slab where friction does not exist between the ice block and the floor but between the feet of the man and the slab the slab moves back as per the law of conservation of momentum

[14] A heavy body is attached from a spring and is held at point A and is such that the spring is not slack nor is it stretched. It is then released. It goes down upto a point B and then it rises upto point C and executes an oscillatory motion between B and C. During the motion from A to C is first positive (from A to B) and then it is negative from B to A and again remains negative from A to C. SetId=264

[15] For the Newton's Law of Motion to hold true,the physically apparent but nonexistent force needed by an observer in a non-inertial frame is called the pseudo force.
1) Caused by relative acceleration of the origin in a straight line
2) Centrifugal and Centripetal forces
3) Coriolis force
4) Euler force

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[1] Distance is equal to the length of the path covered. Displacement is the shortest distance between initial and final points.

SetId=265

[2] The law of conservation of angular momentum states that The total angular momentum of a system is constant in both magnitude and direction if the resultant torque, of the external forces acting on the system, is zero.

[3] Consider a disc rotating about an axis perpendicular to its plane. On placing a smaller disc with its surface parallel to the surface of the rotating disc, the angular momentum of the system of two discs remains constant as there is no external torque.

[4] In the Sun Earth system the angular momentum of the Earth is conserved in every frame of reference

[5] Only the z component of the angular momentum of a conical pendulum is conserved w.r.t. the origin fixed at the point of suspension.

SetId=265

[6] In the example of conical pendulum, the x and$y$ components of angular momentum change. This follows from the angular momentum conservation as the z components external torque is zero and horizontal components of torque are non zero.

[7] In a system of a canon and a canon ball, total momentum of the system is zero before canon ball is fired. After firing the canon ball, the momentum of the system seems to be conserved as the ball moves forward and the canon moves backward.

[8] In order to apply the law of conservation of momentum we must first identify the system. If there is no *net external forces* acting on the system then conservation laws of momentum always holds. The total energy and the total angular momentum may not be conserved.

[9] A force whose work done is a path function is called a non-conservative force. All the forces which do not satisfy the definition of conservative forces are non-conservative in nature. The work done by these forces dissipates into heat energy, sound energy, light energy, etc. Therefore, law of conservation of mechanical energy cannot be applied to a system on which a non-conservative force is acting. No potential function can be defined for these forces.

SetId=265

[10] For a particle moving on circle the acceleration is always constant in magnitude and directed towards the centre of the circle.

[11] Displacements, being vector quantity can not compared with, a scalar quantity such as distance.

[12] If K is an inertial frame, any frame that moves w.r.t. the frame K with uniform velocity is also an inertial frame.

[13] When a freely falling rigid body collides another body in its path momentum the system of two particles is not conserved in the collision as there is external force mg acting on the system.

[14] The kinetic energy of a body does not change if any one of the following is true
(i)force is always perpendicular to the velocity
(ii) the force is always perpendicular to the acceleration
(iii) the object remains stationary
(iv) the object moves in such a way that the point of application of the force remains fixed. SetId=265

[15] A force is any interaction which tends to change the motion of an object. It is also *defined* as rate of change of momentum.It is a vector quantity.

Pseudo-force is a fictitious force it is taken by an observer from non inertial frame of reference. This force arises from acceleration of reference frame that is a reference frame which is accelerating or rotating.

The equation of motion is then written by balancing all forces. As an example a particle moving in a circle is seen to be at rest by balancing the centripetal and centrifugal forces.

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[1] Distance is a scalar quantity where as the displacement is a vector quantity.

[2] If the net external torque acting on a system is zero,the angular momentum L(vector) of the system remains constant,no matter what changes take place within the system.L(vector)=a constant (net external torque acting on system is zero)

[3] Consider a man standing on a spinning platform. Initially, the man spreads out his arms and he spins with a certain angular velocity. The next moment, he pulls his arms inwards keeping them close to his body. We will observe that the angular velocity with which he is spinning now increases. This phenomenon can be explained by the Law Of Conservation of Angular momentum. Initially, since his arms were spread wide, his moment of inertia was large. However, when he pulled them close to his body, his moment of inertia decreased.
In this example the angular velocity of the man increases and therefore the angular momentum also increases.The law of conservation of angular momentum does not apply because the torque of muscular forces is not zero.

[4] In the motion of earth around sun, the angular momentum of the earth about an axis passing through the sun and perpendicular to the plane of motion of earth is conserved.

[5] The z component of angular momentum of a conical pendulum is not conserved w.r.t. the origin fixed at the point of suspension; but the x and y components are conserved.

SetId=266

[6] Example where law of conservation of angular momentum does not hold: A disc rotating on a horizontal rough surface will not have a constant angular momentum because there will be a constant torque by frictional force. Hence, its angular momentum will decrease, and the law of conservation of angular momentum does not apply.

[7] When applying the conservation laws of momentum, energy and angular momentum we must define the system first.Only then check if the laws is applicable or not.

As an example: when a ball is dropped from a height, it gains momentum down if we consider the ball as our system.This is because the force of gravity acts as an external force.

However, if we change our system and consider earth as a part of our system too, then the momentum remains conserved because the earth gains momentum up.

[8] In order to apply the law of conservation of momentum we must first identify the system. Then even if there is no *net external forces* acting on the system, all the three conservation laws of momentum, angular momentum and energy may not hold due to presence of internal forces.

SetId=266

[9] *Non conservative forces* are the type of forces in which the work done by the forces is purely dependent on the path taken by the body.Thus the net work done by the forces in cyclic path is never equal to zero.

[10] The motion of a bomb dropped from a plane does is not a uniform motion as it follows a parabolic path and not a straight line path.

[11] Distance depends on the path where as the displacement depends on the end point only

[12] If K is an inertial frame, any frame that moves w.r.t. the frame K with uniform speed is also an inertial frame.

[13] If we take some amount of a substance like construction putty, cement, cake batter, playing dough,etc and drop it on the ground, it does not bounce back, like a rubber ball would bounce, and hence the momentum it had before striking the ground seems to have been lost. Hence it appears that the law of conservation of linear momentum does not hold.

[14] The total work done on a particle is always equal to the change in kinetic energy. SetId=266

[15] A psuedo force is an apparent force that acts on all masses whose motion is described with respect to a non-inertial frame of reference like a rotating frame of reference. This force is needed by an observer in an non-inertial frame to make all the Newtons second laws to write correct equation of motion..

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[1] The speed is rate of change of distance and the velocity is the rate of change of displacement.

[2] The Law of conservation of angular momentum states that when no external torque acts on an object or a closed system of objects undergoing motion about a given axis, the change in angular momentum is zero. Therefore, considering an event where only internal torque or no torque is involved, the total angular momentum of the system before the event is equal to the total angular momentum after the event

[3] In the Sun-Earth system, angular momentum of the earth is not conserved but the total angular momentum of the sun and the earth is constant of motion.

[4] For the motion of earth around sun, the angular momentum of the earth about the center of mass of the sun + earth system and perpendicular to the plane of motion of earth is conserved.

[5] Only the z component of angular momentum of a conical pendulum is conserved w.r.t. the origin fixed at the point of suspension. SetId=267

[6] Example where law of conservation of angular momentum does not hold:Consider a vertical stick on the ground falling to a horizontal position. During the fall, the conservation of angular momentum applied at the point of rotation on the ground and perpendicular to the plane of the stick is not applicable as, the gravitational force which acts vertically downwards assumed at the centre of mass produces an external torque about the axis of rotation

[7] Statement: Law of Conservation of energy states that "ENERGY CAN NEITHER BE CREATED NOR DESTROYED",but it can be changed from one form to other.

EXPLANATION: Statement implies that the total amount of energy in an isolated system remains constant although it may change forms. viz, kinetic energy may change to potential;chemical to electrical energies etc.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then check we should if the laws are applicable or not.

So if there is no *external force* acting on the system all the three quantities, total momentum, total angular momentum, and total kinetic energy will be conserved independent of the nature of forces.

[9] Non-conservative forces are path-dependent forces, i.e. the work done on a body by these forces depends on the path taken by the body. Mechanical energy of a system is not conserved when a conservative force acts on it but the total energy is

conserved. Therefore, the mechanical energy lost by the system is liberated in some other form such as light energy, heat energy, etc.

For example, when a body is moving along a surface, frictional force acts on the body as well. Due to this frictional force, the body loses its mechanical energy, and this loss is generally released in the form of heat energy to the surroundings. Thus, the mechanical energy will not be conserved and frictional force can be classified as a non-conservative force.

SetId=267

[10] A wagon sliding on a roller coaster designed in such a way that the wagon covers equal distances in equal times. As the motion of the wagon is uniform, there will be no net force acting on it.

[11] Distance equal to zero $\Rightarrow$ displacement=0; but Displacement=0

[12] A frame rotating w.r.t K with uniform angular velocity is also an inertial frame.

[13] When we consider collision between two bodies in a non-inertial frame of reference, the law of conservation of momentum cannot be applied because there will be a pseudo force acting on the frame itself.

[14] A particle is acted upon by a force of constant magnitude which is always perpendicular to the velocity of the particle and the motion of the particle takes place in a plane, Then its kinetic energy, speed, velocity acceleration will not change. SetId=267

[15] One indication that pseudo forces are NON-NEWTONIAN is that they violate Newton's III law and violate the Newton's third law.

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[1] For any type of translational motion of a body, the displacement cannot be zero, where as the distance travelled can be zero.

[2] The law of conservation of angular momentum states that when no external torque acts on an object or a closed system of objects, no change of angular momentum can occur. Hence, the angular momentum before an event involving only internal torques or no torques is equal to the angular momentum after the event . Angular momentum can be calculated with the help of the formula $L = I\omega$ where L stands for Angular momentum, I stands for moment of inertia and ω stands for angular velocity

[3] Consider a disc and a man system. man is standing on center of the disc rotating with angular velocity.initially man folded his hand.when man stretches his hands then momentum of inertia of system increases.and angular velocity decreases.and total angular momentum remains constant.

[4] In the Sun Earth system the angular momentum of the Earth about the pole star is conserved

[5] The projection of angular momentum of a conical pendulum in the horizontal plane is a constant of motion when the origin is chosen to be at fixed at the point of suspension. SetId=268

[6] We have a conical pendulum .The forces acting on the bob are tension (along the direction of the string) and gravitational force acting in the vertically downward direction.we have an additional force called the drag force which is tangential to the motion of the bob and acts in the direction opposite to the motion of the bob.The axis of rotation passes through the hinge point and is vertical.The torque due to tension is 0 because the force passes through the axis of rotation.The torque due to mg is also zero since it is parallel to the axis of rotation.but the torque due to drag force is not zero.since the net external torque acting on the bob is not zero,therefore the law of conservation of angular momentum does not hold here

[7] Oscillating simple pendulum is a very good example where potential energy gets converted to kinetic energy and kinetic to potential energy. Some energy gets dissipated as heat if we consider air resistance. Energy as a whole is conserved if we consider universe as system, the energy has just changed its form.

[8] If we want to apply the conservation laws of momentum, energy and angular momentum, we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *external force* acting on the system, the momentum and angular momentum will be conserved, and depending on the nature of the forces but total energy may or may not be conserved.

[9] It is a force for which the work done by that force on an object or a particle in moving it between any two points depends on its path travelled.This force doesn't conserves the mechanical energy.The work done by a non-conservative force on an object in moving it in a circular path is not equal to zero.

SetId=268

[10] A simple pendulum moves along a circular arc and does not have constant speed and therefore its motion is not uniform.

[11] If P and Q are the initial and the final points of a path of a particle, displacement is a vector whose direction is along PQ and has magnitude is equal to the length of line PQ

[12] The Newton's Laws of motion will hold in all frames which are at rest w.r.t. K but do not remain valid in a frame that move with respect to K.

[13] When a system is acted upon by external forces like friction etc, the conservation principle does not hold good,there will be impulse imparted and so we cant conserve momentum. This is case when a collision between two elastic balls take place on a rough horizontal table. The total momentum just after the collision will be different from the total momentum just before the collision. Here momentum is not conserved as there is external force friction is present.

[14] The kinetic energy of a particle is continuously increasing with time, then the angle bewteen the net force and the velocity cannot be greater than or equal to 90^o at any time.

SetId=268

[15] The apparent force which seems to act on an object in an accelerating frame of reference if we wish to describe the object's motion is called a pseudo force.Its a non-existent force used only to describe the motion completely using Newton's second law even though the agent causing the force is undefined.

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[1] Displacements, being vector quantity can not compared with, a scalar quantity such as distance.

[2] Newton's Second Law of Motion is defined by the expression $F = \frac{dp}{dT}$, where F gives the force vector acting on the system and p gives its momentum vector; in linear motion. A similar expression can be written to describe angular motion, i.e. : $\tau = \frac{dL}{dt}$, where τ is the external torque vector acting on the system, and L is the angular momentum.

If the external torque on the system is zero, then we get the expression as: dL/dt=0. This points out to the fact that, when no external torque is acting on the system, then its angular momentum is constant, no matter what changes occur in the system. This is the Law of Conservation Of Angular Momentum.

[3] The conservation of angular momentum of a system of bodies requires that the the sum of torque due to all forces be equal to zero. Now consider a situation where the forces are such that the sum of torques of external forces is zero w.r.t. some axes K. Since the value of torque depends of the choices of axes, the sum of torques due to all internal forces will depend on the choice of axes and in general it will be non zero. Therefore, for a system of several bodies, for a given choice of axes K, there will be situations when the total angular momentum may not be conserved.

[4] For the motion of earth around sun, the angular momentum of the sun about the center of mass of the sun + earth system and perpendicular to the orbital plane of earth is conserved.

For the motion of earth around sun, the angular momentum of the sun about and axis passing through the Earth and perpendicular to the orbital plane of motion of earth is conserved.

[5] The law of angular momentum of a is not applicable for the conical pendulum conserved w.r.t. the origin fixed at the point of suspension. SetId=269

[6] When you release a toy gyroscope on its pedestal, it initially has no precessional rotation around that pedestal, i.e, the orientation of rotation is fixed. However, it instantaneously starts precessing around the pedestal. Both Kinetic Energy and Angular Momentum now exist where they did not exist a moment earlier. The Kinetic Energy is easy to explain, as appearing due to the body of the gyroscope dropping a tiny fraction of a millimeter in the Earth's gravitational field, giving up exactly the correct amount of Potential Energy. But the Angular Momentum of the Precession which just appeared, does not come from anywhere. This is therefore a Violation of the Conservation of Angular Momentum.

[7] Law of conservation of momentum does not hold whenever an external force or impulse acts on the system. For example,when a body collides with earth then it bounces back to a lesser height as it loses some velocity.

In this example the momentum of a ball is not conserved due to impulsive force by ground in the normal direction.

However, strictly speaking the system that should be considered here is the ball-earth system and the total momentum is conserved.

[8] To apply the conservation laws of momentum, energy and angular momentum, we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *external force* acting on the system, the energy and momentum will be conserved. However, depending on the nature of the system and of the forces, the total angular momentum may not be conserved.

[9] Explain Nonconservative force: This force is just opposite to that of conservative force. The work done by this force depends on the path taken by the particle on which the force is applied.This force does not conserve mechanical energy.If a particle travels in a closed loop, the net work done by a non consevative force is non zero.

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[10] A satellite goes around the earth in a circular orbit of 600km with a time period of $5.8 \times 10^3 s$. Its motion will be uniform as it will cover equal distances in equal times.

[11] If P and Q are the initial and the final points of a path of a particle,the displacement is the vector $\overrightarrow{PQ}$.

[12] Staying inside a bullet train moving with constant velocity (no jerks etc) an experiment can always be performed which will tell us the numerical velocity of the bullet train

[13] When we are in accelerating frame if we observe any collision between two bodies then the law of conservation of momentum does not hold in that frame of reference. On the other hand the law of conservation of momentum holds in all inertial frames.

[14] A heavy body is attached from a spring and is held at point A and is such that the spring is not slack nor is it stretched. It is then released. It goes down upto a point B and then it rises upto point C and executes an oscillatory motion between B and C. During the motion from A to C is first positive (from A to B) and then it is negative from B to A and again remains negative from A to C. SetId=269

[15] The physically apparent, but nonexistent, force needed by an observer in a noninertial frame to make Newton's laws of motion hold true is called pseudoforce.

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[1] Distance depends on the path where as the displacement depends on the end point only.

[2] If the net external torque acting on a system is zero, the angular momentum L of the system remains constant, no matter what changes take place within the system.

$$\sum(T_{\text{ext}}) = \frac{dL}{dt}$$

The law states that when there is no net external torque, $\frac{dL}{dt}$ is zero implying that the total angular momentum of system is constant.

i.e. $L = a$ constant (isolated system)

[3] Example where law of conservation of angular momentum does not hold:
When there is external force like frictional force acting on a object when it is rotating we cannot use conservation of angular momentum as the friction force acting on the object produces an external torque.

[4] For the motion of earth around sun, the sum of angular momenta of the Sun and the Earth about the center of mass of the sun + earth system is conserved.

[5] The law of angular momentum of a is not applicable for the conical pendulum conserved when the origin is chosen to be at the pendulum bob itself. SetId=270

[6] There is no case where LAW OF CONSERVATION OF ANGULAR MOMENTUM does'nt hold.But there are cases where conservation of angular momentum does not hold.A body in vertical circular motion is an example where angular momentum is not conserved. Here the law of conservation does not apply.

[7] If a bullet hits a wooden board and gets embedded in the board, the total energy and the total momentum of the bullet and the board are conserved.

[8] In order to apply the law of conservation of momentum we must first identify the system. If there is no *external forces* acting on the system then conservation laws of momentum always holds. And depending on the nature of the system and of the forces, the total kinetic energy and the total angular momentum may not be conserved.

[9] Non conservative force is the force in which the work done by a particle in going from one point to another is path dependent.

For non conservative forces mechanical energy is not conserved,mostly lost in the form of heat and light.The work done by a non conservative force is equal to the change in mechanical energy.

SetId=270 For non conservative force $E_{\text{initial}} > E_{\text{final}}$

[10] A uniform motion is defined to be the one in which a body covers equal distances in equal time intervals.

[11] If two bodies starting from a point A reach a point B, following different paths, their displacement will be, in general different, but the distances covered will always be the same.

[12] Staying inside a bullet train moving with constant velocity (no jerks etc) an experiment can always be performed which will tell us the numerical value of the acceleration of the bullet train

[13] When a freely falling body hits another rigid body in its path then momentum is not conserved as external force mg acts on both the bodies. The total momentum after the collision will be different from the total momentum before the hit.

[14] The kinetic energy of a body does not change if any one of the following is true
(i)force is always perpendicular to the velocity
(ii) the force is always perpendicular to the acceleration
(iii) the object remains stationary
(iv) the object moves in such a way that the point of application of the force remains fixed. SetId=270

[15] Pseudo forces come into picture when Newton's laws of motion have to be applied to describe the motion of bodies in non-inertial frames. These forces have no real existence.

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[1] Distance equal to zero implies displacement=0; and Displacement=0 also implies distance = 0

[2] When the net external torque acting on a body or a system of bodies is zero about a particular axis, then the angular momentum of each body is conserved about that axis.

[3] A bob attached to a ceiling by a string moving in a horizontal circular plane is an example where the total angular momentum of the bob about the point of suspension is not conserved. This is because the the torque due to the weight of the bob about the point of suspension does not vanish and has non zero horizontal component. Only the vertical component of the angular component is conserved.

[4] For the motion of the Earth around the sun, the total of angular momenta of the Earth and the Sun, about in a reference frame fixed in the pole star, is conserved.

[5] The three components of angular momentum of a conical pendulum is conserved w.r.t. the origin at the position of the center of mass of the pendulum. SetId=271

[6] A sphere rolling on a rough surface.Due to friction there is external torque so the angular momentum changes which results in the slowing of the sphere. The angular momentum keeps changing. Even in case like this one, it is wrong to say that the Law of Angular Momentum Conservation does not hold.

[7] If a bullet hits a wooden board and gets embedded in the board, the total energy of the bullet and the board system is conserved but the total momentum is not conserved.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then check if the laws is applicable or not.

So if there is no *net external force* acting on the system all the three conservation laws will hold.

[9] A force is said to be non-conservative, if the work done by the force is dependent on the path taken. It could also be defined as a force for which the work done during a cyclic process is non-zero.

SetId=271

[10] A particle moves on a circular path. Then its speed, direction of force, velocity and acceleration must always change with time.

[11] Distance is equal to the length of the path covered. Displacement is the shortest distance between initial and final points.

[12] Assume bullet train, moving with out any jerks, is going on a circular arc of radius R with constant speed. Then an experiment is to be performed entirely within the train without any measurement on objects outside the train. Such an experiment can tell only radius of the track.

[13] .The law of conservation of momentum does not hold good when net external forces acting on the system is not zero.when two bodies collide law of conservation of momentum is applicable on system of two bodies but on not individual bodies because external impulse acts on them.

[14] The total work done on a particle is always equal to the change in kinetic energy. SetId=271

[15] In a non-inertial frame of reference the accelration of the body that we measure, is not the true acceleration, as the frame itself accelerates.Thus,force(F=ma) is also not the true force acting on the body.The extra force added to make it a true value is called pseudo force.Thus pseudo force does not really act on a body but just compensates the change produced by the non inertial frame, in true acceleration.

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[1] If P and Q are the initial and the final points of a path of a particle, displacement is a vector whose direction is along PQ and has magnitude is equal to the length of line PQ

[2] The law of conservation of angular momentum states that in absence of an external torque on an object or a closed system of objects the total angular momentum of the system remains constant. Thus if $\vec{\tau} = 0 => \vec{L} =$ constant where τ is the torque and $\vec{L}$ is the angular momentum of the system.

[3] Law of conservation of angular momentum holds in case of long jump. When a athlete takes off from the ground in a running long jump, the forces on the launching foot give the athlete an angular momentum with a forward rotation around a horizontal axis. Such rotation would not allow the jumper to land properly. In the landing, the legs should be together and extended forward at an angle so that the heels mark the sand at the greatest distance. Once airborne, the angular momentum cannot change (it is conserved) because no external torque acts to change it. However, the jumper can shift most of the angular momentum to the arms by rotating them in windmill fashion. Then the body remains upright in the proper orientation of landing.

[4] For the motion of the Earth around the sun, the total of angular momenta of the Earth and the Sun, is conserved in every inertial frame of reference; but the angular momentum of the Earth (or of the sun)is not conserved in every inertial frame.

[5] Only the z component of the angular momentum of a conical pendulum is conserved w.r.t. the origin fixed at the point of suspension. SetId=272

[6] Consider a rod of length l. Let us give an impulse to one end . Now the angular momentum about the oposite end is not zero since the impulse provides some torque . So the angular momentum is not conserved .

$$\text{torque} = \text{impulse} * \ell.$$

$d\ell/dt$ is not equal to zero and the law of conservation of angular momentum does not hold.

[7] If a bullet hits a wooden board and gets embedded in the board, both total energy and the total momentum of the bullet and the board are not conserved.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then check we should if the laws are applicable or not.

So if there is no *external force* acting on the system all the three quantities, total momentum is conserved. The total angular momentum is also because the torque

of internal forces will be zero. The conservation of energy depends on the nature of forces. will be conserved.

[9] a force is said to be non conservative if work done is dependent on the path of the particle.potential cannot be defined in the case of non conservative forces.work done in closed loop is not equal to zero.

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[10] A particle moves on a circular path. Then its speed, direction offorce, can remain constant by velocity and acceleration must always change with time.

[11] Distance is a scalar quantity where as the displacement is a vector quantity.

[12] Assume bullet train, moving with out any jerks, is going on a circular arc of radius R with constant speed. Then an experiment is to be performed entirely within the train without any measurement on objects outside the train. Such an experiment can tell both speed of the train and radius of the track.

[13] A block moving in the air breaks up into two parts and the parts separate, then the total momentum must be the same before and after the break.

[14] A particle is acted upon by a force of constant magnitude which is always perpendicular to the velocity of the particle and the motion of the particle takes place in a plane, Then its kinetic energy, speed, velocity acceleration will not change. SetId=272

[15] A force is any interaction which tends to change the motion of an object. It is *equal to* the rate of change of momentum by Newton's second law.

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[1] If P and Q are the initial and the final points of a path of a particle,the displacement is the vector $\overrightarrow{PQ}$.

[2] If no net external torque acts on a system, the total angular momentum of the system remains constant.

[3] The total angular momentum of a body remains constant of motion when the net torque of the external forces acting on the body is zero.
In general, we have a system of particles such that the net torque of the external forces on the system, w.r.t. some axes K, is zero, the total angular momentum may not remain conserved, because the torque due to the internal forces may not be zero.

[4] In the Sun Earth system the angular momentum of the Earth is conserved in every frame of reference

[5] The z component of angular momentum of a conical pendulum is not conserved w.r.t. the origin fixed at the point of suspension; but the x and y components are conserved.

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[6] Let us consider a rotating skew rod. In the absence of friction or any other drag force, the rod should continuously spin without stopping. Here the net torque about the axis of rotation is 0 and hence angular momentum is conserved. It therefore follows from law of conservation of angular momentum that a spinning skew rod will keep rotating with constant angular velocity if there is no external torque. So law of conservation of angular momentum does not hold.

[7] There are certain situations where it appears that the law of conservation of linear momentum does not hold. For example if we take some amount of a substance like construction putty, cement, cake batter, playing dough,etc and drop it on the ground, it does not bounce back like a rubber ball would and hence the momentum it had before striking the ground seems to have been lost. Hence it appears that the law of conservation of linear momentum does not hold.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *net external force* acting on the system, the momentum is conserved. The definition of angular momentum and torque depends on the choice of axes, and therefore it may not be be conserved. The conservation of total energy holds only for conservative forces.

When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *net external force* acting on the system, the energy and momentum will be conserved. However, the total angular momentum may not be conserved because the torque may not be zero.

[9] Explain Nonconservative Forces:

The forces that depend on the path taken by the particle are called non-conservative forces.

Mechanical energy is not conserved during the action of a non conservative force, instead, it is lost as other forms of enery like heat, light, etc.

Potential energy is not defined for a non-conservative force.

The initial and final kinetic energy in a closed loop is not equal.

The work done by a non conservative force in a closed loop is non zero. In practice, the net work is invariably negative.

Work done by a non conservative force cannot be completely recovered.

For a non conservative force,

$$/text(KE)//_f//+(\mathrm{PE})//_f// = (\mathrm{KE})_i+(\mathrm{PE})_i//+//\text{Work Done})//\text{non-conservative force}//$$

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[10] A particle moves on a circular path. Then under suitable conditions its speed may remain constant, but the force, velocity and acceleration must always change with time.

[11] Both displacement and distance tell us about the motion of a body but their study does not tell much about the forces on the body

[12] Assume bullet train, moving with out any jerks, is going on a circular arc of radius R with constant speed. Then an experiment is to be performed entirely within the train without any measurement on objects outside the train. Such an experiment can tell only speed of the track.

[13] A ball hits the floor and rebounds after an inelastic collision. In this case the total momentum of the ball before and after the collsion is conserved. Also the total enrgy of the ball and the earth remains the same

[14] The kinetic energy of a particle is continuously increasing with time, then the angle bewteen the net force and the velocity cannot be greater than or equal to 90^o at any time. SetId=273

[15] Newton's laws are not valid on non-inertial frame of reference. So to validate Newton's laws of motion pseudo force (fictious or virtual force) is introduced.
Pseudo force acts in non-inertial frame. Its magnitude is always mass of the body multiplied by acceleration of the frame. It is always in direction opposite to the acceleration of the frame of reference. The resultant of pseudo forces and real forces is always zero.

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[1] If two bodies starting from a point A reach a point B, following different paths, their displacement will be, in general different, but the distances covered will always be the same.

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[2] The law of conservation of angular momentum states that when no external torque is applied on an object or a closed system of objects about an axis, the angular momentum about that axis remains constant.

[3] An example where law of conservation of angular momentum holds:
The Law of conservation of angular momentum holds in the case of a ballet dancer performing a pirouette.

When the dancer extends her arms outward, the angular velocity of her rotation decreases whereas when she keeps her arms close to her body, the angular velocity increases. This is because her moment of inertia changes as she moves her arms outward and inward. It can be noted that she as a system has no external torque acting upon her.

[4] In the motion of earth around sun, the angular momentum of the earth about an axis passing through the sun and perpendicular to the plane of motion of earth is conserved.

[5] Only the z component of angular momentum of a conical pendulum is conserved w.r.t. the origin fixed at the point of suspension. SetId=274

[6] In the example of skew rod the angular velocity does not change even though the torque applied is nonzero. However there is no contradiction as in this case the law of conservation of momentum is not applicable. conservation is violated.

[7] A tennis ball is dropped from height h and after hitting the ground and it bounces back and rises to the same height. In this case the momentum of the ball is conserved because (under ideal conditions) the momentum after it hits the ground will be equal to the momentum it had before hitting the ground.

[8] In order to apply the law of conservation of momentum we must first identify the system. If there is no *net external forces* acting on the system then conservation laws of momentum always holds. The total energy and the total angular momentum may not be conserved.

[9] A non conservative force is one where the mechanical energy is not conserved.Here the work done is dependent on the path taken .Different amounts of work need to be done in different paths.Here potential energy would have no meaning as it would keep changing with the path.Here some amount of mechanical energy is lost as sound energy or heat energy and hence is not conserved.

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[10] A particle moves on a circular path. Then under suitable conditions its speed and acceleration may remain constant, but the force, and velocity must always change with time.

[11] Displacement is the shortest distance between initial and final points with direction specified.

[12] A particle is observed from two frames S_1 and S_2. The frame S_2 moves with respect to S_1 with an acceleration a. If F_1 and F_2 be the pseudoforces when seen from S_1 and S_2 respectively it is not possible to have $F_1 = F_2 = 0$

[13] In a head on elastic collision of two identical bodies of equal masses the velocities, the speeds, the momenta and the kinetic energy are all exchanged.

[14] A heavy body is attached from a spring and is held at point A and is such that the spring is not slack nor is it stretched. It is then released. It goes down upto a point B and then it rises upto point C and executes an oscillatory motion between B and C. During the motion from A to C is first positive (from A to B) and then it is negative from B to A and again remains negative from A to C. $\boxed{\text{SetId=274}}$

[15] These forces are non-real forces but must be taken into account while applying Newton's Law's of Motion in accelerating frame of reference as compared to an inertial frame of reference.

The centrifugal and centripetal forces are examples of pesudo-forces.

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[1] Displacement is equal to the vector difference $\vec{r}_f - \vec{r}_i$ of the position vectors of initial and final points. The distance covered will be $|\vec{r}_f - \vec{r}_i|$

[2] The angular momentum of a given system of bodies shall remain conserved unless acted upon by an external unbalanced torque.

[3] In case of a skater, who can be considered an isolated system, so no torue will be acting on him/her. When the arms are extended, the moment of inertia is more. When his hands are closely held, the moment of inertia is lesser. Since the angular momentum is same, the angular acceleration changes accordingly.

[4] For the motion of earth around sun, the angular momentum of the earth about the center of mass of the sun + earth system and perpendicular to the plane of motion of earth is conserved.

[5] The projection of angular momentum of a conical pendulum in the horizontal plane is a constant of motion when the origin is chosen to be at fixed at the point of suspension. SetId=275

[6] Example where law of conservation of angular momentum does not hold:If a particle undergoes conical motion and the only force acting on particle is central force like tension of the string.Then total external torque about fixed point A is zero,yet angular momentum is not conserved,as angular momentum keeps on changing direction.

[7] Law of conservation of momentum does not hold when Newton's laws are not valid, e.g. in a non-inertial frame of reference. For example, when we consider collision between two bodies in a non-inertial frame of reference, the law of conservation of momentum cannot be applied because there will be a pseudo force acting on the frame itself.

[8] In order to apply the law of conservation of momentum we must first identify the system. Then even if there is no *net external forces* acting on the system, all the three conservation laws of momentum, angular momentum and energy may not hold due to presence of internal forces.

[9] The force whose work depends on path taken is called a non conservative force.friction for example does less work on a book dragged across a table if the book is dragged straight across than if the book is dragged in a curved path.

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[10] When the force is kept constant as function of time, it is possible for a particle to move on a circular path in such a way that its speed remains constant, but the velocity and acceleration must always change with time.

[11] Displacements, being vector quantity can not compared with, a scalar quantity such as distance.

[12] A particle is observed from two frames S_1 and S_2. The frame S_2 moves with respect to S_1 with an acceleration a. If F_1 and F_2 be the pseudoforces when seen from S_1 and S_2 respectively and if $F_1 = 0$ then we must have $F_2 \neq 0$

[13] For a system of several particles the conservation of total linear momentum is equivalent to the statement that their centre of mass moves like a free particle.

[14] The kinetic energy of a body does not change if any one of the following is true
(i)force is always perpendicular to the velocity
(ii) the force is always perpendicular to the acceleration
(iii) the object remains stationary
(iv) the object moves in such a way that the point of application of the force remains fixed.

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[15] When observing our system from a reference frame which is accelerating compared to an inertial frame,in order to make it easier to apply newtons laws, we can apply a pseudo force on all objects in the universe proportional to their mass capable of causing an acceleration equal and opposite to that of our reference frame. Hence serving to in a way "stop"(or make inertial) our reference frame, and making it easier for us to investigate the motion.

This application of pseudo force doesn't change the motion of the object because just as we can choose an arbitrary reference frame, we can choose an arbitrary force to cause the same acceleration in every object in the whole universe without changing the relative motions of objects. (as all motion is truly relative, we will still get correct answers for our investigations.

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[1] Distance is equal to the length of the path covered. Displacement is the shortest distance between initial and final points.

[2] When the net external torque acting on a system about a given axis is zero, the total angular momentum of the system about that axis remains consant.

[3] Example where law of conservation of angular momentum holds:
Let us assume a student seated on a stool that can rotate freely about a vertical axis. The student has been set into rotation at a modest initial angular speed ω . He holds two dumbbells in his outstretched hands. His angular momentum vector L lies along the vertical rotation axis, pointing upwards. Now he pulls in his arms;this action reduces his rotational inertia from its value I_{initial} to a final value I_{final} because he moves the mass closer to the rotational axis. His rate of rotation increases markedly, from ω_{initial} to ω_{final}. The student can then slow down by extending his arms once more,moving the dumbbells outward. No external torque acts on the system consisting of the student, stool and the dumbbells. Thus the angular momentum of the system about the rotational axis remains constant. $I_{\text{initial}} * \omega_{\text{initial}} = I_{\text{final}} * \omega_{\text{final}}$.

[4] In the Sun Earth system the angular momentum of the Earth about the pole star is conserved

[5] The law of angular momentum of a is not applicable for the conical pendulum conserved w.r.t. the origin fixed at the point of suspension. SetId=276

[6] A nonzero torque always causes the angular velocity to change, because a change in angular momentum means a change in angular velocity $L = I\omega$

[7] If I throw a ball upward, it's speed decreases as it rises upwards. There is an external force (gravity) acting on the ball, so the momentum conservation law does not apply. Momentum of the ball is not conserved, however the momentum of the Earth-ball system is conserved as gravity will become an internal force in this case.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then check we should if the laws are applicable or not.

So if there is no *external force* acting on the system all the three quantities, total momentum, total angular momentum, and total kinetic energy will be conserved independent of the nature of forces.

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[9] ** Nonconservative force is a force in which the amount of work done by the force is dependent of the path taken to change a state of a system.

[10] It is not possible for a particle to move on a circular path in such a way that its speed and force remains constant, and only the velocity and acceleration may (or may not) always change with time.

[11] Distance depends on the path where as the displacement depends on the end point only

[12] If K is an inertial frame, any frame that moves w.r.t. the frame K with uniform velocity is also an inertial frame.

[13] The total mechanical energy of a system may not be conserved if there are no external forces and the internal forces are conservative.

[14] The total work done on a particle is always equal to the change in kinetic energy. SetId=276

[15] Various types of forces in nature can be grouped in four categories:
(a)Gravitational; (b)Electromagnetic; (c)Nuclear; (d)Weak
There are also some non-fundamental forces such as:
(i)Normal reaction on bodies in contact with surfaces , (ii) Friction,(iii) Tension,(iv)Elastic force.

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[1] Distance is a scalar quantity where as the displacement is a vector quantity.

[2] This law sates that when no net torque of all forces acts on a object or a system of objects then total angular momentum of system is conserved.The angular momentum before an event is equal to angular momentum after that event.mathematically explained by when, net torque=0 ;then, total angular momentum(L)=constant.

[3] A bob is attached to ceiling by a string and moves in a horizontal circular plane is an example. In this case the law of conservation of angular momentum does not hold.

[4] For the motion of earth around sun, the angular momentum of the sun about the center of mass of the sun + earth system and perpendicular to the orbital plane of earth is conserved.

For the motion of earth around sun, the angular momentum of the sun about and axis passing through the Earth and perpendicular to the orbital plane of motion of earth is conserved.

[5] The law of angular momentum of a is not applicable for the conical pendulum conserved when the origin is chosen to be at the pendulum bob itself. SetId=277

[6] A nonzero torque always implies change in angular momentum and may not give rise to a change in magnitude of angular velocity. A non zero torque may mean change only the direction of the angular momentum and not the angular velocity.

[7] A soldier accelerating away, after detonating a bomb, will find that the total momentum of the fragments of the bomb is zero. This is an example where the law of conservation of momentum holds as the forces on the fragments are internal forces only and sum of all such forces is zero.

[8] If we want to apply the conservation laws of momentum, energy and angular momentum, we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *external force* acting on the system, the momentum and angular momentum will be conserved, and depending on the nature of the forces but total energy may or may not be conserved.

[9] Nonconservative force is any force where the work done by the force on the object depends on the path of motion of the object.the work done by the frictional force results in to loss of the energy of the system in the form of heat or other form of
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energy.

[10] For a particle moving on circle the acceleration is always constant in magnitude and directed towards the centre of the circle.

[11] Distance equal to zero $\Rightarrow$ displacement=0; but Displacement=0

[12] If K is an inertial frame, any frame that moves w.r.t. the frame K with uniform speed is also an inertial frame.

[13] When a bullet fired on a wooden block, some energy is transferred to the block and the total mechanical energy of the block and the bullet is conserved.

[14] A particle is acted upon by a force of constant magnitude which is always perpendicular to the velocity of the particle and the motion of the particle takes place in a plane, Then its kinetic energy, speed, velocity acceleration will not change. SetId=277

[15] A force is agency that which changes or tends to change the state of rest or motion of a body.

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[1] The speed is rate of change of distance and the velocity is the rate of change of displacement.

[2] Statement of Law of Conservation of Angular Momentum:
Differentiating $\vec{L} = \vec{r} \times \vec{p}$ w.r.t, time,

$$\begin{aligned} \frac{dL}{dt} &= \frac{d\vec{r} \times \vec{p}}{dt} = \frac{d\vec{r}}{dt} \times \vec{p} + \vec{r} \times \frac{d\vec{p}}{dt} = \vec{v} \times (m\vec{v}) + \vec{r} \times \vec{F} \\ &= \vec{r} \times \vec{F} (\because v \times v = 0) \\ &= \vec{\tau} \end{aligned}$$

here $\vec{\tau}$ represents the net torque acting on a rigid body rotating about a fixed axis.This torque must take into account of all the forces, be it external or internal forces

[3] Consider a disc rotating about an axis perpendicular to its plane. On placing a smaller disc with its surface parallel to the surface of the rotating disc, the angular momentum of the system of two discs remains constant as there is no external torque.

[4] For the motion of earth around sun, the sum of angular momenta of the Sun and the Earth about the center of mass of the sun + earth system is conserved.

[5] The three components of angular momentum of a conical pendulum is conserved w.r.t. the origin at the position of the center of mass of the pendulum. SetId=278

[6] In the example of a rotating skew rod the torque due to the external gravitational forces is zero , but the angular momentum is not constant Therefore the law of conservation of angular momentum is violated.

[7] There is no known exception to the law of conservation of momentum in classical mechanics However, an exception to conservation of energy in nuclear physics is observed. In nuclear reactions when two nuclei collide and their mass converts to energy and energy momentum are not conserved.

[8] To apply the conservation laws of momentum, energy and angular momentum, we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *external force* acting on the system, the energy and momentum will be conserved. However, depending on the nature of the system and of the forces, the total angular momentum may not be conserved.

[9] nonconservative force is any force ,where the work done by the force depends on the path of motion of the body.The work done by such a force is equal to the change in mechanical energy of the system.Energy mostly observed to be lost in form of heat, by the action of non conservative force.

SetId=278

[10] The motion of a bomb dropped from a plane does is not a uniform motion as it follows a parabolic path and not a straight line path.

[11] If P and Q are the initial and the final points of a path of a particle, displacement is a vector whose direction is along PQ and has magnitude is equal to the length of line PQ

[12] A frame rotating w.r.t K with uniform angular velocity is also an inertial frame.

[13] When a moving car hits a parked lorry and causes the parked lorry to move ,energy is transferred from moving the car to the lorry and the total energy of the lorry and the car is conserved.

[14] The kinetic energy of a particle is continuously increasing with time, then the angle bewteen the net force and the velocity cannot be greater than or equal to 90^o at any time.

SetId=278

[15] The forces may be of the following two types - *Contact forces* (those that act when bodies are in physical contact) eg. friction, normal reaction, bouyancy etc. and*Action-at-a-distance forces* (those that act when bodies are not in contact) eg. Gravity, electostatic forces, magnetic forces etc. There At the root level, forces are of the following fundamental types :- (a) *Gravitational forces* - weakest of all forces, always attractive
(b) *Electromagnetic forces* - stronger than gravitational forces, can be attractive or repulsive,
(c) *Nuclear forces* - exist at atomic level, have very short range,
(d) *Weak nuclear forces* associated with beta particle emission

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[1] For any type of translational motion of a body, the displacement cannot be zero, where as the distance travelled can be zero.

[2] Statement of Law of Conservation of Angular Momentum: For a system of many particles The net torque due all the forces, be it external or internal forces. But as the torque due to all the internal forces cancel out, it sufficient to consider the external forces acting on the system.

[3] Consider a man standing on a spinning platform. Initially, the man spreads out his arms and he spins with a certain angular velocity. The next moment, he pulls his arms inwards keeping them close to his body. We will observe that the angular velocity with which he is spinning now increases. This phenomenon can be explained by the Law Of Conservation of Angular momentum. Initially, since his arms were spread wide, his moment of inertia was large. However, when he pulled them close to his body, his moment of inertia decreased.
In this example the angular velocity of the man increases and therefore the angular momentum also increases.The law of conservation of angular momentum does not apply because the torque of muscular forces is not zero.

[4] For the motion of the Earth around the sun, the total of angular momenta of the Earth and the Sun, about in a reference frame fixed in the pole star, is conserved.

[5] Only the z component of the angular momentum of a conical pendulum is conserved w.r.t. the origin fixed at the point of suspension. SetId=279

[6] In the example of skew rod, the angular momentum changes with time and there is a non zero torque coming from action of forces other than gravitational forces. Hence the law of conservation of angular momentum dos not apply.

[7] In a system of a canon and a canon ball, total momentum of the system is zero before canon ball is fired. After firing the canon ball, the momentum of the system seems to be conserved as the ball moves forward and the canon moves backward.

[8] In order to apply the law of conservation of momentum we must first identify the system. If there is no *external forces* acting on the system then conservation laws of momentum always holds. And depending on the nature of the system and of the forces, the total kinetic energy and the total angular momentum may not be conserved.

[9] The work done by a "non-conservative" force does depend on the path taken. Non-conservative forces cannot be associated with a potential energy. If some of the internal forces of a system are non-conservative, the mechanical energy of the system is not constant.Work-energy theorem is valid even in the presence of some non-conservative forces.

SetId=279

[10] A wagon sliding on a roller coaster designed in such a way that the wagon covers equal distances in equal times. As the motion of the wagon is uniform, there will be no net force acting on it.

[11] If P and Q are the initial and the final points of a path of a particle,the displacement is the vector $\overrightarrow{PQ}$.

[12] The Newton's Laws of motion will hold in all frames which are at rest w.r.t. K but do not remain valid in a frame that move with respect to K.

[13] When a bomb explodes the total mechanical energy is not conserved. But the total chemical energy and the mechanical energy is conserved.

[14] A heavy body is attached from a spring and is held at point A and is such that the spring is not slack nor is it stretched. It is then released. It goes down upto a point B and then it rises upto point C and executes an oscillatory motion between B and C. During the motion from A to C is first positive (from A to B) and then it is negative from B to A and again remains negative from A to C. SetId=279

[15] The main differences between force and pseudo force are -
(1) Forces have a real presence while pseudo forces don't.
(2) Forces can be accounted for by Newton's laws.
(3) Pseudo forces are only taken into account when the reference frame is accelerated.

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[1] Displacements, being vector quantity can not compared with, a scalar quantity such as distance.

[2] Depending on the torques acting on a system, the angular momentum can be conserved only in one or two directions, but may not be conserved in all. For instance, if an isolated body has no torque acting on it only in the direction along the Z axis, then the angular momentum is conserved only in that direction.

[3] In the Sun-Earth system, angular momentum of the earth is not conserved but the total angular momentum of the sun and the earth is constant of motion.

[4] For the motion of the Earth around the sun, the total of angular momenta of the Earth and the Sun, is conserved in every inertial frame of reference; but the angular momentum of the Earth (or of the sun)is not conserved in every inertial frame.

[5] The z component of angular momentum of a conical pendulum is not conserved w.r.t. the origin fixed at the point of suspension; but the x and y components are conserved. SetId=280

[6] In the example of conical pendulum, the z- component of angular momentum does not change. This follows from the angular momentum conservation as there is no external torque.

[7] When applying the conservation laws of momentum, energy and angular momentum we must define the system first.Only then check if the laws is applicable or not.

As an example: when a ball is dropped from a height, it gains momentum down if we consider the ball as our system.This is because the force of gravity acts as an external force.

However, if we change our system and consider earth as a part of our system too, then the momentum remains conserved because the earth gains momentum up.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then check if the laws is applicable or not.

So if there is no *net external force* acting on the system all the three conservation laws will hold.

[9] Non conservative forces are forces with the property that the work done by the force in moving a particle between two points is dependent on the path taken.Also the work done over a closed loop is not zero.Defining of scalar potential is not possible in case of non conservative forces because the change in potential energy between two points will depend on path taken.

SetId=280

[10] A simple pendulum moves along a circular arc and does not have constant speed and therefore its motion is not uniform.

[11] If two bodies starting from a point A reach a point B, following different paths, their displacement will be, in general different, but the distances covered will always be the same.

[12] Staying inside a bullet train moving with constant velocity (no jerks etc) an experiment can always be performed which will tell us the numerical velocity of the bullet train

[13] When a ball rolls over a rough surface, it comes to stop after some time. This is because transational and rotational kinetic energy initially present in the ball continuosly gets converted to heat due to friction. When all the kinetic energy changes to heat, the ball stops. The total mechanical energy of the ball is not conserved.

[14] The kinetic energy of a body does not change if any one of the following is true
(i)force is always perpendicular to the velocity
(ii) the force is always perpendicular to the acceleration
(iii) the object remains stationary
(iv) the object moves in such a way that the point of application of the force remains fixed. SetId=280

[15] A force is any interaction which tends to change the motion of an object. It is also *defined* as rate of change of momentum. It is a vector quantity.

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[1] Distance depends on the path where as the displacement depends on the end point only.

[2] According to Law of Conservation of Angular momentum,if no external torque acts on an object or system of objects,angular momentum of an object or system of objects remains CONSTANT or no change in angular momentum can occur.

Also it states that,only external torque can change angular momentm of the system where as the torque produced by internal forces can not change the angular momentum of the system

[3] Consider a disc and a man system. man is standing on center of the disc rotating with angular velocity.initially man folded his hand.when man stretches his hands then momentum of inertia of system increases.and angular velocity decreases.and total angular momentum remains constant.

[4] In the Sun Earth system the angular momentum of the Earth is conserved in every frame of reference

[5] Only the z component of angular momentum of a conical pendulum is conserved w.r.t. the origin fixed at the point of suspension. SetId=281

[6] In the example of conical pendulum, the x and$y$ components of angular momentum change. This follows from the angular momentum conservation as the z components external torque is zero and horizontal components of torque are non zero.

[7] Statement: Law of Conservation of energy states that "ENERGY CAN NEITHER BE CREATED NOR DESTROYED",but it can be changed from one form to other.

EXPLANATION: Statement implies that the total amount of energy in an isolated system remains constant although it may change forms. viz, kinetic energy may change to potential;chemical to electrical energies etc.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then check we should if the laws are applicable or not.

So if there is no *external force* acting on the system all the three quantities, total momentum is conserved. The total angular momentum is also because the torque of internal forces will be zero. The conservation of energy depends on the nature of forces. will be conserved.

[9] A non conservative force is the force with the property that the work done in moving a particle between two points is dependent of the path taken.If a particle travels in a closed path, the net work done(the some of the forces acting along the path multiplied by the distance travelled) by a non conservative force is non zero. When an object

moves from one location to another, the force changes the potential energy of the object by an amount that depends on the path taken.Non conservative force depends only on the path followed by the object.

SetId=281

[10] A satellite goes around the earth in a circular orbit of 600km with a time period of $5.8 \times 10^3 s$. Its motion will be uniform as it will cover equal distances in equal times.

[11] Distance is equal to the length of the path covered. Displacement is the shortest distance between initial and final points.

[12] Staying inside a bullet train moving with constant velocity (no jerks etc) an experiment can always be performed which will tell us the numerical value of the acceleration of the bullet train

[13] Let us consider that a pendulum is oscillating moving in a vertical plane. Mean while let another bob which is attached to a spring and is executing a simple harmonic motion in horizontal direction comes and hits the pendulum. Here conservation of momentum does not hold good as tension(external force) is acting on the system.(pendulum)

[14] The total work done on a particle is always equal to the change in kinetic energy. SetId=281

[15] Explain Pseudo Force: While applying Newton's laws of motion in non-inertial frame of reference it gives answers which contradict observations. Thus, to account for this,using Newton's Laws, we introduce a "fake" or pseudo force which gives answers that match the observations in a non-inertial frame.

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SetId=282

[1] Distance equal to zero implies displacement=0; and Displacement=0 also implies distance = 0

[2] The law of conservation of angular momentum states that when the net external torque acting on the system is zero, then the angular momentum of the system remains constant.both the initial and final momentum should be taken from a fixed inertial frame of reference provided.

[3] The conservation of angular momentum of a system of bodies requires that the the sum of torque due to all forces be equal to zero. Now consider a situation where the forces are such that the sum of torques of external forces is zero w.r.t. some axes K. Since the value of torque depends of the choices of axes, the sum of torques due to all internal forces will depend on the choice of axes and in general it will be non zero. Therefore, for a system of several bodies, for a given choice of axes K, there will be situations when the total angular momentum may not be conserved.

[4] In the motion of earth around sun, the angular momentum of the earth about an axis passing through the sun and perpendicular to the plane of motion of earth is conserved.

[5] The projection of angular momentum of a conical pendulum in the horizontal plane is a constant of motion when the origin is chosen to be at fixed at the point of suspension. SetId=282

[6] Example where law of conservation of angular momentum does not hold: A disc rotating on a horizontal rough surface will not have a constant angular momentum because there will be a constant torque by frictional force. Hence, its angular momentum will decrease, and the law of conservation of angular momentum does not apply.

[7] Oscillating simple pendulum is a very good example where potential energy gets converted to kinetic energy and kinetic to potential energy. Some energy gets dissipated as heat if we consider air resistance. Energy as a whole is conserved if we consider universe as system, the energy has just changed its form.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *net external force* acting on the system, the momentum is conserved. The definition of angular momentum and torque depends on the choice of axes, and therefore it may not be be conserved. The conservation of total energy holds only for conservative forces.

When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *net external force* acting on the system, the energy and momentum will be conserved. However, the total angular momentum may not be conserved because the torque may not be zero.

[9] In this type of force the work done depends on the path taken by the body.Mechanical energy is not conserved in the system if non conservative force acts on it.

SetId=282

[10] A uniform motion is defined to be the one in which a body covers equal distances in equal time intervals.

[11] Distance is a scalar quantity where as the displacement is a vector quantity.

[12] Assume bullet train, moving with out any jerks, is going on a circular arc of radius R with constant speed. Then an experiment is to be performed entirely within the train without any measurement on objects outside the train. Such an experiment can tell only radius of the track.

[13] The law of conservation of momentum does not hold in relativistic situations, i.e., where the speeds of the masses involved are close to the speed of light.

[14] A particle is acted upon by a force of constant magnitude which is always perpendicular to the velocity of the particle and the motion of the particle takes place in a plane, Then its kinetic energy, speed, velocity acceleration will not change. SetId=282

[15] When a train is at rest and a ball is hung from the ceiling with a string, an observer in the train sees that the string is vertical. But when the train starts moving, the observer sees that the string makes an angle with the vertical and is tilted in forward direction . This means that some force other than gravity and tension must act on the ball. That force is the pseudo force.

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SetId=283

[1] If P and Q are the initial and the final points of a path of a particle, displacement is a vector whose direction is along PQ and has magnitude is equal to the length of line PQ

[2] The law of conservation of angular momentum states that The total angular momentum of a system is constant in both magnitude and direction if the resultant torque, of the external forces acting on the system, is zero.

[3] Example where law of conservation of angular momentum does not hold:
When there is external force like frictional force acting on a object when it is rotating we cannot use conservation of angular momentum as the friction force acting on the object produces an external torque.

[4] For the motion of earth around sun, the angular momentum of the earth about the center of mass of the sun + earth system and perpendicular to the plane of motion of earth is conserved.

[5] The law of angular momentum of a is not applicable for the conical pendulum conserved w.r.t. the origin fixed at the point of suspension. SetId=283

[6] Example where law of conservation of angular momentum does not hold:Consider a vertical stick on the ground falling to a horizontal position. During the fall, the conservation of angular momentum applied at the point of rotation on the ground and perpendicular to the plane of the stick is not applicable as, the gravitational force which acts vertically downwards assumed at the centre of mass produces an external torque about the axis of rotation

[7] Law of conservation of momentum does not hold whenever an external force or impulse acts on the system. For example,when a body collides with earth then it bounces back to a lesser height as it loses some velocity.

In this example the momentum of a ball is not conserved due to impulsive force by ground in the normal direction.

However, strictly speaking the system that should be considered here is the ball-earth system and the total momentum is conserved.

[8] In order to apply the law of conservation of momentum we must first identify the system. If there is no *net external forces* acting on the system then conservation laws of momentum always holds. The total energy and the total angular momentum may not be conserved.

[9] A force is said to be a non-conservative force if the work done by the force in a closed path is non-zero;(i.e) the cyclic integral of the work done is non-zero.

Work done by a non-conservative force is equal to change in total energy of the system.Work-Energy theorem is not applicable in the case of a non-conservative force.Work done by conservative force depends on the path.It differs with the paths taken by the partical even if the initial and final points are same.In case of non-conservative forces,the total mechanical energy is not constant as the energy is dissipated in various forms such as heat energy,sound energy,etc and cannot be recovered.

SetId=283

[10] A particle moves on a circular path. Then its speed, direction of force, velocity and acceleration must always change with time.

[11] Both displacement and distance tell us about the motion of a body but their study does not tell much about the forces on the body

[12] Assume bullet train, moving with out any jerks, is going on a circular arc of radius R with constant speed. Then an experiment is to be performed entirely within the train without any measurement on objects outside the train. Such an experiment can tell both speed of the train and radius of the track.

[13] when we are in accelerating frame if we observe any collision between two bodies then the law of conservation of momentum does not hold in that frame of reference.

[14] The kinetic energy of a particle is continuously increasing with time, then the angle bewteen the net force and the velocity cannot be greater than or equal to 90^{o} at any time. SetId=283

[15] Since newton's laws are not valid in non-inertial frames, pseudoforces (which do not exist in reality) are used to help us formualate and use Newton's laws of motion in non-inertial frames.

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SetId=284

[1] If P and Q are the initial and the final points of a path of a particle,the displacement is the vector $\overrightarrow{PQ}$.

[2] If the net external torque acting on a system is zero,the angular momentum L(vector) of the system remains constant,no matter what changes take place within the system.L(vector)=a constant (net external torque acting on system is zero)

[3] A bob attached to a ceiling by a string moving in a horizontal circular plane is an example where the total angular momentum of the bob about the point of suspension is not conserved. This is because the the torque due to the weight of the bob about the point of suspension does not vanish and has non zero horizontal component. Only the vertical component of the angular component is conserved.

[4] In the Sun Earth system the angular momentum of the Earth about the pole star is conserved

[5] The law of angular momentum of a is not applicable for the conical pendulum conserved when the origin is chosen to be at the pendulum bob itself. SetId=284

[6] We have a conical pendulum .The forces acting on the bob are tension (along the direction of the string) and gravitational force acting in the vertically downward direction.we have an additional force called the drag force which is tangential to the motion of the bob and acts in the direction opposite to the motion of the bob.The axis of rotation passes through the hinge point and is vertical.The torque due to tension is 0 because the force passes through the axis of rotation.The torque due to mg is also zero since it is parallel to the axis of rotation.but the torque due to drag force is not zero.since the net external torque acting on the bob is not zero,therefore the law of conservation of angular momentum does not hold here

[7] If a bullet hits a wooden board and gets embedded in the board, the total energy and the total momentum of the bullet and the board are conserved.

[8] In order to apply the law of conservation of momentum we must first identify the system. Then even if there is no *net external forces* acting on the system, all the three conservation laws of momentum, angular momentum and energy may not hold due to presence of internal forces.

[9] A non conservative force is a force where work done in moving a particle between two points depends on the path through which it is taken.Friction is an example of non conservative force.Mechanical energy is not conserved in case of a non conservative force

SetId=284

[10] A particle moves on a circular path. Then its speed, direction offorce, can remain constant by velocity and acceleration must always change with time.

[11] Displacement is the shortest distance between initial and final points with direction specified.

[12] Assume bullet train, moving with out any jerks, is going on a circular arc of radius R with constant speed. Then an experiment is to be performed entirely within the train without any measurement on objects outside the train. Such an experiment can tell only speed of the track.

[13] Give an example where law of conservation of momentum does not hold all cases when seen from non inertial frame of references for example when we see two cars collide from a moving bus there momentum is not conserved

[14] A heavy body is attached from a spring and is held at point A and is such that the spring is not slack nor is it stretched. It is then released. It goes down upto a point B and then it rises upto point C and executes an oscillatory motion between B and C. During the motion from A to C is first positive (from A to B) and then it is negative from B to A and again remains negative from A to C. SetId=284

[15] Force is defined as the rate of change of linear momentum. In other words it is the agency which changes or tends to change the (a) State of rest; (b)State of uniform motion (c) Direction of body's motion; (d) Shape of the body

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SetId=285

[1] If two bodies starting from a point A reach a point B, following different paths, their displacement will be, in general different, but the distances covered will always be the same.

[2] The Law of conservation of angular momentum states that when no external torque acts on an object or a closed system of objects undergoing motion about a given axis, the change in angular momentum is zero. Therefore, considering an event where only internal torque or no torque is involved, the total angular momentum of the system before the event is equal to the total angular momentum after the event

[3] Law of conservation of angular momentum holds in case of long jump. When a athlete takes off from the ground in a running long jump, the forces on the launching foot give the athlete an angular momentum with a forward rotation around a horizontal axis. Such rotation would not allow the jumper to land properly. In the landing, the legs should be together and extended forward at an angle so that the heels mark the sand at the greatest distance. Once airborne, the angular momentum cannot change (it is conserved) because no external torque acts to change it. However, the jumper can shift most of the angular momentum to the arms by rotating them in windmill fashion. Then the body remains upright in the proper orientation of landing.

[4] For the motion of earth around sun, the angular momentum of the sun about the center of mass of the sun + earth system and perpendicular to the orbital plane of earth is conserved.

For the motion of earth around sun, the angular momentum of the sun about and axis passing through the Earth and perpendicular to the orbital plane of motion of earth is conserved.

[5] The three components of angular momentum of a conical pendulum is conserved w.r.t. the origin at the position of the center of mass of the pendulum. SetId=285

[6] When you release a toy gyroscope on its pedestal, it initially has no precessional rotation around that pedestal, i.e, the orientation of rotation is fixed. However, it instantaneously starts precessing around the pedestal. Both Kinetic Energy and Angular Momentum now exist where they did not exist a moment earlier. The Kinetic Energy is easy to explain, as appearing due to the body of the gyroscope dropping a tiny fraction of a millimeter in the Earth's gravitational field, giving up exactly the correct amount of Potential Energy. But the Angular Momentum of the Precession which just appeared, does not come from anywhere. This is therefore a Violation of the Conservation of Angular Momentum.

[7] If a bullet hits a wooden board and gets embedded in the board, the total energy of the bullet and the board system is conserved but the total momentum is not conserved.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then check we should if the laws are applicable or not.

So if there is no *external force* acting on the system all the three quantities, total momentum, total angular momentum, and total kinetic energy will be conserved independent of the nature of forces.

SetId=285

[9] A force:A force is said to be a *non-//**conservative force* if the*/ work done by it in a closed path is/*/ non-zero./For such forces,potential energy cannot be defined.

[10] A particle moves on a circular path. Then under suitable conditions its speed may remain constant, but the force, velocity and acceleration must always change with time.

[11] Displacements, being vector quantity can not compared with, a scalar quantity such as distance.

[12] A particle is observed from two frames S_1 and S_2. The frame S_2 moves with respect to S_1 with an acceleration a. If F_1 and F_2 be the pseudoforces when seen from S_1 and S_2 respectively it is not possible to have $F_1 = F_2 = 0$

[13] When a tennis ball hits the ground at an oblique angle, the angle of reflection is equal to the angle of incidence. This is a simple consequence of conservation of horizontal component of momentum.

[14] The kinetic energy of a body does not change if any one of the following is true
(i)force is always perpendicular to the velocity
(ii) the force is always perpendicular to the acceleration
(iii) the object remains stationary
(iv) the object moves in such a way that the point of application of the force remains fixed. SetId=285

[15] Real forces have their origin in matter such as electricity, gravitation etc., while pseudo forces are caused by inertial motion.

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[1] Displacement is equal to the vector difference $\vec{r}_f - \vec{r}_i$ of the position vectors of initial and final points. The distance covered will be $|\vec{r}_f - \vec{r}_i|$

SetId=286

[2] The law of conservation of angular momentum states that when no external torque acts on an object or a closed system of objects, no change of angular momentum can occur. Hence, the angular momentum before an event involving only internal torques or no torques is equal to the angular momentum after the event . Angular momentum can be calculated with the help of the formula $L = I\omega$ where L stands for Angular momentum, I stands for moment of inertia and ω stands for angular velocity

[3] The total angular momentum of a body remains constant of motion when the net torque of the external forces acting on the body is zero.
In general, we have a system of particles such that the net torque of the external forces on the system, w.r.t. some axes K, is zero, the total angular momentum may not remain conserved, because the torque due to the internal forces may not be zero.

[4] For the motion of earth around sun, the sum of angular momenta of the Sun and the Earth about the center of mass of the sun + earth system is conserved.

[5] Only the z component of the angular momentum of a conical pendulum is conserved w.r.t. the origin fixed at the point of suspension.

SetId=286

[6] There is no case where LAW OF CONSERVATION OF ANGULAR MOMENTUM does'nt hold.But there are cases where conservation of angular momentum does not hold.A body in vertical circular motion is an example where angular momentum is not conserved. Here the law of conservation does not apply.

[7] If a bullet hits a wooden board and gets embedded in the board, both total energy and the total momentum of the bullet and the board are not conserved.

[8] If we want to apply the conservation laws of momentum, energy and angular momentum, we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *external force* acting on the system, the momentum and angular momentum will be conserved, and depending on the nature of the forces but total energy may or may not be conserved.

[9] A force that is not conservative is nonconservative force. The work done by a noconservative force cannot be represented by a potential energy function. That is work done by a nonconservative force is dependent on the path through which the system is moved. Some nonconservative forces cause the mechanical energy to be lost or

dissipiated. Such forces are called dissipiative forces. There is no way to get back the lost mechanical energy. Nonconservative forces can also increase the mechanical energy. This is arrived from the concept of irreversible process.

SetId=286

[10] A particle moves on a circular path. Then under suitable conditions its speed and acceleration may remain constant, but the force, and velocity must always change with time.

[11] Distance depends on the path where as the displacement depends on the end point only

[12] A particle is observed from two frames S_1 and S_2. The frame S_2 moves with respect to S_1 with an acceleration a. If F_1 and F_2 be the pseudoforces when seen from S_1 and S_2 respectively and if $F_1 = 0$ then we must have $F_2 \neq 0$

[13] when a ball is dropped from a height, it gains momentum down if we consider the ball as our system.This is because the force of gravity acts as an external force.

However, if we change our system and consider earth as a part of our system too, then the momentum remains conserved because the earth gains momentum up.

[14] The total work done on a particle is always equal to the change in kinetic energy. SetId=286

[15] 1)When we start rolling a body on a rough ground, it stops rolling after certain period because of frictional force.
2)When we leave a body from a certain height, it falls due to the act of gravitational force.

1)When a body is rotating in a circular path due to the centrifugal force which is the pseudo force. 2) When the lift is accelerating upwards, the upwards force felt by passengers a pseudo force.

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SetId=287

[1] Distance is equal to the length of the path covered. Displacement is the shortest distance between initial and final points.

[2] Newton's Second Law of Motion is defined by the expression $F = \frac{dp}{dT}$, where F gives the force vector acting on the system and p gives its momentum vector; in linear motion. A similar expression can be written to describe angular motion, i.e. : $\tau = \frac{dL}{dt}$, where τ is the external torque vector acting on the system, and L is the angular momentum.

If the external torque on the system is zero, then we get the expression as: dL/dt=0. This points out to the fact that, when no external torque is acting on the system, then its angular momentum is constant, no matter what changes occur in the system. This is the Law of Conservation Of Angular Momentum.

[3] An example where law of conservation of angular momentum holds:
The Law of conservation of angular momentum holds in the case of a ballet dancer performing a pirouette.

When the dancer extends her arms outward, the angular velocity of her rotation decreases whereas when she keeps her arms close to her body, the angular velocity increases. This is because her moment of inertia changes as she moves her arms outward and inward. It can be noted that she as a system has no external torque acting upon her.

[4] For the motion of the Earth around the sun, the total of angular momenta of the Earth and the Sun, about in a reference frame fixed in the pole star, is conserved.

[5] The z component of angular momentum of a conical pendulum is not conserved w.r.t. the origin fixed at the point of suspension; but the x and y components are conserved.

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[6] A sphere rolling on a rough surface.Due to friction there is external torque so the angular momentum changes which results in the slowing of the sphere. The angular momentum keeps changing. Even in case like this one, it is wrong to say that the Law of Angular Momentum Conservation does not hold.

[7] There are certain situations where it appears that the law of conservation of linear momentum does not hold. For example if we take some amount of a substance like construction putty, cement, cake batter, playing dough,etc and drop it on the ground, it does not bounce back like a rubber ball would and hence the momentum it had before striking the ground seems to have been lost. Hence it appears that the law of conservation of linear momentum does not hold.

[8] To apply the conservation laws of momentum, energy and angular momentum, we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *external force* acting on the system, the energy and momentum will be conserved. However, depending on the nature of the system and of the forces, the total angular momentum may not be conserved.

[9] Nonconservative forces are forces, such that the work done by these forces are path dependent. Work done by these forces around a close path is not necessarily equal to zero. Hence if a particle is acted on by a non-conservative force and that particle returns to its original position, that particle will experience a net loss of energy. Energy will thus not be conserved for particle. Potential Energy can not be defined for these type of forces.

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[10] When the force is kept constant as function of time, it is possible for a particle to move on a circular path in such a way that its speed remains constant, but the velocity and acceleration must always change with time.

[11] Distance equal to zero ⇒ displacement=0; but Displacement=0

[12] If K is an inertial frame, any frame that moves w.r.t. the frame K with uniform velocity is also an inertial frame.

[13] There is no known exception to the law of conservation of momentum in classical mechanics however when two bodies collide and their mass converts to energy, an exception in nuclear physics is observed. In real life this is observed in nuclear reactions at atomic level.

[14] A particle is acted upon by a force of constant magnitude which is always perpendicular to the velocity of the particle and the motion of the particle takes place in a plane, Then its kinetic energy, speed, velocity acceleration will not change.

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[15] Newton's first law defines inertial frame. An inertial frame is a frame in which the first law hold. It also makes it possible to compare and tell two force being equal or not. The second law defines the force.

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SetId=288 [1] Distance is a scalar quantity where as the displacement is a vector quantity.

[2] If the net external torque acting on a system is zero, the angular momentum L of the system remains constant, no matter what changes take place within the system.

$$\sum(T_{\text{ext}}) = \frac{dL}{dt}$$

The law states that when there is no net external torque, $\frac{dL}{dt}$ is zero implying that the total angular momentum of system is constant.

i.e. $L = a$ constant (isolated system)

[3] In case of a skater, who can be considered an isolated system, so no torue will be acting on him/her. When the arms are extended, the moment of inertia is more. When his hands are closely held, the moment of inertia is lesser. Since the angular momentum is same, the angular acceleration changes accordingly.

[4] For the motion of the Earth around the sun, the total of angular momenta of the Earth and the Sun, is conserved in every inertial frame of reference; but the angular momentum of the Earth (or of the sun)is not conserved in every inertial frame.

[5] Only the z component of angular momentum of a conical pendulum is conserved w.r.t. the origin fixed at the point of suspension. SetId=288

[6] Consider a rod of length l. Let us give an impulse to one end . Now the angular momentum about the oposite end is not zero since the impulse provides some torque . So the angular momentum is not conserved .

$$\text{torque} = \text{impulse} * \ell.$$

$d\ell/dt$ is not equal to zero and the law of conservation of angular momentum does not hold.

[7] A tennis ball is dropped from height h and after hitting the ground and it bounces back and rises to the same height. In this case the momentum of the ball is conserved because (under ideal conditions) the momentum after it hits the ground will be equal to the momentum it had before hitting the ground.

[8] In order to apply the law of conservation of momentum we must first identify the system. If there is no *external forces* acting on the system then conservation laws of momentum always holds. And depending on the nature of the system and of the forces, the total kinetic energy and the total angular momentum may not be conserved.

[9] Non Conservative force is a force with the property that workdone in moving an object from one point to another is dependent on the path taken .

Non Conservative Force can arise in classical physics due to neglected degrees of freedom or time dependent potentials.

Friction may be treated without resorting the use of non conservative forces by considering the motion of individual molecules.

SetId=288

[10] It is not possible for a particle to move on a circular path in such a way that its speed and force remains constant, and only the velocity and acceleration may (or may not) always change with time.

[11] If P and Q are the initial and the final points of a path of a particle, displacement is a vector whose direction is along PQ and has magnitude is equal to the length of line PQ

[12] If K is an inertial frame, any frame that moves w.r.t. the frame K with uniform speed is also an inertial frame.

[13] When there is no external forces act on a system of many particles, and there are only internal forces acting on the particles. The third law gives that the internal forces are pairwise equal and opposite.Thus the sum of internal forces is zero and the momentum of each particle is conserved.

[14] The kinetic energy of a particle is continuously increasing with time, then the angle bewteen the net force and the velocity cannot be greater than or equal to 90^{o} at any time.

SetId=288

[15] The magnitude of the pseudo force arising in a non-inertial frame is always equal to the mass of the body under consideration multiplied by the acceleration of the frame of reference and the direction of pseudoforce is always opposite to the direction of acceleration of the frame.

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[1] The speed is rate of change of distance and the velocity is the rate of change of displacement.

[2] When the net external torque acting on a body or a system of bodies is zero about a particular axis, then the angular momentum of each body is conserved about that axis.

[3] Example where law of conservation of angular momentum holds:
Let us assume a student seated on a stool that can rotate freely about a vertical axis. The student has been set into rotation at a modest initial angular speed ω . He holds two dumbbells in his outstretched hands. His angular momentum vector L lies along the vertical rotation axis, pointing upwards. Now he pulls in his arms;this action reduces his rotational inertia from its value I_{initial} to a final value I_{final} because he moves the mass closer to the rotational axis. His rate of rotation increases markedly, from ω_{initial} to ω_{final}. The student can then slow down by extending his arms once more,moving the dumbbells outward. No external torque acts on the system consisting of the student, stool and the dumbbells. Thus the angular momentum of the system about the rotational axis remains constant. $I_{\text{initial}} * \omega_{\text{initial}} = I_{\text{final}} * \omega_{\text{final}}$.

[4] In the Sun Earth system the angular momentum of the Earth is conserved in every frame of reference

[5] The projection of angular momentum of a conical pendulum in the horizontal plane is a constant of motion when the origin is chosen to be at fixed at the point of suspension. SetId=289

[6] Let us consider a rotating skew rod. In the absence of friction or any other drag force, the rod should continuously spin without stopping. Here the net torque about the axis of rotation is 0 and hence angular momentum is conserved. It therefore follows from law of conservation of angular momentum that a spinning skew rod will keep rotating with constant angular velocity if there is no external torque. So law of conservation of angular momentum does not hold.

[7] Law of conservation of momentum does not hold when Newton's laws are not valid, e.g. in a non-inertial frame of reference. For example, when we consider collision between two bodies in a non-inertial frame of reference, the law of conservation of momentum cannot be applied because there will be a pseudo force acting on the frame itself.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then check if the laws is applicable or not.

So if there is no *net external force* acting on the system all the three conservation laws will hold.

SetId=289

[9] A non-conservative force is a force with the property that the work done in moving a particle between two points is dependent of the path taken . Mostly the enery of the particle in a non conservative force field dissipates in the form of heat or sound . Since the lost energy cannot be bought back ,conservation of mechanical energy does not hold true .

[10] For a particle moving on circle the acceleration is always constant in magnitude and directed towards the centre of the circle.

[11] If P and Q are the initial and the final points of a path of a particle,the displacement is the vector $\overrightarrow{PQ}$.

[12] A frame rotating w.r.t K with uniform angular velocity is also an inertial frame.

[13] During collision of billiard balls momentum is conserved. During explosion of a bomb also momentum is conserved and the total momentum of the fragments of bomb will be zero. This is because all the forces are only internal forces.

[14] A heavy body is attached from a spring and is held at point A and is such that the spring is not slack nor is it stretched. It is then released. It goes down upto a point B and then it rises upto point C and executes an oscillatory motion between B and C. During the motion from A to C is first positive (from A to B) and then it is negative from B to A and again remains negative from A to C. SetId=289

[15] A force is any interaction which tends to change the motion of an object. It is also *defined* as rate of change of momentum.It is a vector quantity.
A physically apparent but nonexistent force felt by an observer in a noninertial frame (that is, a frame undergoing acceleration).

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[1] For any type of translational motion of a body, the displacement cannot be zero, where as the distance travelled can be zero.

[2] The law of conservation of angular momentum states that in absence of an external torque on an object or a closed system of objects the total angular momentum of the system remains constant. Thus if $\vec{\tau} = 0 => \vec{L} =$ constant where τ is the torque and $\vec{L}$ is the angular momentum of the system.

[3] A bob is attached to ceiling by a string and moves in a horizontal circular plane is an example. In this case the law of conservation of angular momentum does not hold.

[4] In the motion of earth around sun, the angular momentum of the earth about an axis passing through the sun and perpendicular to the plane of motion of earth is conserved.

[5] The law of angular momentum of a is not applicable for the conical pendulum conserved w.r.t. the origin fixed at the point of suspension. SetId=290

[6] In the example of skew rod the angular velocity does not change even though the torque applied is nonzero. However there is no contradiction as in this case the law of conservation of momentum is not applicable. conservation is violated.

[7] If I throw a ball upward, it's speed decreases as it rises upwards. There is an external force (gravity) acting on the ball, so the momentum conservation law does not apply. Momentum of the ball is not conserved, however the momentum of the Earth-ball system is conserved as gravity will become an internal force in this case.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then check we should if the laws are applicable or not.

So if there is no *external force* acting on the system all the three quantities, total momentum is conserved. The total angular momentum is also because the torque of internal forces will be zero. The conservation of energy depends on the nature of forces. will be conserved.

[9] If the work done by a force depends on the path followed by the particle, it is called a Non conservative force. Work done by a non conservative force is not zero in round trip.

SetId=290

[10] The motion of a bomb dropped from a plane does is not a uniform motion as it follows a parabolic path and not a straight line path.

[11] If two bodies starting from a point A reach a point B, following different paths, their displacement will be, in general different, but the distances covered will always be the same.

[12] The Newton's Laws of motion will hold in all frames which are at rest w.r.t. K but do not remain valid in a frame that move with respect to K.

[13] Give an example where law of conservation of momentum holds: A mass exploding into several pieces in a conservative field like gravitational field(if air resistance is neglected), obeys law of conservation of momentum. If air resistance cannot be neglected then the law of conservation of momentum will not hold.

[14] The kinetic energy of a body does not change if any one of the following is true
(i)force is always perpendicular to the velocity
(ii) the force is always perpendicular to the acceleration
(iii) the object remains stationary
(iv) the object moves in such a way that the point of application of the force remains fixed. SetId=290

[15] Psuedo Force is defined as an apparent force that acts in only non-inertial frames. Pseudo Forces are also called Fictitious Forces. It is an Imaginary force. It is independent of mass.

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[1] Displacements, being vector quantity can not compared with, a scalar quantity such as distance.

[2] If no net external torque acts on a system, the total angular momentum of the system remains constant.

[3] Consider a disc rotating about an axis perpendicular to its plane. On placing a smaller disc with its surface parallel to the surface of the rotating disc, the angular momentum of the system of two discs remains constant as there is no external torque.

[4] For the motion of earth around sun, the angular momentum of the earth about the center of mass of the sun + earth system and perpendicular to the plane of motion of earth is conserved.

[5] The law of angular momentum of a is not applicable for the conical pendulum conserved when the origin is chosen to be at the pendulum bob itself. SetId=291

[6] Example where law of conservation of angular momentum does not hold:If a particle undergoes conical motion and the only force acting on particle is central force like tension of the string.Then total external torque about fixed point A is zero,yet angular momentum is not conserved,as angular momentum keeps on changing direction.

[7] A soldier accelerating away, after detonating a bomb, will find that the total momentum of the fragments of the bomb is zero. This is an example where the law of conservation of momentum holds as the forces on the fragments are internal forces only and sum of all such forces is zero.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *net external force* acting on the system, the momentum is conserved. The definition of angular momentum and torque depends on the choice of axes, and therefore it may not be be conserved. The conservation of total energy holds only for conservative forces.

When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *net external force* acting on the system, the energy and momentum will be conserved. However, the total angular momentum may not be conserved because the torque may not be zero.

SetId=291

[9] The workdone by a non conservative force is dependant on its path. the work varies as the path varies.

[10] A wagon sliding on a roller coaster designed in such a way that the wagon covers equal distances in equal times. As the motion of the wagon is uniform, there will be no net force acting on it.

[11] Distance is equal to the length of the path covered. Displacement is the shortest distance between initial and final points.

[12] Staying inside a bullet train moving with constant velocity (no jerks etc) an experiment can always be performed which will tell us the numerical velocity of the bullet train

[13] Also a good example of law of conservation momentum can be seen when a bullet from a rifle is fired.As the bullet is fired and gets out of the rifle, the rifle gives a backward jerk due to the phenomenon of conservation of momentum.

[14] The total work done on a particle is always equal to the change in kinetic energy. SetId=291

[15] Psuedo Force is defined as an apparent force that acts in only non-inertial frames. Pseudo Forces are also called Fictious Forces. It is an Imaginary force. It is always proportional to mass. It is sometimes dependent on speed.

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SetId=292

[1] Distance depends on the path where as the displacement depends on the end point only.

[2] The law of conservation of angular momentum states that when no external torque is applied on an object or a closed system of objects about an axis, the angular momentum about that axis remains constant.

[3] Consider a man standing on a spinning platform. Initially, the man spreads out his arms and he spins with a certain angular velocity. The next moment, he pulls his arms inwards keeping them close to his body. We will observe that the angular velocity with which he is spinning now increases. This phenomenon can be explained by the Law Of Conservation of Angular momentum. Initially, since his arms were spread wide, his moment of inertia was large. However, when he pulled them close to his body, his moment of inertia decreased.
In this example the angular velocity of the man increases and therefore the angular momentum also increases.The law of conservation of angular momentum does not apply because the torque of muscular forces is not zero.

[4] In the Sun Earth system the angular momentum of the Earth about the pole star is conserved

[5] The three components of angular momentum of a conical pendulum is conserved w.r.t. the origin at the position of the center of mass of the pendulum. SetId=292

[6] A nonzero torque always causes the angular velocity to change, because a change in angular momentum means a change in angular velocity $L = I\omega$

[7] There is no known exception to the law of conservation of momentum in classical mechanics However, an exception to conservation of energy in nuclear physics is observed. In nuclear reactions when two nuclei collide and their mass converts to energy and energy momentum are not conserved.

[8] In order to apply the law of conservation of momentum we must first identify the system. If there is no *net external forces* acting on the system then conservation laws of momentum always holds. The total energy and the total angular momentum may not be conserved.

SetId=292

[9] A non conservative force is a force with the property that the work done in moving a particle between two points is dependent on the path followed.

[10] A simple pendulum moves along a circular arc and does not have constant speed and therefore its motion is not uniform.

[11] Distance is a scalar quantity where as the displacement is a vector quantity.

[12] Staying inside a bullet train moving with constant velocity (no jerks etc) an experiment can always be performed which will tell us the numerical value of the acceleration of the bullet train

[13] when a man walks on the ice slab where friction does not exist between the ice block and the floor but between the feet of the man and the slab the slab moves back as per the law of conservation of momentum

[14] A particle is acted upon by a force of constant magnitude which is always perpendicular to the velocity of the particle and the motion of the particle takes place in a plane, Then its kinetic energy, speed, velocity acceleration will not change. SetId=292

[15] Since pseudo forces are not real forces, they do not affect the conservation laws and all the three conservation laws hold in noninertial frames.

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SetId=293

[1] Distance equal to zero implies displacement=0; and Displacement=0 also implies distance = 0

[2] The angular momentum of a given system of bodies shall remain conserved unless acted upon by an external unbalanced torque.

[3] In the Sun-Earth system, angular momentum of the earth is not conserved but the total angular momentum of the sun and the earth is constant of motion.

[4] For the motion of earth around sun, the angular momentum of the sun about the center of mass of the sun + earth system and perpendicular to the orbital plane of earth is conserved.

For the motion of earth around sun, the angular momentum of the sun about and axis passing through the Earth and perpendicular to the orbital plane of motion of earth is conserved.

[5] Only the z component of the angular momentum of a conical pendulum is conserved w.r.t. the origin fixed at the point of suspension. SetId=293

[6] A nonzero torque always implies change in angular momentum and may not give rise to a change in magnitude of angular velocity. A non zero torque may mean change only the direction of the angular momentum and not the angular velocity.

[7] In a system of a canon and a canon ball, total momentum of the system is zero before canon ball is fired. After firing the canon ball, the momentum of the system seems to be conserved as the ball moves forward and the canon moves backward.

[8] In order to apply the law of conservation of momentum we must first identify the system. Then even if there is no *net external forces* acting on the system, all the three conservation laws of momentum, angular momentum and energy may not hold due to presence of internal forces.

[9] A non conservative force is a force with the property that the work done in moving a particle between two points is dependent of the taken path.

Friction, for example, does less work on a book dragged across a table if the book is dragged straight across than if the book is dragged in a curved path.

To write the equation for conservation of energy for non conservative forces we need to include the work done by the non conservative force also.This is because forces

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like friction liberate heat which are not included in the mechanical energy.

[10] A satellite goes around the earth in a circular orbit of 600km with a time period of $5.8 \times 10^3 s$. Its motion will be uniform as it will cover equal distances in equal times.

[11] Both displacement and distance tell us about the motion of a body but their study does not tell much about the forces on the body

[12] Assume bullet train, moving with out any jerks, is going on a circular arc of radius R with constant speed. Then an experiment is to be performed entirely within the train without any measurement on objects outside the train. Such an experiment can tell only radius of the track.

[13] When a freely falling rigid body collides another body in its path momentum the system of two particles is not conserved in the collision as there is external force mg acting on the system.

[14] The kinetic energy of a particle is continuously increasing with time, then the angle bewteen the net force and the velocity cannot be greater than or equal to 90° at any time. SetId=293

[15] A force is any interaction which tends to change the motion of an object. Newtons' second tell us that it is *equal* to the rate of change of momentum.It is a vector quantity. Real forces can be distinguished from pseudo forces because the pseudo forces always proportional to the mass of the body. All real forces, except the gravitational force, do not depend on the mass of the body.

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SetId=294

[1] If P and Q are the initial and the final points of a path of a particle, displacement is a vector whose direction is along PQ and has magnitude is equal to the length of line PQ

[2] When the net external torque acting on a system about a given axis is zero, the total angular momentum of the system about that axis remains consant.

[3] Consider a disc and a man system. man is standing on center of the disc rotating with angular velocity.initially man folded his hand.when man stretches his hands then momentum of inertia of system increases.and angular velocity decreases.and total angular momentum remains constant.

[4] For the motion of earth around sun, the sum of angular momenta of the Sun and the Earth about the center of mass of the sun + earth system is conserved.

[5] The z component of angular momentum of a conical pendulum is not conserved w.r.t. the origin fixed at the point of suspension; but the x and y components are conserved.

SetId=294

[6] In the example of a rotating skew rod the torque due to the external gravitational forces is zero , but the angular momentum is not constant Therefore the law of conservation of angular momentum is violated.

[7] When applying the conservation laws of momentum, energy and angular momentum we must define the system first.Only then check if the laws is applicable or not.

As an example: when a ball is dropped from a height, it gains momentum down if we consider the ball as our system.This is because the force of gravity acts as an external force.

However, if we change our system and consider earth as a part of our system too, then the momentum remains conserved because the earth gains momentum up.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then check we should if the laws are applicable or not.

So if there is no *external force* acting on the system all the three quantities, total momentum, total angular momentum, and total kinetic energy will be conserved independent of the nature of forces.

[9] A non conservative force is a force with the property that the work done in moving a particle between two points is dependent of the taken path.

Friction, for example, does less work on a book dragged across a table if the book is dragged straight across than if the book is dragged in a curved path.

To write the equation for conservation of energy for nonconservative forces we need toinclude the work done by the non conservative force also.This is because forces like friction liberate heat which are not included in the mechanical energy. SetId=294

[10] A uniform motion is defined to be the one in which a body covers equal distances in equal time intervals.

[11] Displacement is the shortest distance between initial and final points with direction specified.

[12] Assume bullet train, moving with out any jerks, is going on a circular arc of radius R with constant speed. Then an experiment is to be performed entirely within the train without any measurement on objects outside the train. Such an experiment can tell both speed of the train and radius of the track.

[13] If we take some amount of a substance like construction putty, cement, cake batter, playing dough,etc and drop it on the ground, it does not bounce back, like a rubber ball would bounce, and hence the momentum it had before striking the ground seems to have been lost. Hence it appears that the law of conservation of linear momentum does not hold.

[14] A heavy body is attached from a spring and is held at point A and is such that the spring is not slack nor is it stretched. It is then released. It goes down upto a point B and then it rises upto point C and executes an oscillatory motion between B and C. During the motion from A to C is first positive (from A to B) and then it is negative from B to A and again remains negative from A to C. SetId=294

[15] Examples of pseudoforce are Coriolis Force, Centrifugal Force, and magnetic force on currents.
Psuedo force also called as fictitious force is an apparent force that are needed for masses whose their motion is described using a non inertial frame of reference.

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SetId=295

[1] If P and Q are the initial and the final points of a path of a particle,the displacement is the vector $\overrightarrow{PQ}$.

[2] This law sates that when no net torque of all forces acts on a object or a system of objects then total angular momentum of system is conserved.The angular momentum before an event is equal to angular momentum after that event.mathematically explained by when, net torque=0 ;then, total angular momentum(L)=constant.

[3] The conservation of angular momentum of a system of bodies requires that the the sum of torque due to all forces be equal to zero. Now consider a situation where the forces are such that the sum of torques of external forces is zero w.r.t. some axes K. Since the value of torque depends of the choices of axes, the sum of torques due to all internal forces will depend on the choice of axes and in general it will be non zero. Therefore, for a system of several bodies, for a given choice of axes K, there will be situations when the total angular momentum may not be conserved.

[4] For the motion of the Earth around the sun, the total of angular momenta of the Earth and the Sun, about in a reference frame fixed in the pole star, is conserved.

[5] Only the z component of angular momentum of a conical pendulum is conserved w.r.t. the origin fixed at the point of suspension. SetId=295

[6] In the example of skew rod, the angular momentum changes with time and there is a non zero torque coming from action of forces other than gravitational forces. Hence the law of conservation of angular momentum dos not apply.

[7] Statement: Law of Conservation of energy states that "ENERGY CAN NEITHER BE CREATED NOR DESTROYED",but it can be changed from one form to other.

EXPLANATION: Statement implies that the total amount of energy in an isolated system remains constant although it may change forms. viz, kinetic energy may change to potential;chemical to electrical energies etc.

[8] If we want to apply the conservation laws of momentum, energy and angular momentum, we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *external force* acting on the system, the momentum and angular momentum will be conserved, and depending on the nature of the forces but total energy may or may not be conserved.

[9] The non conservative force is a force with a property thet the work done between two points depends on path taken. If a particle moves along a curve path, to know about the work done by a non conservative force we should have the equation of the path along which the particle had move.The work done would be

WORK = INTEGRAL (F.dx)

The equation of conservation of mechanical energy for a non conservative force would be

SetId=295 $KE_{\text{final}} + PE_{final} = KE_{initial} + PE_{initial} + W_{nc}$

[10] A particle moves on a circular path. Then its speed, direction of force, velocity and acceleration must always change with time.

[11] Displacements, being vector quantity can not compared with, a scalar quantity such as distance.

[12] Assume bullet train, moving with out any jerks, is going on a circular arc of radius R with constant speed. Then an experiment is to be performed entirely within the train without any measurement on objects outside the train. Such an experiment can tell only speed of the track.

[13] When we consider collision between two bodies in a non-inertial frame of reference, the law of conservation of momentum cannot be applied because there will be a pseudo force acting on the frame itself.

[14] The kinetic energy of a body does not change if any one of the following is true
(i)force is always perpendicular to the velocity
(ii) the force is always perpendicular to the acceleration
(iii) the object remains stationary
(iv) the object moves in such a way that the point of application of the force remains fixed. SetId=295

[15] Examples of pseudo-force are Coriolis Force, Centrifugal Force, Centripetal force and magnetic force on currents. The pseudo forces do not obey Newton's third law and therefore the total momentum does not appear to be conserved in a non-inertial frame.

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[1] If two bodies starting from a point A reach a point B, following different paths, their displacement will be, in general different, but the distances covered will always be the same.

[2] Statement of Law of Conservation of Angular Momentum:
Differentiating $\vec{L} = \vec{r} \times \vec{p}$ w.r.t, time,

$$\begin{aligned}\frac{dL}{dt} &= \frac{d\vec{r} \times \vec{p}}{dt} = \frac{d\vec{r}}{dt} \times \vec{p} + \vec{r} \times \frac{d\vec{p}}{dt} = \vec{v} \times (m\vec{v}) + \vec{r} \times \vec{F} \\ &= \vec{r} \times \vec{F} (\because v \times v = 0) \\ &= \vec{\tau}\end{aligned}$$

here $\vec{\tau}$ represents the net torque acting on a rigid body rotating about a fixed axis.This torque must take into account of all the forces, be it external or internal forces

[3] Example where law of conservation of angular momentum does not hold:
When there is external force like frictional force acting on a object when it is rotating we cannot use conservation of angular momentum as the friction force acting on the object produces an external torque.

[4] For the motion of the Earth around the sun, the total of angular momenta of the Earth and the Sun, is conserved in every inertial frame of reference; but the angular momentum of the Earth (or of the sun)is not conserved in every inertial frame.

[5] The projection of angular momentum of a conical pendulum in the horizontal plane is a constant of motion when the origin is chosen to be at fixed at the point of suspension.

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[6] In the example of conical pendulum, the z- component of angular momentum does not change. This follows from the angular momentum conservation as there is no external torque.

[7] Oscillating simple pendulum is a very good example where potential energy gets converted to kinetic energy and kinetic to potential energy. Some energy gets dissipated as heat if we consider air resistance. Energy as a whole is conserved if we consider universe as system, the energy has just changed its form.

[8] To apply the conservation laws of momentum, energy and angular momentum, we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *external force* acting on the system, the energy and momentum will be conserved. However, depending on the nature of the system and of the forces, the total angular momentum may not be conserved.

[9] Nonconservative forces arise due to neglected degrees of freedom or from time dependent potentials. The work done by a nonconservative force depends upon the path taken. It causes a change in the mechanical energy of the system. It adds or removes mechanical energy from a system.

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[10] A particle moves on a circular path. Then its speed, direction offorce, can remain constant by velocity and acceleration must always change with time.

[11] Distance depends on the path where as the displacement depends on the end point only

[12] A particle is observed from two frames S_1 and S_2. The frame S_2 moves with respect to S_1 with an acceleration a. If F_1 and F_2 be the pseudoforces when seen from S_1 and S_2 respectively it is not possible to have $F_1 = F_2 = 0$

[13] When a system is acted upon by external forces like friction etc, the conservation principle does not hold good,there will be impulse imparted and so we cant conserve momentum. This is case when a collision between two elastic balls take place on a rough horizontal table. The total momentum just after the collision will be different from the total momentum just before the collision. Here momentum is not conserved as there is external force friction is present.

[14] The total work done on a particle is always equal to the change in kinetic energy. SetId=296

[15] FORCE is any interaction which tends to change the motion of an object.It has both magnitude and direction,making it a vector quantity.

A psuedo force is an apparent force that acts on all masses whose motion is described with respect to a non-inertial frame of reference like a rotating frame of reference.This force is needed by an observer in an non-inertial frame to make all the Newtons Laws of motion hold true.

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[1] Displacement is equal to the vector difference $\vec{r}_f - \vec{r}_i$ of the position vectors of initial and final points. The distance covered will be $|\vec{r}_f - \vec{r}_i|$

[2] Statement of Law of Conservation of Angular Momentum: For a system of many particles The net torque due all the forces, be it external or internal forces. But as the torque due to all the internal forces cancel out, it sufficient to consider the external forces acting on the system.

[3] A bob attached to a ceiling by a string moving in a horizontal circular plane is an example where the total angular momentum of the bob about the point of suspension is not conserved. This is because the the torque due to the weight of the bob about the point of suspension does not vanish and has non zero horizontal component. Only the vertical component of the angular component is conserved.

[4] In the Sun Earth system the angular momentum of the Earth is conserved in every frame of reference

[5] The law of angular momentum of a is not applicable for the conical pendulum conserved w.r.t. the origin fixed at the point of suspension. SetId=297

[6] In the example of conical pendulum, the x and$y$ components of angular momentum change. This follows from the angular momentum conservation as the z components external torque is zero and horizontal components of torque are non zero.

[7] Law of conservation of momentum does not hold whenever an external force or impulse acts on the system. For example,when a body collides with earth then it bounces back to a lesser height as it loses some velocity.

In this example the momentum of a ball is not conserved due to impulsive force by ground in the normal direction.

However, strictly speaking the system that should be considered here is the ball-earth system and the total momentum is conserved.

[8] In order to apply the law of conservation of momentum we must first identify the system. If there is no *external forces* acting on the system then conservation laws of momentum always holds. And depending on the nature of the system and of the forces, the total kinetic energy and the total angular momentum may not be conserved.

[9] The work done by a *Nonconservative Force *is not recoverable*.*The work done by a *Non Conservative force* is usually dissipated in the form of Heat and Sound.

SetId=297 Non conservative force *cannot* be expressed in the form of *Potential Energy*.

[10] A particle moves on a circular path. Then under suitable conditions its speed may remain constant, but the force, velocity and acceleration must always change with time.

[11] Distance equal to zero $\Rightarrow$ displacement=0; but Displacement=0

[12] A particle is observed from two frames S_1 and S_2. The frame S_2 moves with respect to S_1 with an acceleration a. If F_1 and F_2 be the pseudoforces when seen from S_1 and S_2 respectively and if $F_1 = 0$ then we must have $F_2 \neq 0$

[13] When we are in accelerating frame if we observe any collision between two bodies then the law of conservation of momentum does not hold in that frame of reference. On the other hand the law of conservation of momentum holds in all inertial frames.

[14] A particle is acted upon by a force of constant magnitude which is always perpendicular to the velocity of the particle and the motion of the particle takes place in a plane, Then its kinetic energy, speed, velocity acceleration will not change. SetId=297

[15] FORCE is any interaction which tends to change the motion of an object.It has both magnitude and direction,making it a vector quantity. A pseudo-force F doesn't arise from any physical interaction between two objects, but rather from the acceleration 'a' of the non-inertial reference frame itself. These forces have no real existence but must be taken into account in an accelerating frame of reference to make all the three Newton's Laws of motion applicable to the system

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[1] Distance is equal to the length of the path covered. Displacement is the shortest distance between initial and final points.

[2] Depending on the torques acting on a system, the angular momentum can be conserved only in one or two directions, but may not be conserved in all. For instance, if an isolated body has no torque acting on it only in the direction along the Z axis, then the angular momentum is conserved only in that direction.

[3] Law of conservation of angular momentum holds in case of long jump. When a athlete takes off from the ground in a running long jump, the forces on the launching foot give the athlete an angular momentum with a forward rotation around a horizontal axis. Such rotation would not allow the jumper to land properly. In the landing, the legs should be together and extended forward at an angle so that the heels mark the sand at the greatest distance. Once airborne, the angular momentum cannot change (it is conserved) because no external torque acts to change it. However, the jumper can shift most of the angular momentum to the arms by rotating them in windmill fashion. Then the body remains upright in the proper orientation of landing.

[4] In the motion of earth around sun, the angular momentum of the earth about an axis passing through the sun and perpendicular to the plane of motion of earth is conserved.

[5] The law of angular momentum of a is not applicable for the conical pendulum conserved when the origin is chosen to be at the pendulum bob itself. SetId=298

[6] Example where law of conservation of angular momentum does not hold: A disc rotating on a horizontal rough surface will not have a constant angular momentum because there will be a constant torque by frictional force. Hence, its angular momentum will decrease, and the law of conservation of angular momentum does not apply.

[7] If a bullet hits a wooden board and gets embedded in the board, the total energy and the total momentum of the bullet and the board are conserved.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then check if the laws is applicable or not.

So if there is no *net external force* acting on the system all the three conservation laws will hold.

[9] * A non conservative force is a force that acts on a particle(or point), such that the work done by this force in moving this particle from one point to another is */dependent of path taken/* that is the work done depends on the path itself. *

For example frictional force is non conservative because the work done by friction always acts in the direction of travel and therefore depends on length L of the path taken.

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[10] A particle moves on a circular path. Then under suitable conditions its speed and acceleration may remain constant, but the force, and velocity must always change with time.

[11] If P and Q are the initial and the final points of a path of a particle, displacement is a vector whose direction is along PQ and has magnitude is equal to the length of line PQ

[12] If K is an inertial frame, any frame that moves w.r.t. the frame K with uniform velocity is also an inertial frame.

[13] When a freely falling body hits another rigid body in its path then momentum is not conserved as external force mg acts on both the bodies. The total momentum after the collision will be different from the total momentum before the hit.

[14] The kinetic energy of a particle is continuously increasing with time, then the angle bewteen the net force and the velocity cannot be greater than or equal to 90^{o} at any time.

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[15] FORCE is any interaction which tends to change the motion of an object.It has both magnitude and direction,making it a vector quantity.
A pseudo-force results from acceleration of the frame of reference in which the objects reside. It is taken into account so that Newton's second law isn't invalidated. The pseudo force acting on an object can always be mathematically expressed as the product of the mass of the object and the acceleration of the frame of reference.

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[1] Distance is a scalar quantity where as the displacement is a vector quantity.

[2] According to Law of Conservation of Angular momentum,if no external torque acts on an object or system of objects,angular momentum of an object or system of objects remains CONSTANT or no change in angular momentum can occur.

Also it states that,only external torque can change angular momentm of the system where as the torque produced by internal forces can not change the angular momentum of the system

[3] The total angular momentum of a body remains constant of motion when the net torque of the external forces acting on the body is zero.
In general, we have a system of particles such that the net torque of the external forces on the system, w.r.t. some axes K, is zero, the total angular momentum may not remain conserved, because the torque due to the internal forces may not be zero.

[4] For the motion of earth around sun, the angular momentum of the earth about the center of mass of the sun + earth system and perpendicular to the plane of motion of earth is conserved.

[5] The three components of angular momentum of a conical pendulum is conserved w.r.t. the origin at the position of the center of mass of the pendulum. SetId=299

[6] Example where law of conservation of angular momentum does not hold:Consider a vertical stick on the ground falling to a horizontal position. During the fall, the conservation of angular momentum applied at the point of rotation on the ground and perpendicular to the plane of the stick is not applicable as, the gravitational force which acts vertically downwards assumed at the centre of mass produces an external torque about the axis of rotation

[7] If a bullet hits a wooden board and gets embedded in the board, the total energy of the bullet and the board system is conserved but the total momentum is not conserved.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then check we should if the laws are applicable or not.

So if there is no *external force* acting on the system all the three quantities, total momentum is conserved. The total angular momentum is also because the torque of internal forces will be zero. The conservation of energy depends on the nature of forces. will be conserved.

[9] A force with the property that the work done in moving a particle is dependent on the path followed. The work done by a conservative force in moving a body from an initial location to a final location is dependent on the path taken between the two points

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[10] When the force is kept constant as function of time, it is possible for a particle to move on a circular path in such a way that its speed remains constant, but the velocity and acceleration must always change with time.

[11] If P and Q are the initial and the final points of a path of a particle,the displacement is the vector $\overrightarrow{PQ}$.

[12] If K is an inertial frame, any frame that moves w.r.t. the frame K with uniform speed is also an inertial frame.

[13] .The law of conservation of momentum does not hold good when net external forces acting on the system is not zero.when two bodies collide law of conservation of momentum is applicable on system of two bodies but on not individual bodies because external impulse acts on them.

[14] A heavy body is attached from a spring and is held at point A and is such that the spring is not slack nor is it stretched. It is then released. It goes down upto a point B and then it rises upto point C and executes an oscillatory motion between B and C. During the motion from A to C is first positive (from A to B) and then it is negative from B to A and again remains negative from A to C.

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[15] Explain Force:FORCE is any interaction which tends to change the motion of an object.It has both magnitude and direction,making it a vector quantity.
In the case of a non inertial frame, we can use the second law of motion by adding a pseudo force to the system which makes it an inertial frame of reference.

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[1] The speed is rate of change of distance and the velocity is the rate of change of displacement.

[2] The law of conservation of angular momentum states that when the net external torque acting on the system is zero, then the angular momentum of the system remains constant.both the initial and final momentum should be taken from a fixed inertial frame of reference provided.

[3] An example where law of conservation of angular momentum holds:
The Law of conservation of angular momentum holds in the case of a ballet dancer performing a pirouette.

When the dancer extends her arms outward, the angular velocity of her rotation decreases whereas when she keeps her arms close to her body, the angular velocity increases. This is because her moment of inertia changes as she moves her arms outward and inward. It can be noted that she as a system has no external torque acting upon her.

[4] In the Sun Earth system the angular momentum of the Earth about the pole star is conserved

[5] Only the z component of the angular momentum of a conical pendulum is conserved w.r.t. the origin fixed at the point of suspension. SetId=300

[6] We have a conical pendulum .The forces acting on the bob are tension (along the direction of the string) and gravitational force acting in the vertically downward direction.we have an additional force called the drag force which is tangential to the motion of the bob and acts in the direction opposite to the motion of the bob.The axis of rotation passes through the hinge point and is vertical.The torque due to tension is 0 because the force passes through the axis of rotation.The torque due to mg is also zero since it is parallel to the axis of rotation.but the torque due to drag force is not zero.since the net external torque acting on the bob is not zero,therefore the law of conservation of angular momentum does not hold here

[7] If a bullet hits a wooden board and gets embedded in the board, both total energy and the total momentum of the bullet and the board are not conserved.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *net external force* acting on the system, the momentum is conserved. The definition of angular momentum and torque depends on the choice of axes, and therefore it may not be be conserved. The conservation of total energy holds only for conservative forces.

When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *net external force* acting on the system, the energy and momentum will be conserved. However, the total angular momentum may not be conserved because the torque may not be zero.

[9] The work done by non conservative force is dependent on the path taken by the particle in reaching final position from initial position. Non conservative force depends on the distance travelled by the particle

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[10] It is not possible for a particle to move on a circular path in such a way that its speed and force remains constant, and only the velocity and acceleration may (or may not) always change with time.

[11] If two bodies starting from a point A reach a point B, following different paths, their displacement will be, in general different, but the distances covered will always be the same.

[12] A frame rotating w.r.t K with uniform angular velocity is also an inertial frame.

[13] A block moving in the air breaks up into two parts and the parts separate, then the total momentum must be the same before and after the break.

[14] The kinetic energy of a body does not change if any one of the following is true
(i)force is always perpendicular to the velocity
(ii) the force is always perpendicular to the acceleration
(iii) the object remains stationary
(iv) the object moves in such a way that the point of application of the force remains fixed.

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[15] For the Newton's Law of Motion to hold true,the physically apparent but nonexistent force needed by an observer in a non-inertial frame is called the pseudo force.
1) Caused by relative acceleration of the origin in a straight line
2) Centrifugal and Centripetal forces
3) Coriolis force
4) Euler force

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[1] For any type of translational motion of a body, the displacement cannot be zero, where as the distance travelled can be zero.

[2] The law of conservation of angular momentum states that The total angular momentum of a system is constant in both magnitude and direction if the resultant torque, of the external forces acting on the system, is zero.

[3] In case of a skater, who can be considered an isolated system, so no torue will be acting on him/her. When the arms are extended, the moment of inertia is more. When his hands are closely held, the moment of inertia is lesser. Since the angular momentum is same, the angular acceleration changes accordingly.

[4] For the motion of earth around sun, the angular momentum of the sun about the center of mass of the sun + earth system and perpendicular to the orbital plane of earth is conserved.

For the motion of earth around sun, the angular momentum of the sun about and axis passing through the Earth and perpendicular to the orbital plane of motion of earth is conserved.

[5] The z component of angular momentum of a conical pendulum is not conserved w.r.t. the origin fixed at the point of suspension; but the x and y components are conserved. SetId=301

[6] When you release a toy gyroscope on its pedestal, it initially has no precessional rotation around that pedestal, i.e, the orientation of rotation is fixed. However, it instantaneously starts precessing around the pedestal. Both Kinetic Energy and Angular Momentum now exist where they did not exist a moment earlier. The Kinetic Energy is easy to explain, as appearing due to the body of the gyroscope dropping a tiny fraction of a millimeter in the Earth's gravitational field, giving up exactly the correct amount of Potential Energy. But the Angular Momentum of the Precession which just appeared, does not come from anywhere. This is therefore a Violation of the Conservation of Angular Momentum.

[7] There are certain situations where it appears that the law of conservation of linear momentum does not hold. For example if we take some amount of a substance like construction putty, cement, cake batter, playing dough,etc and drop it on the ground, it does not bounce back like a rubber ball would and hence the momentum it had before striking the ground seems to have been lost. Hence it appears that the law of conservation of linear momentum does not hold.

[8] In order to apply the law of conservation of momentum we must first identify the system. If there is no *net external forces* acting on the system then conservation laws of momentum always holds. The total energy and the total angular momentum may not be conserved.

[9] The work done by non conservative force is dependent on the path taken by the particle in reaching final position from initial position. Non conservative force depends on the distance travelled by the particle

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[10] For a particle moving on circle the acceleration is always constant in magnitude and directed towards the centre of the circle.

[11] Distance is equal to the length of the path covered. Displacement is the shortest distance between initial and final points.

[12] The Newton's Laws of motion will hold in all frames which are at rest w.r.t. K but do not remain valid in a frame that move with respect to K.

[13] A ball hits the floor and rebounds after an inelastic collision. In this case the total momentum of the ball before and after the collsion is conserved. Also the total enrgy of the ball and the earth remains the same

[14] The total work done on a particle is always equal to the change in kinetic energy.

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[15] A force is any interaction which tends to change the motion of an object. It is also *defined* as rate of change of momentum.It is a vector quantity.

Pseudo-force is a fictitious force it is taken by an observer from non inertial frame of reference. This force arises from acceleration of reference frame that is a reference frame which is accelerating or rotating.

The equation of motion is then written by balancing all forces. As an example a particle moving in a circle is seen to be at rest by balancing the centripetal and centrifugal forces.

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[1] Displacements, being vector quantity can not compared with, a scalar quantity such as distance.

[2] If the net external torque acting on a system is zero,the angular momentum L(vector) of the system remains constant,no matter what changes take place within the system.L(vector)=a constant (net external torque acting on system is zero)

[3] Example where law of conservation of angular momentum holds:
Let us assume a student seated on a stool that can rotate freely about a vertical axis. The student has been set into rotation at a modest initial angular speed ω . He holds two dumbbells in his outstretched hands. His angular momentum vector L lies along the vertical rotation axis, pointing upwards. Now he pulls in his arms;this action reduces his rotational inertia from its value I_{initial} to a final value I_{final} because he moves the mass closer to the rotational axis. His rate of rotation increases markedly, from ω_{initial} to ω_{final}. The student can then slow down by extending his arms once more,moving the dumbbells outward. No external torque acts on the system consisting of the student, stool and the dumbbells. Thus the angular momentum of the system about the rotational axis remains constant. $I_{\text{initial}} * \omega_{\text{initial}} = I_{\text{final}} * \omega_{\text{final}}$.

[4] For the motion of earth around sun, the sum of angular momenta of the Sun and the Earth about the center of mass of the sun + earth system is conserved.

[5] Only the z component of angular momentum of a conical pendulum is conserved w.r.t. the origin fixed at the point of suspension. SetId=302

[6] There is no case where LAW OF CONSERVATION OF ANGULAR MOMENTUM does'nt hold.But there are cases where conservation of angular momentum does not hold.A body in vertical circular motion is an example where angular momentum is not conserved. Here the law of conservation does not apply.

[7] A tennis ball is dropped from height h and after hitting the ground and it bounces back and rises to the same height. In this case the momentum of the ball is conserved because (under ideal conditions) the momentum after it hits the ground will be equal to the momentum it had before hitting the ground.

[8] In order to apply the law of conservation of momentum we must first identify the system. Then even if there is no *net external forces* acting on the system, all the three conservation laws of momentum, angular momentum and energy may not hold due to presence of internal forces.

[9] Nonconservative forces are those forces in which the work done in moving a particle is dependant on the path taken to cover the distance. Some energy woul be lost to

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the environment in the form of heat, sound, etc. The energy in the final state is less than that in the initial state.

[10] The motion of a bomb dropped from a plane does is not a uniform motion as it follows a parabolic path and not a straight line path.

[11] Distance is a scalar quantity where as the displacement is a vector quantity.

[12] Staying inside a bullet train moving with constant velocity (no jerks etc) an experiment can always be performed which will tell us the numerical velocity of the bullet train

[13] In a head on elastic collision of two identical bodies of equal masses the velocities, the speeds, the momenta and the kinetic energy are all exchanged.

[14] A particle is acted upon by a force of constant magnitude which is always perpendicular to the velocity of the particle and the motion of the particle takes place in a plane, Then its kinetic energy, speed, velocity acceleration will not change. SetId=302

[15] A psuedo force is an apparent force that acts on all masses whose motion is described with respect to a non-inertial frame of reference like a rotating frame of reference. This force is needed by an observer in an non-inertial frame to make all the Newtons second laws to write correct equation of motion..

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[1] Distance depends on the path where as the displacement depends on the end point only.

[2] The Law of conservation of angular momentum states that when no external torque acts on an object or a closed system of objects undergoing motion about a given axis, the change in angular momentum is zero. Therefore, considering an event where only internal torque or no torque is involved, the total angular momentum of the system before the event is equal to the total angular momentum after the event

[3] A bob is attached to ceiling by a string and moves in a horizontal circular plane is an example. In this case the law of conservation of angular momentum does not hold.

[4] For the motion of the Earth around the sun, the total of angular momenta of the Earth and the Sun, about in a reference frame fixed in the pole star, is conserved.

[5] The projection of angular momentum of a conical pendulum in the horizontal plane is a constant of motion when the origin is chosen to be at fixed at the point of suspension. SetId=303

[6] A sphere rolling on a rough surface.Due to friction there is external torque so the angular momentum changes which results in the slowing of the sphere. The angular momentum keeps changing. Even in case like this one, it is wrong to say that the Law of Angular Momentum Conservation does not hold.

[7] Law of conservation of momentum does not hold when Newton's laws are not valid, e.g. in a non-inertial frame of reference. For example, when we consider collision between two bodies in a non-inertial frame of reference, the law of conservation of momentum cannot be applied because there will be a pseudo force acting on the frame itself.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then check we should if the laws are applicable or not.

So if there is no *external force* acting on the system all the three quantities, total momentum, total angular momentum, and total kinetic energy will be conserved independent of the nature of forces.

SetId=303

[9] The work done by such forces depends on the path taken. The work done cannot be represented as a potential energy function.Work done by such forces is always negative.

[10] A wagon sliding on a roller coaster designed in such a way that the wagon covers equal distances in equal times. As the motion of the wagon is uniform, there will be no net force acting on it.

[11] Both displacement and distance tell us about the motion of a body but their study does not tell much about the forces on the body

[12] Staying inside a bullet train moving with constant velocity (no jerks etc) an experiment can always be performed which will tell us the numerical value of the acceleration of the bullet train

[13] For a system of several particles the conservation of total linear momentum is equivalent to the statement that their centre of mass moves like a free particle.

[14] The kinetic energy of a particle is continuously increasing with time, then the angle bewteen the net force and the velocity cannot be greater than or equal to 90^{o} at any time.

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[15] One indication that pseudo forces are NON-NEWTONIAN is that they violate Newton's III law and violate the Newton's third law.

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[1] Distance equal to zero implies displacement=0; and Displacement=0 also implies distance = 0

[2] The law of conservation of angular momentum states that when no external torque acts on an object or a closed system of objects, no change of angular momentum can occur. Hence, the angular momentum before an event involving only internal torques or no torques is equal to the angular momentum after the event . Angular momentum can be calculated with the help of the formula $L = I\omega$ where L stands for Angular momentum, I stands for moment of inertia and ω stands for angular velocity

[3] Consider a disc rotating about an axis perpendicular to its plane. On placing a smaller disc with its surface parallel to the surface of the rotating disc, the angular momentum of the system of two discs remains constant as there is no external torque.

[4] For the motion of the Earth around the sun, the total of angular momenta of the Earth and the Sun, is conserved in every inertial frame of reference; but the angular momentum of the Earth (or of the sun)is not conserved in every inertial frame.

[5] The law of angular momentum of a is not applicable for the conical pendulum conserved w.r.t. the origin fixed at the point of suspension. SetId=304

[6] Consider a rod of length l. Let us give an impulse to one end . Now the angular momentum about the oposite end is not zero since the impulse provides some torque . So the angular momentum is not conserved .

$$\text{torque} = \text{impulse} * \ell.$$

$d\ell/dt$ is not equal to zero and the law of conservation of angular momentum does not hold.

[7] If I throw a ball upward, it's speed decreases as it rises upwards. There is an external force (gravity) acting on the ball, so the momentum conservation law does not apply. Momentum of the ball is not conserved, however the momentum of the Earth-ball system is conserved as gravity will become an internal force in this case.

[8] If we want to apply the conservation laws of momentum, energy and angular momentum, we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *external force* acting on the system, the momentum and angular momentum will be conserved, and depending on the nature of the forces but total energy may or may not be conserved.

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[9] A nonconservative force is a force with the property that the work done in moving a particle depends on the path taken.Also, the net work done in a closed loop is non zero.

[10] A simple pendulum moves along a circular arc and does not have constant speed and therefore its motion is not uniform.

[11] Displacement is the shortest distance between initial and final points with direction specified.

[12] Assume bullet train, moving with out any jerks, is going on a circular arc of radius R with constant speed. Then an experiment is to be performed entirely within the train without any measurement on objects outside the train. Such an experiment can tell only radius of the track.

[13] The total mechanical energy of a system may not be conserved if there are no external forces and the internal forces are conservative.

[14] A heavy body is attached from a spring and is held at point A and is such that the spring is not slack nor is it stretched. It is then released. It goes down upto a point B and then it rises upto point C and executes an oscillatory motion between B and C. During the motion from A to C is first positive (from A to B) and then it is negative from B to A and again remains negative from A to C.

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[15] The apparent force which seems to act on an object in an accelerating frame of reference if we wish to describe the object's motion is called a pseudo force.Its a non-existent force used only to describe the motion completely using Newton's second law even though the agent causing the force is undefined.

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[1] If P and Q are the initial and the final points of a path of a particle, displacement is a vector whose direction is along PQ and has magnitude is equal to the length of line PQ

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[2] Newton's Second Law of Motion is defined by the expression $F = \frac{dp}{dT}$, where F gives the force vector acting on the system and p gives its momentum vector; in linear motion. A similar expression can be written to describe angular motion, i.e. : $\tau = \frac{dL}{dt}$, where τ is the external torque vector acting on the system, and L is the angular momentum.

If the external torque on the system is zero, then we get the expression as: dL/dt=0. This points out to the fact that, when no external torque is acting on the system, then its angular momentum is constant, no matter what changes occur in the system. This is the Law of Conservation Of Angular Momentum.

[3] Consider a man standing on a spinning platform. Initially, the man spreads out his arms and he spins with a certain angular velocity. The next moment, he pulls his arms inwards keeping them close to his body. We will observe that the angular velocity with which he is spinning now increases. This phenomenon can be explained by the Law Of Conservation of Angular momentum. Initially, since his arms were spread wide, his moment of inertia was large. However, when he pulled them close to his body, his moment of inertia decreased.
In this example the angular velocity of the man increases and therefore the angular momentum also increases.The law of conservation of angular momentum does not apply because the torque of muscular forces is not zero.

[4] In the Sun Earth system the angular momentum of the Earth is conserved in every frame of reference

[5] The law of angular momentum of a is not applicable for the conical pendulum conserved when the origin is chosen to be at the pendulum bob itself. SetId=305

[6] Let us consider a rotating skew rod. In the absence of friction or any other drag force, the rod should continuously spin without stopping. Here the net torque about the axis of rotation is 0 and hence angular momentum is conserved. It therefore follows from law of conservation of angular momentum that a spinning skew rod will keep rotating with constant angular velocity if there is no external torque. So law of conservation of angular momentum does not hold.

[7] A soldier accelerating away, after detonating a bomb, will find that the total momentum of the fragments of the bomb is zero. This is an example where the law of conservation of momentum holds as the forces on the fragments are internal forces only and sum of all such forces is zero.

[8] To apply the conservation laws of momentum, energy and angular momentum, we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *external force* acting on the system, the energy and momentum will be conserved. However, depending on the nature of the system and of the forces, the total angular momentum may not be conserved.

[9] A force whose work done is a path function is called a non-conservative force. All the forces which do not satisfy the definition of conservative forces are non-conservative in nature. The work done by these forces dissipates into heat energy, sound energy, light energy, etc. Therefore, law of conservation of mechanical energy cannot be applied to a system on which a non-conservative force is acting. No potential function can be defined for these forces.

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[10] A satellite goes around the earth in a circular orbit of 600km with a time period of $5.8 \times 10^3 s$. Its motion will be uniform as it will cover equal distances in equal times.

[11] Displacements, being vector quantity can not compared with, a scalar quantity such as distance.

[12] Assume bullet train, moving with out any jerks, is going on a circular arc of radius R with constant speed. Then an experiment is to be performed entirely within the train without any measurement on objects outside the train. Such an experiment can tell both speed of the train and radius of the track.

[13] When a bullet fired on a wooden block, some energy is transferred to the block and the total mechanical energy of the block and the bullet is conserved.

[14] The kinetic energy of a body does not change if any one of the following is true
(i)force is always perpendicular to the velocity
(ii) the force is always perpendicular to the acceleration
(iii) the object remains stationary
(iv) the object moves in such a way that the point of application of the force remains fixed.

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[15] The physically apparent, but nonexistent, force needed by an observer in a noninertial frame to make Newton's laws of motion hold true is called pseudoforce.

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[1] If P and Q are the initial and the final points of a path of a particle,the displacement is the vector $\overrightarrow{PQ}$.

[2] If the net external torque acting on a system is zero, the angular momentum L of the system remains constant, no matter what changes take place within the system.

$$\sum(T_{\text{ext}}) = \frac{dL}{dt}$$

The law states that when there is no net external torque, $\frac{dL}{dt}$ is zero implying that the total angular momentum of system is constant.

i.e. $L = a$ constant (isolated system)

[3] In the Sun-Earth system, angular momentum of the earth is not conserved but the total angular momentum of the sun and the earth is constant of motion.

[4] In the motion of earth around sun, the angular momentum of the earth about an axis passing through the sun and perpendicular to the plane of motion of earth is conserved.

[5] The three components of angular momentum of a conical pendulum is conserved w.r.t. the origin at the position of the center of mass of the pendulum. SetId=306

[6] In the example of skew rod the angular velocity does not change even though the torque applied is nonzero. However there is no contradiction as in this case the law of conservation of momentum is not applicable. conservation is violated.

[7] There is no known exception to the law of conservation of momentum in classical mechanics However, an exception to conservation of energy in nuclear physics is observed. In nuclear reactions when two nuclei collide and their mass converts to energy and energy momentum are not conserved.

[8] In order to apply the law of conservation of momentum we must first identify the system. If there is no *external forces* acting on the system then conservation laws of momentum always holds. And depending on the nature of the system and of the forces, the total kinetic energy and the total angular momentum may not be conserved.

[9] *Non conservative forces* are the type of forces in which the work done by the forces is purely dependent on the path taken by the body.Thus the net work done by the forces in cyclic path is never equal to zero.

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[10] A uniform motion is defined to be the one in which a body covers equal distances in equal time intervals.

[11] Distance depends on the path where as the displacement depends on the end point only

[12] Assume bullet train, moving with out any jerks, is going on a circular arc of radius R with constant speed. Then an experiment is to be performed entirely within the train without any measurement on objects outside the train. Such an experiment can tell only speed of the track.

[13] When a moving car hits a parked lorry and causes the parked lorry to move ,energy is transferred from moving the car to the lorry and the total energy of the lorry and the car is conserved.

[14] The total work done on a particle is always equal to the change in kinetic energy. SetId=306

[15] Pseudo forces come into picture when Newton's laws of motion have to be applied to describe the motion of bodies in non-inertial frames. These forces have no real existence.

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[1] If two bodies starting from a point A reach a point B, following different paths, their displacement will be, in general different, but the distances covered will always be the same.

[2] When the net external torque acting on a body or a system of bodies is zero about a particular axis, then the angular momentum of each body is conserved about that axis.

[3] Consider a disc and a man system. man is standing on center of the disc rotating with angular velocity.initially man folded his hand.when man stretches his hands then momentum of inertia of system increases.and angular velocity decreases.and total angular momentum remains constant.

[4] For the motion of earth around sun, the angular momentum of the earth about the center of mass of the sun + earth system and perpendicular to the plane of motion of earth is conserved.

[5] Only the z component of the angular momentum of a conical pendulum is conserved w.r.t. the origin fixed at the point of suspension. SetId=307

[6] Example where law of conservation of angular momentum does not hold:If a particle undergoes conical motion and the only force acting on particle is central force like tension of the string.Then total external torque about fixed point A is zero,yet angular momentum is not conserved,as angular momentum keeps on changing direction.

[7] In a system of a canon and a canon ball, total momentum of the system is zero before canon ball is fired. After firing the canon ball, the momentum of the system seems to be conserved as the ball moves forward and the canon moves backward.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then check if the laws is applicable or not.

So if there is no *net external force* acting on the system all the three conservation laws will hold.

[9] Non-conservative forces are path-dependent forces, i.e. the work done on a body by these forces depends on the path taken by the body. Mechanical energy of a system is not conserved when a conservative force acts on it but the total energy is conserved. Therefore, the mechanical energy lost by the system is liberated in some other form such as light energy, heat energy, etc.

For example, when a body is moving along a surface, frictional force acts on the body as well. Due to this frictional force, the body loses its mechanical energy, and this loss is generally released in the form of heat energy to the surroundings. Thus, the mechanical energy will not be conserved and frictional force can be classified as a non-conservative force.

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[10] A particle moves on a circular path. Then its speed, direction of force, velocity and acceleration must always change with time.

[11] Distance equal to zero $\Rightarrow$ displacement=0; but Displacement=0

[12] A particle is observed from two frames S_1 and S_2. The frame S_2 moves with respect to S_1 with an acceleration a. If F_1 and F_2 be the pseudoforces when seen from S_1 and S_2 respectively it is not possible to have $F_1 = F_2 = 0$

[13] When a bomb explodes the total mechanical energy is not conserved. But the total chemical energy and the mechanical energy is conserved.

[14] A particle is acted upon by a force of constant magnitude which is always perpendicular to the velocity of the particle and the motion of the particle takes place in a plane, Then its kinetic energy, speed, velocity acceleration will not change. SetId=307

[15] In a non-inertial frame of reference the accelration of the body that we measure, is not the true acceleration, as the frame itself accelerates.Thus,force(F=ma) is also not the true force acting on the body.The extra force added to make it a true value is called pseudo force.Thus pseudo force does not really act on a body but just compensates the change produced by the non inertial frame, in true acceleration.

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[1] Displacement is equal to the vector difference $\vec{r}_f - \vec{r}_i$ of the position vectors of initial and final points. The distance covered will be $|\vec{r}_f - \vec{r}_i|$

[2] The law of conservation of angular momentum states that in absence of an external torque on an object or a closed system of objects the total angular momentum of the system remains constant. Thus if $\vec{\tau} = 0 => \vec{L} =$ constant where τ is the torque and $\vec{L}$ is the angular momentum of the system.

[3] The conservation of angular momentum of a system of bodies requires that the the sum of torque due to <u>all forces</u> be equal to zero. Now consider a situation where the forces are such that the sum of torques of external forces is zero w.r.t. some axes K. Since the value of torque depends of the choices of axes, the sum of torques due to all <u>internal forces</u> will depend on the choice of axes and in general it will be non zero. Therefore, for a system of several bodies, for a given choice of axes K, there will be situations when the total angular momentum may not be conserved.

[4] In the Sun Earth system the angular momentum of the Earth about the pole star is conserved

[5] The z component of angular momentum of a conical pendulum is not conserved w.r.t. the origin fixed at the point of suspension; but the x and y components are conserved.

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[6] A nonzero torque always causes the angular velocity to change, because a change in angular momentum means a change in angular velocity $L = I\omega$

[7] When applying the conservation laws of momentum, energy and angular momentum we must define the system first.Only then check if the laws is applicable or not.

As an example: when a ball is dropped from a height, it gains momentum down if we consider the ball as our system.This is because the force of gravity acts as an external force.

However, if we change our system and consider earth as a part of our system too, then the momentum remains conserved because the earth gains momentum up.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then check we should if the laws are applicable or not.

So if there is no *external force* acting on the system all the three quantities, total momentum is conserved. The total angular momentum is also because the torque of internal forces will be zero. The conservation of energy depends on the nature of forces. will be conserved.

[9] It is a force for which the work done by that force on an object or a particle in moving it between any two points depends on its path travelled.This force doesn't conserves the mechanical energy.The work done by a non-conservative force on an object in moving it in a circular path is not equal to zero.

SetId=308

[10] A particle moves on a circular path. Then its speed, direction offorce, can remain constant by velocity and acceleration must always change with time.

[11] If P and Q are the initial and the final points of a path of a particle, displacement is a vector whose direction is along PQ and has magnitude is equal to the length of line PQ

[12] A particle is observed from two frames S_1 and S_2. The frame S_2 moves with respect to S_1 with an acceleration a. If F_1 and F_2 be the pseudoforces when seen from S_1 and S_2 respectively and if $F_1 = 0$ then we must have $F_2 \neq 0$

[13] When a ball rolls over a rough surface, it comes to stop after some time. This is because transational and rotational kinetic energy initially present in the ball continuosly gets converted to heat due to friction. When all the kinetic energy changes to heat, the ball stops. The total mechanical energy of the ball is not conserved.

[14] The kinetic energy of a particle is continuously increasing with time, then the angle bewteen the net force and the velocity cannot be greater than or equal to 90° at any time.

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[15] A force is any interaction which tends to change the motion of an object. It is *equal to* the rate of change of momentum by Newton's second law.

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[1] Distance is equal to the length of the path covered. Displacement is the shortest distance between initial and final points.

[2] If no net external torque acts on a system, the total angular momentum of the system remains constant.

[3] Example where law of conservation of angular momentum does not hold:
When there is external force like frictional force acting on a object when it is rotating we cannot use conservation of angular momentum as the friction force acting on the object produces an external torque.

[4] For the motion of earth around sun, the angular momentum of the sun about the center of mass of the sun + earth system and perpendicular to the orbital plane of earth is conserved.

For the motion of earth around sun, the angular momentum of the sun about and axis passing through the Earth and perpendicular to the orbital plane of motion of earth is conserved.

[5] Only the z component of angular momentum of a conical pendulum is conserved w.r.t. the origin fixed at the point of suspension. SetId=309

[6] A nonzero torque always implies change in angular momentum and may not give rise to a change in magnitude of angular velocity. A non zero torque may mean change only the direction of the angular momentum and not the angular velocity.

[7] Statement: Law of Conservation of energy states that "ENERGY CAN NEITHER BE CREATED NOR DESTROYED",but it can be changed from one form to other.

EXPLANATION: Statement implies that the total amount of energy in an isolated system remains constant although it may change forms. viz, kinetic energy may change to potential;chemical to electrical energies etc.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *net external force* acting on the system, the momentum is conserved. The definition of angular momentum and torque depends on the choice of axes, and therefore it may not be be conserved. The conservation of total energy holds only for conservative forces.

When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *net external force* acting on the system, the energy and momentum will be conserved. However, the total angular momentum may not be conserved because the torque may not be zero.

[9] Explain Nonconservative force: This force is just opposite to that of conservative force. The work done by this force depends on the path taken by the particle on which the force is applied.This force does not conserve mechanical energy.If a particle travels in a closed loop, the net work done by a non consevative force is non zero.

SetId=309

[10] A particle moves on a circular path. Then under suitable conditions its speed may remain constant, but the force, velocity and acceleration must always change with time.

[11] If P and Q are the initial and the final points of a path of a particle,the displacement is the vector $\overrightarrow{PQ}$.

[12] If K is an inertial frame, any frame that moves w.r.t. the frame K with uniform velocity is also an inertial frame.

[13] Let us consider that a pendulum is oscillating moving in a vertical plane. Mean while let another bob which is attached to a spring and is executing a simple harmonic motion in horizontal direction comes and hits the pendulum. Here conservation of momentum does not hold good as tension(external force) is acting on the system.(pendulum)

[14] A heavy body is attached from a spring and is held at point A and is such that the spring is not slack nor is it stretched. It is then released. It goes down upto a point B and then it rises upto point C and executes an oscillatory motion between B and C. During the motion from A to C is first positive (from A to B) and then it is negative from B to A and again remains negative from A to C.

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[15] Newton's laws are not valid on non-inertial frame of reference. So to validate Newton's laws of motion pseudo force (fictious or virtual force) is introduced.
Pseudo force acts in non-inertial frame. Its magnitude is always mass of the body multiplied by acceleration of the frame. It is always in direction opposite to the acceleration of the frame of reference. The resultant of pseudo forces and real forces is always zero.

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SetId=310 [1] Distance is a scalar quantity where as the displacement is a vector quantity.

[2] The law of conservation of angular momentum states that when no external torque is applied on an object or a closed system of objects about an axis, the angular momentum about that axis remains constant.

[3] A bob attached to a ceiling by a string moving in a horizontal circular plane is an example where the total angular momentum of the bob about the point of suspension is not conserved. This is because the the torque due to the weight of the bob about the point of suspension does not vanish and has non zero horizontal component. Only the vertical component of the angular component is conserved.

[4] For the motion of earth around sun, the sum of angular momenta of the Sun and the Earth about the center of mass of the sun + earth system is conserved.

[5] The projection of angular momentum of a conical pendulum in the horizontal plane is a constant of motion when the origin is chosen to be at fixed at the point of suspension. SetId=310

[6] In the example of a rotating skew rod the torque due to the external gravitational forces is zero , but the angular momentum is not constant Therefore the law of conservation of angular momentum is violated.

[7] Oscillating simple pendulum is a very good example where potential energy gets converted to kinetic energy and kinetic to potential energy. Some energy gets dissipated as heat if we consider air resistance. Energy as a whole is conserved if we consider universe as system, the energy has just changed its form.

[8] In order to apply the law of conservation of momentum we must first identify the system. If there is no *net external forces* acting on the system then conservation laws of momentum always holds. The total energy and the total angular momentum may not be conserved.

[9] Non conservative force is the force in which the work done by a particle in going from one point to another is path dependent.

For non conservative forces mechanical energy is not conserved,mostly lost in the form of heat and light.The work done by a non conservative force is equal to the change in mechanical energy.

SetId=310 For non conservative force $E_{\text{initial}} > E_{\text{final}}$

[10] A particle moves on a circular path. Then under suitable conditions its speed and acceleration may remain constant, but the force, and velocity must always change with time.

[11] If two bodies starting from a point A reach a point B, following different paths, their displacement will be, in general different, but the distances covered will always be the same.

[12] If K is an inertial frame, any frame that moves w.r.t. the frame K with uniform speed is also an inertial frame.

[13] The law of conservation of momentum does not hold in relativistic situations, i.e., where the speeds of the masses involved are close to the speed of light.

[14] The kinetic energy of a body does not change if any one of the following is true
(i)force is always perpendicular to the velocity
(ii) the force is always perpendicular to the acceleration
(iii) the object remains stationary
(iv) the object moves in such a way that the point of application of the force remains fixed.

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[15] These forces are non-real forces but must be taken into account while applying Newton's Law's of Motion in accelerating frame of reference as compared to an inertial frame of reference.

The centrifugal and centripetal forces are examples of pesudo-forces.

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[1] The speed is rate of change of distance and the velocity is the rate of change of displacement.

[2] The angular momentum of a given system of bodies shall remain conserved unless acted upon by an external unbalanced torque.

[3] Law of conservation of angular momentum holds in case of long jump. When a athlete takes off from the ground in a running long jump, the forces on the launching foot give the athlete an angular momentum with a forward rotation around a horizontal axis. Such rotation would not allow the jumper to land properly. In the landing, the legs should be together and extended forward at an angle so that the heels mark the sand at the greatest distance. Once airborne, the angular momentum cannot change (it is conserved) because no external torque acts to change it. However, the jumper can shift most of the angular momentum to the arms by rotating them in windmill fashion. Then the body remains upright in the proper orientation of landing.

[4] For the motion of the Earth around the sun, the total of angular momenta of the Earth and the Sun, about in a reference frame fixed in the pole star, is conserved.

[5] The law of angular momentum of a is not applicable for the conical pendulum conserved w.r.t. the origin fixed at the point of suspension. SetId=311

[6] In the example of skew rod, the angular momentum changes with time and there is a non zero torque coming from action of forces other than gravitational forces. Hence the law of conservation of angular momentum dos not apply.

[7] Law of conservation of momentum does not hold whenever an external force or impulse acts on the system. For example,when a body collides with earth then it bounces back to a lesser height as it loses some velocity.

In this example the momentum of a ball is not conserved due to impulsive force by ground in the normal direction.

However, strictly speaking the system that should be considered here is the ball-earth system and the total momentum is conserved.

[8] In order to apply the law of conservation of momentum we must first identify the system. Then even if there is no *net external forces* acting on the system, all the three conservation laws of momentum, angular momentum and energy may not hold due to presence of internal forces.

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[9] A force is said to be non-conservative, if the work done by the force is dependent on the path taken. It could also be defined as a force for which the work done during a cyclic process is non-zero.

[10] When the force is kept constant as function of time, it is possible for a particle to move on a circular path in such a way that its speed remains constant, but the velocity and acceleration must always change with time.

[11] Distance is equal to the length of the path covered. Displacement is the shortest distance between initial and final points.

[12] A frame rotating w.r.t K with uniform angular velocity is also an inertial frame.

[13] when we are in accelerating frame if we observe any collision between two bodies then the law of conservation of momentum does not hold in that frame of reference.

[14] The total work done on a particle is always equal to the change in kinetic energy. SetId=311

[15] When observing our system from a reference frame which is accelerating compared to an inertial frame,in order to make it easier to apply newtons laws, we can apply a pseudo force on all objects in the universe proportional to their mass capable of causing an acceleration equal and opposite to that of our reference frame. Hence serving to in a way "stop"(or make inertial) our reference frame, and making it easier for us to investigate the motion.

This application of pseudo force doesn't change the motion of the object because just as we can choose an arbitrary reference frame, we can choose an arbitrary force to cause the same acceleration in every object in the whole universe without changing the relative motions of objects. (as all motion is truly relative, we will still get correct answers for our investigations.

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ASSIGNMENT-II **Due On : Nov 18, 2014**

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[1] For any type of translational motion of a body, the displacement cannot be zero, where as the distance travelled can be zero. SetId=312

[2] When the net external torque acting on a system about a given axis is zero, the total angular momentum of the system about that axis remains consant.

[3] The total angular momentum of a body remains constant of motion when the net torque of the external forces acting on the body is zero.
In general, we have a system of particles such that the net torque of the external forces on the system, w.r.t. some axes K, is zero, the total angular momentum may not remain conserved, because the torque due to the internal forces may not be zero.

[4] For the motion of the Earth around the sun, the total of angular momenta of the Earth and the Sun, is conserved in every inertial frame of reference; but the angular momentum of the Earth (or of the sun)is not conserved in every inertial frame.

[5] The law of angular momentum of a is not applicable for the conical pendulum conserved when the origin is chosen to be at the pendulum bob itself. SetId=312

[6] In the example of conical pendulum, the z- component of angular momentum does not change. This follows from the angular momentum conservation as there is no external torque.

[7] If a bullet hits a wooden board and gets embedded in the board, the total energy and the total momentum of the bullet and the board are conserved.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then check we should if the laws are applicable or not.

So if there is no *external force* acting on the system all the three quantities, total momentum, total angular momentum, and total kinetic energy will be conserved independent of the nature of forces.

[9] a force is said to be non conservative if work done is dependent on the path of the particle.potential cannot be defined in the case of non conservative forces.work done in closed loop is not equal to zero. SetId=312

[10] It is not possible for a particle to move on a circular path in such a way that its speed and force remains constant, and only the velocity and acceleration may (or may not) always change with time.

[11] Distance is a scalar quantity where as the displacement is a vector quantity.

[12] The Newton's Laws of motion will hold in all frames which are at rest w.r.t. K but do not remain valid in a frame that move with respect to K.

[13] Give an example where law of conservation of momentum does not hold all cases when seen from non inertial frame of references for example when we see two cars collide from a moving bus there momentum is not conserved

[14] A particle is acted upon by a force of constant magnitude which is always perpendicular to the velocity of the particle and the motion of the particle takes place in a plane, Then its kinetic energy, speed, velocity acceleration will not change. SetId=312

[15] Various types of forces in nature can be grouped in four categories:
(a)Gravitational; (b)Electromagnetic; (c)Nuclear; (d)Weak
There are also some non-fundamental forces such as:
(i)Normal reaction on bodies in contact with surfaces , (ii) Friction,(iii) Tension,(iv)Elastic force.

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[1] Displacements, being vector quantity can not compared with, a scalar quantity such as distance.

[2] This law sates that when no net torque of all forces acts on a object or a system of objects then total angular momentum of system is conserved.The angular momentum before an event is equal to angular momentum after that event.mathematically explained by when, net torque=0 ;then, total angular momentum(L)=constant.

[3] An example where law of conservation of angular momentum holds:
The Law of conservation of angular momentum holds in the case of a ballet dancer performing a pirouette.

When the dancer extends her arms outward, the angular velocity of her rotation decreases whereas when she keeps her arms close to her body, the angular velocity increases. This is because her moment of inertia changes as she moves her arms outward and inward. It can be noted that she as a system has no external torque acting upon her.

[4] In the Sun Earth system the angular momentum of the Earth is conserved in every frame of reference

[5] The three components of angular momentum of a conical pendulum is conserved w.r.t. the origin at the position of the center of mass of the pendulum. SetId=313

[6] In the example of conical pendulum, the x and$y$ components of angular momentum change. This follows from the angular momentum conservation as the z components external torque is zero and horizontal components of torque are non zero.

[7] If a bullet hits a wooden board and gets embedded in the board, the total energy of the bullet and the board system is conserved but the total momentum is not conserved.

[8] If we want to apply the conservation laws of momentum, energy and angular momentum, we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *external force* acting on the system, the momentum and angular momentum will be conserved, and depending on the nature of the forces but total energy may or may not be conserved.

[9] Explain Nonconservative Forces:

The forces that depend on the path taken by the particle are called non-conservative forces.

Mechanical energy is not conserved during the action of a non conservative force, instead, it is lost as other forms of enery like heat, light, etc.

Potential energy is not defined for a non-conservative force.

The initial and final kinetic energy in a closed loop is not equal.

The work done by a non conservative force in a closed loop is non zero. In practice, the net work is invariably negative.

Work done by a non conservative force cannot be completely recovered.

For a non conservative force,

$/text(KE)//_f//+(\mathrm{PE})//_f// = (\mathrm{KE})_i+(\mathrm{PE})_i//+//\text{Work Done})//\text{non-conservative force}//$

$\boxed{\text{SetId=313}}$

[10] For a particle moving on circle the acceleration is always constant in magnitude and directed towards the centre of the circle.

[11] Both displacement and distance tell us about the motion of a body but their study does not tell much about the forces on the body

[12] Staying inside a bullet train moving with constant velocity (no jerks etc) an experiment can always be performed which will tell us the numerical velocity of the bullet train

[13] When a tennis ball hits the ground at an oblique angle, the angle of reflection is equal to the angle of incidence. This is a simple consequence of conservation of horizontal component of momentum.

[14] The kinetic energy of a particle is continuously increasing with time, then the angle bewteen the net force and the velocity cannot be greater than or equal to 90^{o} at any time. $\boxed{\text{SetId=313}}$

[15] A force is agency that which changes or tends to change the state of rest or motion of a body.

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[1] Distance depends on the path where as the displacement depends on the end point only.

[2] Statement of Law of Conservation of Angular Momentum:

Differentiating $\vec{L} = \vec{r} \times \vec{p}$ w.r.t, time,

$$\begin{aligned}
\frac{dL}{dt} &= \frac{d\vec{r} \times \vec{p}}{dt} = \frac{d\vec{r}}{dt} \times \vec{p} + \vec{r} \times \frac{d\vec{p}}{dt} = \vec{v} \times (m\vec{v}) + \vec{r} \times \vec{F} \\
&= \vec{r} \times \vec{F} (\because v \times v = 0) \\
&= \vec{\tau}
\end{aligned}$$

here $\vec{\tau}$ represents the net torque acting on a rigid body rotating about a fixed axis.This torque must take into account of all the forces, be it external or internal forces

[3] In case of a skater, who can be considered an isolated system, so no torue will be acting on him/her. When the arms are extended, the moment of inertia is more. When his hands are closely held, the moment of inertia is lesser. Since the angular momentum is same, the angular acceleration changes accordingly.

[4] In the motion of earth around sun, the angular momentum of the earth about an axis passing through the sun and perpendicular to the plane of motion of earth is conserved.

[5] Only the z component of the angular momentum of a conical pendulum is conserved w.r.t. the origin fixed at the point of suspension.

SetId=314

[6] Example where law of conservation of angular momentum does not hold: A disc rotating on a horizontal rough surface will not have a constant angular momentum because there will be a constant torque by frictional force. Hence, its angular momentum will decrease, and the law of conservation of angular momentum does not apply.

[7] If a bullet hits a wooden board and gets embedded in the board, both total energy and the total momentum of the bullet and the board are not conserved.

[8] To apply the conservation laws of momentum, energy and angular momentum, we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *external force* acting on the system, the energy and momentum will be conserved. However, depending on the nature of the system and of the forces, the total angular momentum may not be conserved.

[9] A non conservative force is one where the mechanical energy is not conserved.Here the work done is dependent on the path taken .Different amounts of work need to be done in different paths.Here potential energy would have no meaning as it would keep changing with the path.Here some amount of mechanical energy is lost as sound energy or heat energy and hence is not conserved.

SetId=314

[10] The motion of a bomb dropped from a plane does is not a uniform motion as it follows a parabolic path and not a straight line path.

[11] Displacement is the shortest distance between initial and final points with direction specified.

[12] Staying inside a bullet train moving with constant velocity (no jerks etc) an experiment can always be performed which will tell us the numerical value of the acceleration of the bullet train

[13] when a ball is dropped from a height, it gains momentum down if we consider the ball as our system.This is because the force of gravity acts as an external force.

However, if we change our system and consider earth as a part of our system too, then the momentum remains conserved because the earth gains momentum up.

[14] A heavy body is attached from a spring and is held at point A and is such that the spring is not slack nor is it stretched. It is then released. It goes down upto a point B and then it rises upto point C and executes an oscillatory motion between B and C. During the motion from A to C is first positive (from A to B) and then it is negative from B to A and again remains negative from A to C.

SetId=314

[15] The forces may be of the following two types - *Contact forces* (those that act when bodies are in physical contact) eg. friction, normal reaction, bouyancy etc. and*Action-at-a-distance forces* (those that act when bodies are not in contact) eg. Gravity, electostatic forces, magnetic forces etc. There At the root level, forces are of the following fundamental types :- (a) *Gravitational forces* - weakest of all forces, always attractive
(b) *Electromagnetic forces* - stronger than gravitational forces, can be attractive or repulsive,
(c) *Nuclear forces* - exist at atomic level, have very short range,
(d) *Weak nuclear forces* associated with beta particle emission

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[1] Distance equal to zero implies displacement=0; and Displacement=0 also implies distance = 0

[2] Statement of Law of Conservation of Angular Momentum: For a system of many particles The net torque due all the forces, be it external or internal forces. But as the torque due to all the internal forces cancel out, it sufficient to consider the external forces acting on the system.

[3] Example where law of conservation of angular momentum holds:
Let us assume a student seated on a stool that can rotate freely about a vertical axis. The student has been set into rotation at a modest initial angular speed ω . He holds two dumbbells in his outstretched hands. His angular momentum vector L lies along the vertical rotation axis, pointing upwards. Now he pulls in his arms;this action reduces his rotational inertia from its value I_{initial} to a final value I_{final} because he moves the mass closer to the rotational axis. His rate of rotation increases markedly, from ω_{initial} to ω_{final}. The student can then slow down by extending his arms once more,moving the dumbbells outward. No external torque acts on the system consisting of the student, stool and the dumbbells. Thus the angular momentum of the system about the rotational axis remains constant. $I_{\text{initial}} * \omega_{\text{initial}} = I_{\text{final}} * \omega_{\text{final}}$.

[4] For the motion of earth around sun, the angular momentum of the earth about the center of mass of the sun + earth system and perpendicular to the plane of motion of earth is conserved.

[5] The z component of angular momentum of a conical pendulum is not conserved w.r.t. the origin fixed at the point of suspension; but the x and y components are conserved. SetId=315

[6] Example where law of conservation of angular momentum does not hold:Consider a vertical stick on the ground falling to a horizontal position. During the fall, the conservation of angular momentum applied at the point of rotation on the ground and perpendicular to the plane of the stick is not applicable as, the gravitational force which acts vertically downwards assumed at the centre of mass produces an external torque about the axis of rotation

[7] There are certain situations where it appears that the law of conservation of linear momentum does not hold. For example if we take some amount of a substance like construction putty, cement, cake batter, playing dough,etc and drop it on the ground, it does not bounce back like a rubber ball would and hence the momentum it had before striking the ground seems to have been lost. Hence it appears that the law of conservation of linear momentum does not hold.

[8] In order to apply the law of conservation of momentum we must first identify the system. If there is no *external forces* acting on the system then conservation laws of momentum always holds. And depending on the nature of the system and of the forces, the total kinetic energy and the total angular momentum may not be conserved.

[9] The force whose work depends on path taken is called a non conservative force.friction for example does less work on a book dragged across a table if the book is dragged straight across than if the book is dragged in a curved path.

SetId=315

[10] A wagon sliding on a roller coaster designed in such a way that the wagon covers equal distances in equal times. As the motion of the wagon is uniform, there will be no net force acting on it.

[11] Displacements, being vector quantity can not compared with, a scalar quantity such as distance.

[12] Assume bullet train, moving with out any jerks, is going on a circular arc of radius R with constant speed. Then an experiment is to be performed entirely within the train without any measurement on objects outside the train. Such an experiment can tell only radius of the track.

[13] There is no known exception to the law of conservation of momentum in classical mechanics however when two bodies collide and their mass converts to energy, an exception in nuclear physics is observed. In real life this is observed in nuclear reactions at atomic level.

[14] The kinetic energy of a body does not change if any one of the following is true
(i)force is always perpendicular to the velocity
(ii) the force is always perpendicular to the acceleration
(iii) the object remains stationary
(iv) the object moves in such a way that the point of application of the force remains fixed.

SetId=315

[15] The main differences between force and pseudo force are -
(1) Forces have a real presence while pseudo forces don't.
(2) Forces can be accounted for by Newton's laws.
(3) Pseudo forces are only taken into account when the reference frame is accelerated.

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[1] If P and Q are the initial and the final points of a path of a particle, displacement is a vector whose direction is along PQ and has magnitude is equal to the length of line PQ

SetId=316

[2] Depending on the torques acting on a system, the angular momentum can be conserved only in one or two directions, but may not be conserved in all. For instance, if an isolated body has no torque acting on it only in the direction along the Z axis, then the angular momentum is conserved only in that direction.

[3] A bob is attached to ceiling by a string and moves in a horizontal circular plane is an example. In this case the law of conservation of angular momentum does not hold.

[4] In the Sun Earth system the angular momentum of the Earth about the pole star is conserved

[5] Only the z component of angular momentum of a conical pendulum is conserved w.r.t. the origin fixed at the point of suspension. SetId=316

[6] We have a conical pendulum .The forces acting on the bob are tension (along the direction of the string) and gravitational force acting in the vertically downward direction.we have an additional force called the drag force which is tangential to the motion of the bob and acts in the direction opposite to the motion of the bob.The axis of rotation passes through the hinge point and is vertical.The torque due to tension is 0 because the force passes through the axis of rotation.The torque due to mg is also zero since it is parallel to the axis of rotation.but the torque due to drag force is not zero.since the net external torque acting on the bob is not zero,therefore the law of conservation of angular momentum does not hold here

[7] A tennis ball is dropped from height h and after hitting the ground and it bounces back and rises to the same height. In this case the momentum of the ball is conserved because (under ideal conditions) the momentum after it hits the ground will be equal to the momentum it had before hitting the ground.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then check if the laws is applicable or not.

So if there is no *net external force* acting on the system all the three conservation laws will hold.

SetId=316

[9] ** Nonconservative force is a force in which the amount of work done by the force is dependent of the path taken to change a state of a system.

[10] A simple pendulum moves along a circular arc and does not have constant speed and therefore its motion is not uniform.

[11] Distance depends on the path where as the displacement depends on the end point only

[12] Assume bullet train, moving with out any jerks, is going on a circular arc of radius R with constant speed. Then an experiment is to be performed entirely within the train without any measurement on objects outside the train. Such an experiment can tell both speed of the train and radius of the track.

[13] When there is no external forces act on a system of many particles, and there are only internal forces acting on the particles. The third law gives that the internal forces are pairwise equal and opposite.Thus the sum of internal forces is zero and the momentum of each particle is conserved.

[14] The total work done on a particle is always equal to the change in kinetic energy. $\boxed{\text{SetId=316}}$

[15] A force is any interaction which tends to change the motion of an object. It is also *defined* as rate of change of momentum. It is a vector quantity.

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[1] If P and Q are the initial and the final points of a path of a particle,the displacement is the vector $\overrightarrow{PQ}$.

[2] According to Law of Conservation of Angular momentum,if no external torque acts on an object or system of objects,angular momentum of an object or system of objects remains CONSTANT or no change in angular momentum can occur.

Also it states that,only external torque can change angular momentm of the system where as the torque produced by internal forces can not change the angular momentum of the system

[3] Consider a disc rotating about an axis perpendicular to its plane. On placing a smaller disc with its surface parallel to the surface of the rotating disc, the angular momentum of the system of two discs remains constant as there is no external torque.

[4] For the motion of earth around sun, the angular momentum of the sun about the center of mass of the sun + earth system and perpendicular to the orbital plane of earth is conserved.

For the motion of earth around sun, the angular momentum of the sun about and axis passing through the Earth and perpendicular to the orbital plane of motion of earth is conserved.

[5] The projection of angular momentum of a conical pendulum in the horizontal plane is a constant of motion when the origin is chosen to be at fixed at the point of suspension. SetId=317

[6] When you release a toy gyroscope on its pedestal, it initially has no precessional rotation around that pedestal, i.e, the orientation of rotation is fixed. However, it instantaneously starts precessing around the pedestal. Both Kinetic Energy and Angular Momentum now exist where they did not exist a moment earlier. The Kinetic Energy is easy to explain, as appearing due to the body of the gyroscope dropping a tiny fraction of a millimeter in the Earth's gravitational field, giving up exactly the correct amount of Potential Energy. But the Angular Momentum of the Precession which just appeared, does not come from anywhere. This is therefore a Violation of the Conservation of Angular Momentum.

[7] Law of conservation of momentum does not hold when Newton's laws are not valid, e.g. in a non-inertial frame of reference. For example, when we consider collision between two bodies in a non-inertial frame of reference, the law of conservation of momentum cannot be applied because there will be a pseudo force acting on the frame itself.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then check we should if the laws are applicable or not.

So if there is no *external force* acting on the system all the three quantities, total momentum is conserved. The total angular momentum is also because the torque of internal forces will be zero. The conservation of energy depends on the nature of forces. will be conserved.

[9] Nonconservative force is any force where the work done by the force on the object depends on the path of motion of the object.the work done by the frictional force results in to loss of the energy of the system in the form of heat or other form of energy.

SetId=317

[10] A satellite goes around the earth in a circular orbit of 600km with a time period of $5.8 \times 10^3 s$. Its motion will be uniform as it will cover equal distances in equal times.

[11] Distance equal to zero $\Rightarrow$ displacement=0; but Displacement=0

[12] Assume bullet train, moving with out any jerks, is going on a circular arc of radius R with constant speed. Then an experiment is to be performed entirely within the train without any measurement on objects outside the train. Such an experiment can tell only speed of the track.

[13] During collision of billiard balls momentum is conserved. During explosion of a bomb also momentum is conserved and the total momentum of the fragments of bomb will be zero. This is because all the forces are only internal forces.

[14] A particle is acted upon by a force of constant magnitude which is always perpendicular to the velocity of the particle and the motion of the particle takes place in a plane, Then its kinetic energy, speed, velocity acceleration will not change. SetId=317

[15] Explain Pseudo Force: While applying Newton's laws of motion in non-inertial frame of reference it gives answers which contradict observations. Thus, to account for this,using Newton's Laws, we introduce a "fake" or pseudo force which gives answers that match the observations in a non-inertial frame.

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[1] If two bodies starting from a point A reach a point B, following different paths, their displacement will be, in general different, but the distances covered will always be the same.

[2] The law of conservation of angular momentum states that when the net external torque acting on the system is zero, then the angular momentum of the system remains constant.both the initial and final momentum should be taken from a fixed inertial frame of reference provided.

[3] Consider a man standing on a spinning platform. Initially, the man spreads out his arms and he spins with a certain angular velocity. The next moment, he pulls his arms inwards keeping them close to his body. We will observe that the angular velocity with which he is spinning now increases. This phenomenon can be explained by the Law Of Conservation of Angular momentum. Initially, since his arms were spread wide, his moment of inertia was large. However, when he pulled them close to his body, his moment of inertia decreased.
In this example the angular velocity of the man increases and therefore the angular momentum also increases.The law of conservation of angular momentum does not apply because the torque of muscular forces is not zero.

[4] For the motion of earth around sun, the sum of angular momenta of the Sun and the Earth about the center of mass of the sun + earth system is conserved.

[5] The law of angular momentum of a is not applicable for the conical pendulum conserved w.r.t. the origin fixed at the point of suspension. SetId=318

[6] There is no case where LAW OF CONSERVATION OF ANGULAR MOMENTUM does'nt hold.But there are cases where conservation of angular momentum does not hold.A body in vertical circular motion is an example where angular momentum is not conserved. Here the law of conservation does not apply.

[7] If I throw a ball upward, it's speed decreases as it rises upwards. There is an external force (gravity) acting on the ball, so the momentum conservation law does not apply. Momentum of the ball is not conserved, however the momentum of the Earth-ball system is conserved as gravity will become an internal force in this case.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *net external force* acting on the system, the momentum is conserved. The definition of angular momentum and torque depends on the choice of axes, and therefore it may not be be conserved. The conservation of total energy holds only for conservative forces.

When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *net external force* acting on the system, the energy and momentum will be conserved. However, the total angular momentum may not be conserved because the torque may not be zero.

[9] nonconservative force is any force ,where the work done by the force depends on the path of motion of the body.The work done by such a force is equal to the change in mechanical energy of the system.Energy mostly observed to be lost in form of heat, by the action of non conservative force.

SetId=318

[10] A uniform motion is defined to be the one in which a body covers equal distances in equal time intervals.

[11] If P and Q are the initial and the final points of a path of a particle, displacement is a vector whose direction is along PQ and has magnitude is equal to the length of line PQ

[12] A particle is observed from two frames S_1 and S_2. The frame S_2 moves with respect to S_1 with an acceleration a. If F_1 and F_2 be the pseudoforces when seen from S_1 and S_2 respectively it is not possible to have $F_1 = F_2 = 0$

[13] Give an example where law of conservation of momentum holds: A mass exploding into several pieces in a conservative field like gravitational field(if air resistance is neglected), obeys law of conservation of momentum. If air resistance cannot be neglected then the law of conservation of momentum will not hold.

[14] The kinetic energy of a particle is continuously increasing with time, then the angle bewteen the net force and the velocity cannot be greater than or equal to 90° at any time.

SetId=318

[15] When a train is at rest and a ball is hung from the ceiling with a string, an observer in the train sees that the string is vertical. But when the train starts moving, the observer sees that the string makes an angle with the vertical and is tilted in forward direction . This means that some force other than gravity and tension must act on the ball. That force is the pseudo force.

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[1] Displacement is equal to the vector difference $\vec{r}_f - \vec{r}_i$ of the position vectors of initial and final points. The distance covered will be $|\vec{r}_f - \vec{r}_i|$

[2] The law of conservation of angular momentum states that The total angular momentum of a system is constant in both magnitude and direction if the resultant torque, of the external forces acting on the system, is zero.

[3] In the Sun-Earth system, angular momentum of the earth is not conserved but the total angular momentum of the sun and the earth is constant of motion.

[4] For the motion of the Earth around the sun, the total of angular momenta of the Earth and the Sun, about in a reference frame fixed in the pole star, is conserved.

[5] The law of angular momentum of a is not applicable for the conical pendulum conserved when the origin is chosen to be at the pendulum bob itself. SetId=319

[6] A sphere rolling on a rough surface.Due to friction there is external torque so the angular momentum changes which results in the slowing of the sphere. The angular momentum keeps changing. Even in case like this one, it is wrong to say that the Law of Angular Momentum Conservation does not hold.

[7] A soldier accelerating away, after detonating a bomb, will find that the total momentum of the fragments of the bomb is zero. This is an example where the law of conservation of momentum holds as the forces on the fragments are internal forces only and sum of all such forces is zero.

[8] In order to apply the law of conservation of momentum we must first identify the system. If there is no *net external forces* acting on the system then conservation laws of momentum always holds. The total energy and the total angular momentum may not be conserved.

[9] The work done by a "non-conservative" force does depend on the path taken. Non-conservative forces cannot be associated with a potential energy. If some of the internal forces of a system are non-conservative, the mechanical energy of the system is not constant.Work-energy theorem is valid even in the presence of some non-conservative forces.

SetId=319

[10] A particle moves on a circular path. Then its speed, direction of force, velocity and acceleration must always change with time.

[11] If P and Q are the initial and the final points of a path of a particle,the displacement is the vector $\overrightarrow{PQ}$.

[12] A particle is observed from two frames S_1 and S_2. The frame S_2 moves with respect to S_1 with an acceleration a. If F_1 and F_2 be the pseudoforces when seen from S_1 and S_2 respectively and if $F_1 = 0$ then we must have $F_2 \neq 0$

[13] Also a good example of law of conservation momentum can be seen when a bullet from a rifle is fired.As the bullet is fired and gets out of the rifle, the rifle gives a backward jerk due to the phenomenon of conservation of momentum.

[14] A heavy body is attached from a spring and is held at point A and is such that the spring is not slack nor is it stretched. It is then released. It goes down upto a point B and then it rises upto point C and executes an oscillatory motion between B and C. During the motion from A to C is first positive (from A to B) and then it is negative from B to A and again remains negative from A to C. SetId=319

[15] Since newton's laws are not valid in non-inertial frames, pseudoforces (which do not exist in reality) are used to help us formualate and use Newton's laws of motion in non-inertial frames.

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[1] Distance is equal to the length of the path covered. Displacement is the shortest distance between initial and final points.

[2] If the net external torque acting on a system is zero,the angular momentum L(vector) of the system remains constant,no matter what changes take place within the system.L(vector)=a constant (net external torque acting on system is zero)

[3] Consider a disc and a man system. man is standing on center of the disc rotating with angular velocity.initially man folded his hand.when man stretches his hands then momentum of inertia of system increases.and angular velocity decreases.and total angular momentum remains constant.

[4] For the motion of the Earth around the sun, the total of angular momenta of the Earth and the Sun, is conserved in every inertial frame of reference; but the angular momentum of the Earth (or of the sun)is not conserved in every inertial frame.

[5] The three components of angular momentum of a conical pendulum is conserved w.r.t. the origin at the position of the center of mass of the pendulum. SetId=320

[6] Consider a rod of length l. Let us give an impulse to one end . Now the angular momentum about the oposite end is not zero since the impulse provides some torque . So the angular momentum is not conserved .

$$\text{torque} = \text{impulse} * \ell.$$

$d\ell/dt$ is not equal to zero and the law of conservation of angular momentum does not hold.

[7] There is no known exception to the law of conservation of momentum in classical mechanics However, an exception to conservation of energy in nuclear physics is observed. In nuclear reactions when two nuclei collide and their mass converts to energy and energy momentum are not conserved.

[8] In order to apply the law of conservation of momentum we must first identify the system. Then even if there is no *net external forces* acting on the system, all the three conservation laws of momentum, angular momentum and energy may not hold due to presence of internal forces.

[9] Non conservative forces are forces with the property that the work done by the force in moving a particle between two points is dependent on the path taken.Also the work done over a closed loop is not zero.Defining of scalar potential is not possible in case of non conservative forces because the change in potential energy between two points will depend on path taken.

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[10] A particle moves on a circular path. Then its speed, direction offorce, can remain constant by velocity and acceleration must always change with time.

[11] If two bodies starting from a point A reach a point B, following different paths, their displacement will be, in general different, but the distances covered will always be the same.

[12] If K is an inertial frame, any frame that moves w.r.t. the frame K with uniform velocity is also an inertial frame.

[13] when a man walks on the ice slab where friction does not exist between the ice block and the floor but between the feet of the man and the slab the slab moves back as per the law of conservation of momentum

[14] The kinetic energy of a body does not change if any one of the following is true
(i)force is always perpendicular to the velocity
(ii) the force is always perpendicular to the acceleration
(iii) the object remains stationary
(iv) the object moves in such a way that the point of application of the force remains fixed. SetId=320

[15] Force is defined as the rate of change of linear momentum. In other words it is the agency which changes or tends to change the (a) State of rest; (b)State of uniform motion (c) Direction of body's motion; (d) Shape of the body

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[1] Distance is a scalar quantity where as the displacement is a vector quantity.

[2] The Law of conservation of angular momentum states that when no external torque acts on an object or a closed system of objects undergoing motion about a given axis, the change in angular momentum is zero. Therefore, considering an event where only internal torque or no torque is involved, the total angular momentum of the system before the event is equal to the total angular momentum after the event

[3] The conservation of angular momentum of a system of bodies requires that the the sum of torque due to all forces be equal to zero. Now consider a situation where the forces are such that the sum of torques of external forces is zero w.r.t. some axes K. Since the value of torque depends of the choices of axes, the sum of torques due to all internal forces will depend on the choice of axes and in general it will be non zero. Therefore, for a system of several bodies, for a given choice of axes K, there will be situations when the total angular momentum may not be conserved.

[4] In the Sun Earth system the angular momentum of the Earth is conserved in every frame of reference

[5] Only the z component of the angular momentum of a conical pendulum is conserved w.r.t. the origin fixed at the point of suspension. SetId=321

[6] Let us consider a rotating skew rod. In the absence of friction or any other drag force, the rod should continuously spin without stopping. Here the net torque about the axis of rotation is 0 and hence angular momentum is conserved. It therefore follows from law of conservation of angular momentum that a spinning skew rod will keep rotating with constant angular velocity if there is no external torque. So law of conservation of angular momentum does not hold.

[7] In a system of a canon and a canon ball, total momentum of the system is zero before canon ball is fired. After firing the canon ball, the momentum of the system seems to be conserved as the ball moves forward and the canon moves backward.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then check we should if the laws are applicable or not.

So if there is no *external force* acting on the system all the three quantities, total momentum, total angular momentum, and total kinetic energy will be conserved independent of the nature of forces.

[9] A non conservative force is the force with the property that the work done in moving a particle between two points is dependent of the path taken.If a particle travels in a closed path, the net work done(the some of the forces acting along the path multiplied

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by the distance travelled) by a non conservative force is non zero. When an object moves from one location to another, the force changes the potential energy of the object by an amount that depends on the path taken.Non conservative force depends only on the path followed by the object.

[10] A particle moves on a circular path. Then under suitable conditions its speed may remain constant, but the force, velocity and acceleration must always change with time.

[11] Distance is equal to the length of the path covered. Displacement is the shortest distance between initial and final points.

[12] If K is an inertial frame, any frame that moves w.r.t. the frame K with uniform speed is also an inertial frame.

[13] When a freely falling rigid body collides another body in its path momentum the system of two particles is not conserved in the collision as there is external force mg acting on the system.

[14] The total work done on a particle is always equal to the change in kinetic energy. SetId=321

[15] Real forces have their origin in matter such as electricity, gravitation etc., while pseudo forces are caused by inertial motion.

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[1] The speed is rate of change of distance and the velocity is the rate of change of displacement.

[2] The law of conservation of angular momentum states that when no external torque acts on an object or a closed system of objects, no change of angular momentum can occur. Hence, the angular momentum before an event involving only internal torques or no torques is equal to the angular momentum after the event . Angular momentum can be calculated with the help of the formula $L = I\omega$ where L stands for Angular momentum, I stands for moment of inertia and ω stands for angular velocity

[3] Example where law of conservation of angular momentum does not hold:
When there is external force like frictional force acting on a object when it is rotating we cannot use conservation of angular momentum as the friction force acting on the object produces an external torque.

[4] In the motion of earth around sun, the angular momentum of the earth about an axis passing through the sun and perpendicular to the plane of motion of earth is conserved.

[5] The z component of angular momentum of a conical pendulum is not conserved w.r.t. the origin fixed at the point of suspension; but the x and y components are conserved.

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[6] In the example of skew rod the angular velocity does not change even though the torque applied is nonzero. However there is no contradiction as in this case the law of conservation of momentum is not applicable. conservation is violated.

[7] When applying the conservation laws of momentum, energy and angular momentum we must define the system first.Only then check if the laws is applicable or not.

As an example: when a ball is dropped from a height, it gains momentum down if we consider the ball as our system.This is because the force of gravity acts as an external force.

However, if we change our system and consider earth as a part of our system too, then the momentum remains conserved because the earth gains momentum up.

[8] If we want to apply the conservation laws of momentum, energy and angular momentum, we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *external force* acting on the system, the momentum and angular momentum will be conserved, and depending on the nature of the forces but total energy may or may not be conserved.

[9] In this type of force the work done depends on the path taken by the body.Mechanical energy is not conserved in the system if non conservative force acts on it.

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[10] A particle moves on a circular path. Then under suitable conditions its speed and acceleration may remain constant, but the force, and velocity must always change with time.

[11] Distance is a scalar quantity where as the displacement is a vector quantity.

[12] A frame rotating w.r.t K with uniform angular velocity is also an inertial frame.

[13] If we take some amount of a substance like construction putty, cement, cake batter, playing dough,etc and drop it on the ground, it does not bounce back, like a rubber ball would bounce, and hence the momentum it had before striking the ground seems to have been lost. Hence it appears that the law of conservation of linear momentum does not hold.

[14] A particle is acted upon by a force of constant magnitude which is always perpendicular to the velocity of the particle and the motion of the particle takes place in a plane, Then its kinetic energy, speed, velocity acceleration will not change.

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[15] 1)When we start rolling a body on a rough ground, it stops rolling after certain period because of frictional force.
2)When we leave a body from a certain height, it falls due to the act of gravitational force.

1)When a body is rotating in a circular path due to the centrifugal force which is the pseudo force. 2) When the lift is accelerating upwards, the upwards force felt by passengers a pseudo force.

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[1] For any type of translational motion of a body, the displacement cannot be zero, where as the distance travelled can be zero.

[2] Newton's Second Law of Motion is defined by the expression $F = \frac{dp}{dT}$, where F gives the force vector acting on the system and p gives its momentum vector; in linear motion. A similar expression can be written to describe angular motion, i.e. : $\tau = \frac{dL}{dt}$, where τ is the external torque vector acting on the system, and L is the angular momentum.

If the external torque on the system is zero, then we get the expression as: dL/dt=0. This points out to the fact that, when no external torque is acting on the system, then its angular momentum is constant, no matter what changes occur in the system. This is the Law of Conservation Of Angular Momentum.

[3] A bob attached to a ceiling by a string moving in a horizontal circular plane is an example where the total angular momentum of the bob about the point of suspension is not conserved. This is because the the torque due to the weight of the bob about the point of suspension does not vanish and has non zero horizontal component. Only the vertical component of the angular component is conserved.

[4] For the motion of earth around sun, the angular momentum of the earth about the center of mass of the sun + earth system and perpendicular to the plane of motion of earth is conserved.

[5] Only the z component of angular momentum of a conical pendulum is conserved w.r.t. the origin fixed at the point of suspension. SetId=323

[6] Example where law of conservation of angular momentum does not hold:If a particle undergoes conical motion and the only force acting on particle is central force like tension of the string.Then total external torque about fixed point A is zero,yet angular momentum is not conserved,as angular momentum keeps on changing direction.

[7] Statement: Law of Conservation of energy states that "ENERGY CAN NEITHER BE CREATED NOR DESTROYED",but it can be changed from one form to other.

EXPLANATION: Statement implies that the total amount of energy in an isolated system remains constant although it may change forms. viz, kinetic energy may change to potential;chemical to electrical energies etc.

[8] To apply the conservation laws of momentum, energy and angular momentum, we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *external force* acting on the system, the energy and momentum will be conserved. However, depending on the nature of the system and of the forces, the total angular momentum may not be conserved.

[9] A force is said to be a non-conservative force if the work done by the force in a closed path is non-zero;(i.e) the cyclic integral of the work done is non-zero.

Work done by a non-conservative force is equal to change in total energy of the system.Work-Energy theorem is not applicable in the case of a non-conservative force.Work done by conservative force depends on the path.It differs with the paths taken by the partical even if the initial and final points are same.In case of non-conservative forces,the total mechanical energy is not constant as the energy is dissipated in various forms such as heat energy,sound energy,etc and cannot be recovered.

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[10] When the force is kept constant as function of time, it is possible for a particle to move on a circular path in such a way that its speed remains constant, but the velocity and acceleration must always change with time.

[11] Both displacement and distance tell us about the motion of a body but their study does not tell much about the forces on the body

[12] The Newton's Laws of motion will hold in all frames which are at rest w.r.t. K but do not remain valid in a frame that move with respect to K.

[13] When we consider collision between two bodies in a non-inertial frame of reference, the law of conservation of momentum cannot be applied because there will be a pseudo force acting on the frame itself.

[14] The kinetic energy of a particle is continuously increasing with time, then the angle bewteen the net force and the velocity cannot be greater than or equal to 90^o at any time.

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[15] Newton's first law defines inertial frame. An inertial frame is a frame in which the first law hold. It also makes it possible to compare and tell two force being equal or not. The second law defines the force.

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[1] Displacements, being vector quantity can not compared with, a scalar quantity such as distance.

[2] If the net external torque acting on a system is zero, the angular momentum L of the system remains constant, no matter what changes take place within the system.

$$\sum(T_{\text{ext}}) = \frac{dL}{dt}$$

The law states that when there is no net external torque, $\frac{dL}{dt}$ is zero implying that the total angular momentum of system is constant.

i.e. $L = a$ constant (isolated system)

[3] Law of conservation of angular momentum holds in case of long jump. When a athlete takes off from the ground in a running long jump, the forces on the launching foot give the athlete an angular momentum with a forward rotation around a horizontal axis. Such rotation would not allow the jumper to land properly. In the landing, the legs should be together and extended forward at an angle so that the heels mark the sand at the greatest distance. Once airborne, the angular momentum cannot change (it is conserved) because no external torque acts to change it. However, the jumper can shift most of the angular momentum to the arms by rotating them in windmill fashion. Then the body remains upright in the proper orientation of landing.

[4] In the Sun Earth system the angular momentum of the Earth about the pole star is conserved

[5] The projection of angular momentum of a conical pendulum in the horizontal plane is a constant of motion when the origin is chosen to be at fixed at the point of suspension. SetId=324

[6] A nonzero torque always causes the angular velocity to change, because a change in angular momentum means a change in angular velocity $L = I\omega$

[7] Oscillating simple pendulum is a very good example where potential energy gets converted to kinetic energy and kinetic to potential energy. Some energy gets dissipated as heat if we consider air resistance. Energy as a whole is conserved if we consider universe as system, the energy has just changed its form.

[8] In order to apply the law of conservation of momentum we must first identify the system. If there is no *external forces* acting on the system then conservation laws of momentum always holds. And depending on the nature of the system and of the forces, the total kinetic energy and the total angular momentum may not be conserved.

[9] A non conservative force is a force where work done in moving a particle between two points depends on the path through which it is taken.Friction is an example of non conservative force.Mechanical energy is not conserved in case of a non conservative force

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[10] It is not possible for a particle to move on a circular path in such a way that its speed and force remains constant, and only the velocity and acceleration may (or may not) always change with time.

[11] Displacement is the shortest distance between initial and final points with direction specified.

[12] Staying inside a bullet train moving with constant velocity (no jerks etc) an experiment can always be performed which will tell us the numerical velocity of the bullet train

[13] When a system is acted upon by external forces like friction etc, the conservation principle does not hold good,there will be impulse imparted and so we cant conserve momentum. This is case when a collision between two elastic balls take place on a rough horizontal table. The total momentum just after the collision will be different from the total momentum just before the collision. Here momentum is not conserved as there is external force friction is present.

[14] A heavy body is attached from a spring and is held at point A and is such that the spring is not slack nor is it stretched. It is then released. It goes down upto a point B and then it rises upto point C and executes an oscillatory motion between B and C. During the motion from A to C is first positive (from A to B) and then it is negative from B to A and again remains negative from A to C. SetId=324

[15] The magnitude of the pseudo force arising in a non-inertial frame is always equal to the mass of the body under consideration multiplied by the acceleration of the frame of reference and the direction of pseudoforce is always opposite to the direction of acceleration of the frame.

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[1] Distance depends on the path where as the displacement depends on the end point only.

[2] When the net external torque acting on a body or a system of bodies is zero about a particular axis, then the angular momentum of each body is conserved about that axis.

[3] The total angular momentum of a body remains constant of motion when the net torque of the external forces acting on the body is zero.
In general, we have a system of particles such that the net torque of the external forces on the system, w.r.t. some axes K, is zero, the total angular momentum may not remain conserved, because the torque due to the internal forces may not be zero.

[4] For the motion of earth around sun, the angular momentum of the sun about the center of mass of the sun + earth system and perpendicular to the orbital plane of earth is conserved.

For the motion of earth around sun, the angular momentum of the sun about and axis passing through the Earth and perpendicular to the orbital plane of motion of earth is conserved.

[5] The law of angular momentum of a is not applicable for the conical pendulum conserved w.r.t. the origin fixed at the point of suspension. SetId=325

[6] A nonzero torque always implies change in angular momentum and may not give rise to a change in magnitude of angular velocity. A non zero torque may mean change only the direction of the angular momentum and not the angular velocity.

[7] Law of conservation of momentum does not hold whenever an external force or impulse acts on the system. For example,when a body collides with earth then it bounces back to a lesser height as it loses some velocity.

In this example the momentum of a ball is not conserved due to impulsive force by ground in the normal direction.

However, strictly speaking the system that should be considered here is the ball-earth system and the total momentum is conserved.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then check if the laws is applicable or not.

So if there is no *net external force* acting on the system all the three conservation laws will hold.

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[9] A force:A force is said to be a *non-//**conservative force* if the*/ work done by it in a closed path is/*/ non-zero./For such forces,potential energy cannot be defined.

[10] For a particle moving on circle the acceleration is always constant in magnitude and directed towards the centre of the circle.

[11] Displacements, being vector quantity can not compared with, a scalar quantity such as distance.

[12] Staying inside a bullet train moving with constant velocity (no jerks etc) an experiment can always be performed which will tell us the numerical value of the acceleration of the bullet train

[13] When we are in accelerating frame if we observe any collision between two bodies then the law of conservation of momentum does not hold in that frame of reference. On the other hand the law of conservation of momentum holds in all inertial frames.

[14] The kinetic energy of a body does not change if any one of the following is true
(i)force is always perpendicular to the velocity
(ii) the force is always perpendicular to the acceleration
(iii) the object remains stationary
(iv) the object moves in such a way that the point of application of the force remains fixed. SetId=325

[15] A force is any interaction which tends to change the motion of an object. It is also *defined* as rate of change of momentum.It is a vector quantity.
A physically apparent but nonexistent force felt by an observer in a noninertial frame (that is, a frame undergoing acceleration).

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[1] Distance equal to zero implies displacement=0; and Displacement=0 also implies distance = 0

[2] The law of conservation of angular momentum states that in absence of an external torque on an object or a closed system of objects the total angular momentum of the system remains constant. Thus if $\vec{\tau} = 0 => \vec{L} =$ constant where τ is the torque and $\vec{L}$ is the angular momentum of the system.

[3] An example where law of conservation of angular momentum holds:
The Law of conservation of angular momentum holds in the case of a ballet dancer performing a pirouette.

When the dancer extends her arms outward, the angular velocity of her rotation decreases whereas when she keeps her arms close to her body, the angular velocity increases. This is because her moment of inertia changes as she moves her arms outward and inward. It can be noted that she as a system has no external torque acting upon her.

[4] For the motion of earth around sun, the sum of angular momenta of the Sun and the Earth about the center of mass of the sun + earth system is conserved.

[5] The law of angular momentum of a is not applicable for the conical pendulum conserved when the origin is chosen to be at the pendulum bob itself. SetId=326

[6] In the example of a rotating skew rod the torque due to the external gravitational forces is zero , but the angular momentum is not constant Therefore the law of conservation of angular momentum is violated.

[7] If a bullet hits a wooden board and gets embedded in the board, the total energy and the total momentum of the bullet and the board are conserved.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then check we should if the laws are applicable or not.

So if there is no *external force* acting on the system all the three quantities, total momentum is conserved. The total angular momentum is also because the torque of internal forces will be zero. The conservation of energy depends on the nature of forces. will be conserved.

[9] A force that is not conservative is nonconservative force. The work done by a noconservative force cannot be represented by a potential energy function. That is work done by a nonconservative force is dependent on the path through which the system is moved. Some nonconservative forces cause the mechanical energy to be lost or dissipiated. Such forces are called dissipiative forces. There is no way to get back

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the lost mechanical energy. Nonconservative forces can also increase the mechanical energy. This is arrived from the concept of irreversible process.

[10] The motion of a bomb dropped from a plane does is not a uniform motion as it follows a parabolic path and not a straight line path.

[11] Distance depends on the path where as the displacement depends on the end point only

[12] Assume bullet train, moving with out any jerks, is going on a circular arc of radius R with constant speed. Then an experiment is to be performed entirely within the train without any measurement on objects outside the train. Such an experiment can tell only radius of the track.

[13] When a freely falling body hits another rigid body in its path then momentum is not conserved as external force mg acts on both the bodies. The total momentum after the collision will be different from the total momentum before the hit.

[14] The total work done on a particle is always equal to the change in kinetic energy. SetId=326

[15] Psuedo Force is defined as an apparent force that acts in only non-inertial frames. Pseudo Forces are also called Fictitious Forces. It is an Imaginary force. It is independent of mass.

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[1] If P and Q are the initial and the final points of a path of a particle, displacement is a vector whose direction is along PQ and has magnitude is equal to the length of line PQ

[2] If no net external torque acts on a system, the total angular momentum of the system remains constant.

[3] In case of a skater, who can be considered an isolated system, so no torue will be acting on him/her. When the arms are extended, the moment of inertia is more. When his hands are closely held, the moment of inertia is lesser. Since the angular momentum is same, the angular acceleration changes accordingly.

[4] For the motion of the Earth around the sun, the total of angular momenta of the Earth and the Sun, about in a reference frame fixed in the pole star, is conserved.

[5] The three components of angular momentum of a conical pendulum is conserved w.r.t. the origin at the position of the center of mass of the pendulum. SetId=327

[6] In the example of skew rod, the angular momentum changes with time and there is a non zero torque coming from action of forces other than gravitational forces. Hence the law of conservation of angular momentum dos not apply.

[7] If a bullet hits a wooden board and gets embedded in the board, the total energy of the bullet and the board system is conserved but the total momentum is not conserved.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *net external force* acting on the system, the momentum is conserved. The definition of angular momentum and torque depends on the choice of axes, and therefore it may not be be conserved. The conservation of total energy holds only for conservative forces.

When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *net external force* acting on the system, the energy and momentum will be conserved. However, the total angular momentum may not be conserved because the torque may not be zero.

[9] Nonconservative forces are forces, such that the work done by these forces are path dependent. Work done by these forces around a close path is not necessarily equal to zero. Hence if a particle is acted on by a non-conservative force and that particle

returns to its original position, that particle will experience a net loss of energy. Energy will thus not be conserved for particle. Potential Energy can not be defined for these type of forces. SetId=327

[10] A wagon sliding on a roller coaster designed in such a way that the wagon covers equal distances in equal times. As the motion of the wagon is uniform, there will be no net force acting on it.

[11] Distance equal to zero $\Rightarrow$ displacement=0; but Displacement=0

[12] Assume bullet train, moving with out any jerks, is going on a circular arc of radius R with constant speed. Then an experiment is to be performed entirely within the train without any measurement on objects outside the train. Such an experiment can tell both speed of the train and radius of the track.

[13] .The law of conservation of momentum does not hold good when net external forces acting on the system is not zero.when two bodies collide law of conservation of momentum is applicable on system of two bodies but on not individual bodies because external impulse acts on them.

[14] A particle is acted upon by a force of constant magnitude which is always perpendicular to the velocity of the particle and the motion of the particle takes place in a plane, Then its kinetic energy, speed, velocity acceleration will not change. SetId=327

[15] Psuedo Force is defined as an apparent force that acts in only non-inertial frames. Pseudo Forces are also called Fictious Forces. It is an Imaginary force. It is always proportional to mass. It is sometimes dependent on speed.

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[1] If P and Q are the initial and the final points of a path of a particle,the displacement is the vector $\overrightarrow{PQ}$.

[2] The law of conservation of angular momentum states that when no external torque is applied on an object or a closed system of objects about an axis, the angular momentum about that axis remains constant.

[3] Example where law of conservation of angular momentum holds:
Let us assume a student seated on a stool that can rotate freely about a vertical axis. The student has been set into rotation at a modest initial angular speed ω . He holds two dumbbells in his outstretched hands. His angular momentum vector L lies along the vertical rotation axis, pointing upwards. Now he pulls in his arms;this action reduces his rotational inertia from its value I_{initial} to a final value I_{final} because he moves the mass closer to the rotational axis. His rate of rotation increases markedly, from ω_{initial} to ω_{final}. The student can then slow down by extending his arms once more,moving the dumbbells outward. No external torque acts on the system consisting of the student, stool and the dumbbells. Thus the angular momentum of the system about the rotational axis remains constant. $I_{\text{initial}} * \omega_{\text{initial}} = I_{\text{final}} * \omega_{\text{final}}$.

[4] For the motion of the Earth around the sun, the total of angular momenta of the Earth and the Sun, is conserved in every inertial frame of reference; but the angular momentum of the Earth (or of the sun)is not conserved in every inertial frame.

[5] Only the z component of the angular momentum of a conical pendulum is conserved w.r.t. the origin fixed at the point of suspension. SetId=328

[6] In the example of conical pendulum, the z- component of angular momentum does not change. This follows from the angular momentum conservation as there is no external torque.

[7] If a bullet hits a wooden board and gets embedded in the board, both total energy and the total momentum of the bullet and the board are not conserved.

[8] In order to apply the law of conservation of momentum we must first identify the system. If there is no *net external forces* acting on the system then conservation laws of momentum always holds. The total energy and the total angular momentum may not be conserved.

[9] Non Conservative force is a force with the property that workdone in moving an object from one point to another is dependent on the path taken .

Non Conservative Force can arise in classical physics due to neglected degrees of freedom or time dependent potentials.

Friction may be treated without resorting the use of non conservative forces by considering the motion of individual molecules.

SetId=328

[10] A simple pendulum moves along a circular arc and does not have constant speed and therefore its motion is not uniform.

[11] If P and Q are the initial and the final points of a path of a particle, displacement is a vector whose direction is along PQ and has magnitude is equal to the length of line PQ

[12] Assume bullet train, moving with out any jerks, is going on a circular arc of radius R with constant speed. Then an experiment is to be performed entirely within the train without any measurement on objects outside the train. Such an experiment can tell only speed of the track.

[13] A block moving in the air breaks up into two parts and the parts separate, then the total momentum must be the same before and after the break.

[14] The kinetic energy of a particle is continuously increasing with time, then the angle bewteen the net force and the velocity cannot be greater than or equal to 90° at any time.

SetId=328

[15] Since pseudo forces are not real forces, they do not affect the conservation laws and all the three conservation laws hold in noninertial frames.

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[1] If two bodies starting from a point A reach a point B, following different paths, their displacement will be, in general different, but the distances covered will always be the same.

SetId=329

[2] The angular momentum of a given system of bodies shall remain conserved unless acted upon by an external unbalanced torque.

[3] A bob is attached to ceiling by a string and moves in a horizontal circular plane is an example. In this case the law of conservation of angular momentum does not hold.

[4] In the Sun Earth system the angular momentum of the Earth is conserved in every frame of reference

[5] The z component of angular momentum of a conical pendulum is not conserved w.r.t. the origin fixed at the point of suspension; but the x and y components are conserved.

SetId=329

[6] In the example of conical pendulum, the x and$y$ components of angular momentum change. This follows from the angular momentum conservation as the z components external torque is zero and horizontal components of torque are non zero.

[7] There are certain situations where it appears that the law of conservation of linear momentum does not hold. For example if we take some amount of a substance like construction putty, cement, cake batter, playing dough,etc and drop it on the ground, it does not bounce back like a rubber ball would and hence the momentum it had before striking the ground seems to have been lost. Hence it appears that the law of conservation of linear momentum does not hold.

[8] In order to apply the law of conservation of momentum we must first identify the system. Then even if there is no *net external forces* acting on the system, all the three conservation laws of momentum, angular momentum and energy may not hold due to presence of internal forces.

[9] A non-conservative force is a force with the property that the work done in moving a particle between two points is dependent of the path taken . Mostly the enery of the particle in a non conservative force field dissipates in the form of heat or sound . Since the lost energy cannot be bought back ,conservation of mechanical energy does not hold true .

SetId=329

[10] A satellite goes around the earth in a circular orbit of 600km with a time period of $5.8 \times 10^3 s$. Its motion will be uniform as it will cover equal distances in equal times.

[11] If P and Q are the initial and the final points of a path of a particle,the displacement is the vector $\overrightarrow{PQ}$.

[12] A particle is observed from two frames S_1 and S_2. The frame S_2 moves with respect to S_1 with an acceleration a. If F_1 and F_2 be the pseudoforces when seen from S_1 and S_2 respectively it is not possible to have $F_1 = F_2 = 0$

[13] A ball hits the floor and rebounds after an inelastic collision. In this case the total momentum of the ball before and after the collsion is conserved. Also the total enrgy of the ball and the earth remains the same

[14] A heavy body is attached from a spring and is held at point A and is such that the spring is not slack nor is it stretched. It is then released. It goes down upto a point B and then it rises upto point C and executes an oscillatory motion between B and C. During the motion from A to C is first positive (from A to B) and then it is negative from B to A and again remains negative from A to C. SetId=329

[15] A force is any interaction which tends to change the motion of an object. Newtons' second tell us that it is *equal* to the rate of change of momentum.It is a vector quantity. Real forces can be distinguished from pseudo forces because the pseudo forces always proportional to the mass of the body. All real forces, except the gravitational force, do not depend on the mass of the body.

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[1] Displacement is equal to the vector difference $\vec{r}_f - \vec{r}_i$ of the position vectors of initial and final points. The distance covered will be $|\vec{r}_f - \vec{r}_i|$

[2] When the net external torque acting on a system about a given axis is zero, the total angular momentum of the system about that axis remains consant.

[3] Consider a disc rotating about an axis perpendicular to its plane. On placing a smaller disc with its surface parallel to the surface of the rotating disc, the angular momentum of the system of two discs remains constant as there is no external torque.

[4] In the motion of earth around sun, the angular momentum of the earth about an axis passing through the sun and perpendicular to the plane of motion of earth is conserved.

[5] Only the z component of angular momentum of a conical pendulum is conserved w.r.t. the origin fixed at the point of suspension.

SetId=330

[6] Example where law of conservation of angular momentum does not hold: A disc rotating on a horizontal rough surface will not have a constant angular momentum because there will be a constant torque by frictional force. Hence, its angular momentum will decrease, and the law of conservation of angular momentum does not apply.

[7] A tennis ball is dropped from height h and after hitting the ground and it bounces back and rises to the same height. In this case the momentum of the ball is conserved because (under ideal conditions) the momentum after it hits the ground will be equal to the momentum it had before hitting the ground.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then check we should if the laws are applicable or not.

So if there is no *external force* acting on the system all the three quantities, total momentum, total angular momentum, and total kinetic energy will be conserved independent of the nature of forces.

[9] If the work done by a force depends on the path followed by the particle, it is called a Non conservative force. Work done by a non conservative force is not zero in round trip.

SetId=330

[10] A uniform motion is defined to be the one in which a body covers equal distances in equal time intervals.

[11] If two bodies starting from a point A reach a point B, following different paths, their displacement will be, in general different, but the distances covered will always be the same.

[12] A particle is observed from two frames S_1 and S_2. The frame S_2 moves with respect to S_1 with an acceleration a. If F_1 and F_2 be the pseudoforces when seen from S_1 and S_2 respectively and if $F_1 = 0$ then we must have $F_2 \neq 0$

[13] In a head on elastic collision of two identical bodies of equal masses the velocities, the speeds, the momenta and the kinetic energy are all exchanged.

[14] The kinetic energy of a body does not change if any one of the following is true
(i)force is always perpendicular to the velocity
(ii) the force is always perpendicular to the acceleration
(iii) the object remains stationary
(iv) the object moves in such a way that the point of application of the force remains fixed. SetId=330

[15] Examples of pseudoforce are Coriolis Force, Centrifugal Force, and magnetic force on currents.
Psuedo force also called as fictitious force is an apparent force that are needed for masses whose their motion is described using a non inertial frame of reference.

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SetId=331

[1] Distance is equal to the length of the path covered. Displacement is the shortest distance between initial and final points.

[2] This law sates that when no net torque of all forces acts on a object or a system of objects then total angular momentum of system is conserved.The angular momentum before an event is equal to angular momentum after that event.mathematically explained by when, net torque=0 ;then, total angular momentum(L)=constant.

[3] Consider a man standing on a spinning platform. Initially, the man spreads out his arms and he spins with a certain angular velocity. The next moment, he pulls his arms inwards keeping them close to his body. We will observe that the angular velocity with which he is spinning now increases. This phenomenon can be explained by the Law Of Conservation of Angular momentum. Initially, since his arms were spread wide, his moment of inertia was large. However, when he pulled them close to his body, his moment of inertia decreased.
In this example the angular velocity of the man increases and therefore the angular momentum also increases.The law of conservation of angular momentum does not apply because the torque of muscular forces is not zero.

[4] For the motion of earth around sun, the angular momentum of the earth about the center of mass of the sun + earth system and perpendicular to the plane of motion of earth is conserved.

[5] The projection of angular momentum of a conical pendulum in the horizontal plane is a constant of motion when the origin is chosen to be at fixed at the point of suspension. SetId=331

[6] Example where law of conservation of angular momentum does not hold:Consider a vertical stick on the ground falling to a horizontal position. During the fall, the conservation of angular momentum applied at the point of rotation on the ground and perpendicular to the plane of the stick is not applicable as, the gravitational force which acts vertically downwards assumed at the centre of mass produces an external torque about the axis of rotation

[7] Law of conservation of momentum does not hold when Newton's laws are not valid, e.g. in a non-inertial frame of reference. For example, when we consider collision between two bodies in a non-inertial frame of reference, the law of conservation of momentum cannot be applied because there will be a pseudo force acting on the frame itself.

[8] If we want to apply the conservation laws of momentum, energy and angular momentum, we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *external force* acting on the system, the momentum and angular momentum will be conserved, and depending on the nature of the forces but total energy may or may not be conserved.

SetId=331

[9] The workdone by a non conservative force is dependant on its path. the work varies as the path varies.

[10] A particle moves on a circular path. Then its speed, direction of force, velocity and acceleration must always change with time.

[11] Distance is equal to the length of the path covered. Displacement is the shortest distance between initial and final points.

[12] If K is an inertial frame, any frame that moves w.r.t. the frame K with uniform velocity is also an inertial frame.

[13] For a system of several particles the conservation of total linear momentum is equivalent to the statement that their centre of mass moves like a free particle.

[14] The total work done on a particle is always equal to the change in kinetic energy. SetId=331

[15] Examples of pseudo-force are Coriolis Force, Centrifugal Force, Centripetal force and magnetic force on currents. The pseudo forces do not obey Newton's third law and therefore the total momentum does not appear to be conserved in a non-inertial frame.

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SetId=332 [1] Distance is a scalar quantity where as the displacement is a vector quantity.

[2] Statement of Law of Conservation of Angular Momentum:
Differentiating $\vec{L} = \vec{r} \times \vec{p}$ w.r.t, time,

$$\begin{aligned} \frac{dL}{dt} &= \frac{d\vec{r} \times \vec{p}}{dt} = \frac{d\vec{r}}{dt} \times \vec{p} + \vec{r} \times \frac{d\vec{p}}{dt} = \vec{v} \times (m\vec{v}) + \vec{r} \times \vec{F} \\ &= \vec{r} \times \vec{F} (\because v \times v = 0) \\ &= \vec{\tau} \end{aligned}$$

here $\vec{\tau}$ represents the net torque acting on a rigid body rotating about a fixed axis.This torque must take into account of all the forces, be it external or internal forces

[3] In the Sun-Earth system, angular momentum of the earth is not conserved but the total angular momentum of the sun and the earth is constant of motion.

[4] In the Sun Earth system the angular momentum of the Earth about the pole star is conserved

[5] The law of angular momentum of a is not applicable for the conical pendulum conserved w.r.t. the origin fixed at the point of suspension. SetId=332

[6] We have a conical pendulum .The forces acting on the bob are tension (along the direction of the string) and gravitational force acting in the vertically downward direction.we have an additional force called the drag force which is tangential to the motion of the bob and acts in the direction opposite to the motion of the bob.The axis of rotation passes through the hinge point and is vertical.The torque due to tension is 0 because the force passes through the axis of rotation.The torque due to mg is also zero since it is parallel to the axis of rotation.but the torque due to drag force is not zero.since the net external torque acting on the bob is not zero,therefore the law of conservation of angular momentum does not hold here

[7] If I throw a ball upward, it's speed decreases as it rises upwards. There is an external force (gravity) acting on the ball, so the momentum conservation law does not apply. Momentum of the ball is not conserved, however the momentum of the Earth-ball system is conserved as gravity will become an internal force in this case.

[8] To apply the conservation laws of momentum, energy and angular momentum, we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *external force* acting on the system, the energy and momentum will be conserved. However, depending on the nature of the system and of the forces, the total angular momentum may not be conserved.

SetId=332

[9] A non conservative force is a force with the property that the work done in moving a particle between two points is dependent on the path followed.

[10] A particle moves on a circular path. Then its speed, direction offorce, can remain constant by velocity and acceleration must always change with time.

[11] Distance is a scalar quantity where as the displacement is a vector quantity.

[12] If K is an inertial frame, any frame that moves w.r.t. the frame K with uniform speed is also an inertial frame.

[13] The total mechanical energy of a system may not be conserved if there are no external forces and the internal forces are conservative.

[14] A particle is acted upon by a force of constant magnitude which is always perpendicular to the velocity of the particle and the motion of the particle takes place in a plane, Then its kinetic energy, speed, velocity acceleration will not change. SetId=332

[15] FORCE is any interaction which tends to change the motion of an object.It has both magnitude and direction,making it a vector quantity.

A psuedo force is an apparent force that acts on all masses whose motion is described with respect to a non-inertial frame of reference like a rotating frame of reference.This force is needed by an observer in an non-inertial frame to make all the Newtons Laws of motion hold true.

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[1] The speed is rate of change of distance and the velocity is the rate of change of displacement.

[2] Statement of Law of Conservation of Angular Momentum: For a system of many particles The net torque due all the forces, be it external or internal forces. But as the torque due to all the internal forces cancel out, it sufficient to consider the external forces acting on the system.

[3] Consider a disc and a man system. man is standing on center of the disc rotating with angular velocity.initially man folded his hand.when man stretches his hands then momentum of inertia of system increases.and angular velocity decreases.and total angular momentum remains constant.

[4] For the motion of earth around sun, the angular momentum of the sun about the center of mass of the sun + earth system and perpendicular to the orbital plane of earth is conserved.

For the motion of earth around sun, the angular momentum of the sun about and axis passing through the Earth and perpendicular to the orbital plane of motion of earth is conserved.

[5] The law of angular momentum of a is not applicable for the conical pendulum conserved when the origin is chosen to be at the pendulum bob itself. SetId=333

[6] When you release a toy gyroscope on its pedestal, it initially has no precessional rotation around that pedestal, i.e, the orientation of rotation is fixed. However, it instantaneously starts precessing around the pedestal. Both Kinetic Energy and Angular Momentum now exist where they did not exist a moment earlier. The Kinetic Energy is easy to explain, as appearing due to the body of the gyroscope dropping a tiny fraction of a millimeter in the Earth's gravitational field, giving up exactly the correct amount of Potential Energy. But the Angular Momentum of the Precession which just appeared, does not come from anywhere. This is therefore a Violation of the Conservation of Angular Momentum.

[7] A soldier accelerating away, after detonating a bomb, will find that the total momentum of the fragments of the bomb is zero. This is an example where the law of conservation of momentum holds as the forces on the fragments are internal forces only and sum of all such forces is zero.

[8] In order to apply the law of conservation of momentum we must first identify the system. If there is no *external forces* acting on the system then conservation laws of momentum always holds. And depending on the nature of the system and of the forces, the total kinetic energy and the total angular momentum may not be conserved.

[9] A non conservative force is a force with the property that the work done in moving a particle between two points is dependent of the taken path.

Friction, for example, does less work on a book dragged across a table if the book is dragged straight across than if the book is dragged in a curved path.

To write the equation for conservation of energy for non conservative forces we need to include the work done by the non conservative force also.This is because forces like friction liberate heat which are not included in the mechanical energy.

SetId=333

[10] A particle moves on a circular path. Then under suitable conditions its speed may remain constant, but the force, velocity and acceleration must always change with time.

[11] Both displacement and distance tell us about the motion of a body but their study does not tell much about the forces on the body

[12] A frame rotating w.r.t K with uniform angular velocity is also an inertial frame.

[13] When a bullet fired on a wooden block, some energy is transferred to the block and the total mechanical energy of the block and the bullet is conserved.

[14] The kinetic energy of a particle is continuously increasing with time, then the angle bewteen the net force and the velocity cannot be greater than or equal to 90^o at any time.

SetId=333

[15] FORCE is any interaction which tends to change the motion of an object.It has both magnitude and direction,making it a vector quantity. A pseudo-force F doesn't arise from any physical interaction between two objects, but rather from the acceleration 'a' of the non-inertial reference frame itself. These forces have no real existence but must be taken into account in an accelerating frame of reference to make all the three Newton's Laws of motion applicable to the system

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[1] For any type of translational motion of a body, the displacement cannot be zero, where as the distance travelled can be zero.

[2] Depending on the torques acting on a system, the angular momentum can be conserved only in one or two directions, but may not be conserved in all. For instance, if an isolated body has no torque acting on it only in the direction along the Z axis, then the angular momentum is conserved only in that direction.

[3] The conservation of angular momentum of a system of bodies requires that the the sum of torque due to all forces be equal to zero. Now consider a situation where the forces are such that the sum of torques of external forces is zero w.r.t. some axes K. Since the value of torque depends of the choices of axes, the sum of torques due to all internal forces will depend on the choice of axes and in general it will be non zero. Therefore, for a system of several bodies, for a given choice of axes K, there will be situations when the total angular momentum may not be conserved.

[4] For the motion of earth around sun, the sum of angular momenta of the Sun and the Earth about the center of mass of the sun + earth system is conserved.

[5] The three components of angular momentum of a conical pendulum is conserved w.r.t. the origin at the position of the center of mass of the pendulum. SetId=334

[6] There is no case where LAW OF CONSERVATION OF ANGULAR MOMENTUM does'nt hold.But there are cases where conservation of angular momentum does not hold.A body in vertical circular motion is an example where angular momentum is not conserved. Here the law of conservation does not apply.

[7] There is no known exception to the law of conservation of momentum in classical mechanics However, an exception to conservation of energy in nuclear physics is observed. In nuclear reactions when two nuclei collide and their mass converts to energy and energy momentum are not conserved.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then check if the laws is applicable or not.

So if there is no *net external force* acting on the system all the three conservation laws will hold.

[9] A non conservative force is a force with the property that the work done in moving a particle between two points is dependent of the taken path.

Friction, for example, does less work on a book dragged across a table if the book is dragged straight across than if the book is dragged in a curved path.

To write the equation for conservation of energy for nonconservative forces we need toinclude the work done by the non conservative force also.This is because forces like friction liberate heat which are not included in the mechanical energy.

SetId=334

[10] A particle moves on a circular path. Then under suitable conditions its speed and acceleration may remain constant, but the force, and velocity must always change with time.

[11] Displacement is the shortest distance between initial and final points with direction specified.

[12] The Newton's Laws of motion will hold in all frames which are at rest w.r.t. K but do not remain valid in a frame that move with respect to K.

[13] When a moving car hits a parked lorry and causes the parked lorry to move ,energy is transferred from moving the car to the lorry and the total energy of the lorry and the car is conserved.

[14] A heavy body is attached from a spring and is held at point A and is such that the spring is not slack nor is it stretched. It is then released. It goes down upto a point B and then it rises upto point C and executes an oscillatory motion between B and C. During the motion from A to C is first positive (from A to B) and then it is negative from B to A and again remains negative from A to C. SetId=334

[15] FORCE is any interaction which tends to change the motion of an object.It has both magnitude and direction,making it a vector quantity.
A pseudo-force results from acceleration of the frame of reference in which the objects reside. It is taken into account so that Newton's second law isn't invalidated. The pseudo force acting on an object can always be mathematically expressed as the product of the mass of the object and the acceleration of the frame of reference.

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[1] Displacements, being vector quantity can not compared with, a scalar quantity such as distance.

[2] According to Law of Conservation of Angular momentum,if no external torque acts on an object or system of objects,angular momentum of an object or system of objects remains CONSTANT or no change in angular momentum can occur.

Also it states that,only external torque can change angular momentm of the system where as the torque produced by internal forces can not change the angular momentum of the system

[3] Example where law of conservation of angular momentum does not hold:
When there is external force like frictional force acting on a object when it is rotating we cannot use conservation of angular momentum as the friction force acting on the object produces an external torque.

[4] For the motion of the Earth around the sun, the total of angular momenta of the Earth and the Sun, about in a reference frame fixed in the pole star, is conserved.

[5] Only the z component of the angular momentum of a conical pendulum is conserved w.r.t. the origin fixed at the point of suspension. SetId=335

[6] A sphere rolling on a rough surface.Due to friction there is external torque so the angular momentum changes which results in the slowing of the sphere. The angular momentum keeps changing. Even in case like this one, it is wrong to say that the Law of Angular Momentum Conservation does not hold.

[7] In a system of a canon and a canon ball, total momentum of the system is zero before canon ball is fired. After firing the canon ball, the momentum of the system seems to be conserved as the ball moves forward and the canon moves backward.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then check we should if the laws are applicable or not.

So if there is no *external force* acting on the system all the three quantities, total momentum is conserved. The total angular momentum is also because the torque of internal forces will be zero. The conservation of energy depends on the nature of forces. will be conserved.

[9] The non conservative force is a force with a property thet the work done between two points depends on path taken. If a particle moves along a curve path, to know about the work done by a non conservative force we should have the equation of the path along which the particle had move.The work done would be

WORK = INTEGRAL (F.dx)

The equation of conservation of mechanical energy for a non conservative force would be

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$$KE_{\text{final}} + PE_{final} = KE_{initial} + PE_{initial} + W_{nc}$$

[10] When the force is kept constant as function of time, it is possible for a particle to move on a circular path in such a way that its speed remains constant, but the velocity and acceleration must always change with time.

[11] Displacements, being vector quantity can not compared with, a scalar quantity such as distance.

[12] Staying inside a bullet train moving with constant velocity (no jerks etc) an experiment can always be performed which will tell us the numerical velocity of the bullet train

[13] When a bomb explodes the total mechanical energy is not conserved. But the total chemical energy and the mechanical energy is conserved.

[14] The kinetic energy of a body does not change if any one of the following is true
(i)force is always perpendicular to the velocity
(ii) the force is always perpendicular to the acceleration
(iii) the object remains stationary
(iv) the object moves in such a way that the point of application of the force remains fixed. SetId=335

[15] Explain Force:FORCE is any interaction which tends to change the motion of an object.It has both magnitude and direction,making it a vector quantity.
In the case of a non inertial frame, we can use the second law of motion by adding a pseudo force to the system which makes it an inertial frame of reference.

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[1] Distance depends on the path where as the displacement depends on the end point only.

[2] The law of conservation of angular momentum states that when the net external torque acting on the system is zero, then the angular momentum of the system remains constant.both the initial and final momentum should be taken from a fixed inertial frame of reference provided.

[3] A bob attached to a ceiling by a string moving in a horizontal circular plane is an example where the total angular momentum of the bob about the point of suspension is not conserved. This is because the the torque due to the weight of the bob about the point of suspension does not vanish and has non zero horizontal component. Only the vertical component of the angular component is conserved.

[4] For the motion of the Earth around the sun, the total of angular momenta of the Earth and the Sun, is conserved in every inertial frame of reference; but the angular momentum of the Earth (or of the sun)is not conserved in every inertial frame.

[5] The z component of angular momentum of a conical pendulum is not conserved w.r.t. the origin fixed at the point of suspension; but the x and y components are conserved. SetId=336

[6] Consider a rod of length l. Let us give an impulse to one end . Now the angular momentum about the oposite end is not zero since the impulse provides some torque . So the angular momentum is not conserved .

$$\text{torque} = \text{impulse} * \ell.$$

$d\ell/dt$ is not equal to zero and the law of conservation of angular momentum does not hold.

[7] When applying the conservation laws of momentum, energy and angular momentum we must define the system first.Only then check if the laws is applicable or not.

As an example: when a ball is dropped from a height, it gains momentum down if we consider the ball as our system.This is because the force of gravity acts as an external force.

However, if we change our system and consider earth as a part of our system too, then the momentum remains conserved because the earth gains momentum up.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *net external force* acting on the system, the momentum is conserved. The definition of angular momentum and torque depends on the choice of axes, and therefore it may not be be conserved. The conservation of total energy holds only for conservative forces.

When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *net external force* acting on the system, the energy and momentum will be conserved. However, the total angular momentum may not be conserved because the torque may not be zero.

[9] Nonconservative forces arise due to neglected degrees of freedom or from time dependent potentials. The work done by a nonconservative force depends upon the path taken. It causes a change in the mechanical energy of the system. It adds or removes mechanical energy from a system.

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[10] It is not possible for a particle to move on a circular path in such a way that its speed and force remains constant, and only the velocity and acceleration may (or may not) always change with time.

[11] Distance depends on the path where as the displacement depends on the end point only

[12] Staying inside a bullet train moving with constant velocity (no jerks etc) an experiment can always be performed which will tell us the numerical value of the acceleration of the bullet train

[13] When a ball rolls over a rough surface, it comes to stop after some time. This is because transational and rotational kinetic energy initially present in the ball continuosly gets converted to heat due to friction. When all the kinetic energy changes to heat, the ball stops. The total mechanical energy of the ball is not conserved.

[14] The total work done on a particle is always equal to the change in kinetic energy. SetId=336

[15] For the Newton's Law of Motion to hold true,the physically apparent but nonexistent force needed by an observer in a non-inertial frame is called the pseudo force.
1) Caused by relative acceleration of the origin in a straight line
2) Centrifugal and Centripetal forces
3) Coriolis force
4) Euler force

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[1] Distance equal to zero implies displacement=0; and Displacement=0 also implies distance = 0

[2] The law of conservation of angular momentum states that The total angular momentum of a system is constant in both magnitude and direction if the resultant torque, of the external forces acting on the system, is zero.

[3] Law of conservation of angular momentum holds in case of long jump. When a athlete takes off from the ground in a running long jump, the forces on the launching foot give the athlete an angular momentum with a forward rotation around a horizontal axis. Such rotation would not allow the jumper to land properly. In the landing, the legs should be together and extended forward at an angle so that the heels mark the sand at the greatest distance. Once airborne, the angular momentum cannot change (it is conserved) because no external torque acts to change it. However, the jumper can shift most of the angular momentum to the arms by rotating them in windmill fashion. Then the body remains upright in the proper orientation of landing.

[4] In the Sun Earth system the angular momentum of the Earth is conserved in every frame of reference

[5] Only the z component of angular momentum of a conical pendulum is conserved w.r.t. the origin fixed at the point of suspension. SetId=337

[6] Let us consider a rotating skew rod. In the absence of friction or any other drag force, the rod should continuously spin without stopping. Here the net torque about the axis of rotation is 0 and hence angular momentum is conserved. It therefore follows from law of conservation of angular momentum that a spinning skew rod will keep rotating with constant angular velocity if there is no external torque. So law of conservation of angular momentum does not hold.

[7] Statement: Law of Conservation of energy states that "ENERGY CAN NEITHER BE CREATED NOR DESTROYED",but it can be changed from one form to other.

EXPLANATION: Statement implies that the total amount of energy in an isolated system remains constant although it may change forms. viz, kinetic energy may change to potential;chemical to electrical energies etc.

[8] In order to apply the law of conservation of momentum we must first identify the system. If there is no *net external forces* acting on the system then conservation laws of momentum always holds. The total energy and the total angular momentum may not be conserved.

[9] The work done by a *Nonconservative Force *is not recoverable*.*The work done by a *Non Conservative force* is usually dissipated in the form of Heat and Sound.

SetId=337

Non conservative force *cannot* be expressed in the form of *Potential Energy*.

[10] For a particle moving on circle the acceleration is always constant in magnitude and directed towards the centre of the circle.

[11] Distance equal to zero $\Rightarrow$ displacement=0; but Displacement=0

[12] Assume bullet train, moving with out any jerks, is going on a circular arc of radius R with constant speed. Then an experiment is to be performed entirely within the train without any measurement on objects outside the train. Such an experiment can tell only radius of the track.

[13] Let us consider that a pendulum is oscillating moving in a vertical plane. Mean while let another bob which is attached to a spring and is executing a simple harmonic motion in horizontal direction comes and hits the pendulum. Here conservation of momentum does not hold good as tension(external force) is acting on the system.(pendulum)

[14] A particle is acted upon by a force of constant magnitude which is always perpendicular to the velocity of the particle and the motion of the particle takes place in a plane, Then its kinetic energy, speed, velocity acceleration will not change. SetId=337

[15] A force is any interaction which tends to change the motion of an object. It is also *defined* as rate of change of momentum.It is a vector quantity.

Pseudo-force is a fictitious force it is taken by an observer from non inertial frame of reference. This force arises from acceleration of reference frame that is a reference frame which is accelerating or rotating.

The equation of motion is then written by balancing all forces. As an example a particle moving in a circle is seen to be at rest by balancing the centripetal and centrifugal forces.

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[1] If P and Q are the initial and the final points of a path of a particle, displacement is a vector whose direction is along PQ and has magnitude is equal to the length of line PQ

[2] If the net external torque acting on a system is zero,the angular momentum L(vector) of the system remains constant,no matter what changes take place within the system.L(vector)=a constant (net external torque acting on system is zero)

[3] The total angular momentum of a body remains constant of motion when the net torque of the external forces acting on the body is zero.
In general, we have a system of particles such that the net torque of the external forces on the system, w.r.t. some axes K, is zero, the total angular momentum may not remain conserved, because the torque due to the internal forces may not be zero.

[4] In the motion of earth around sun, the angular momentum of the earth about an axis passing through the sun and perpendicular to the plane of motion of earth is conserved.

[5] The projection of angular momentum of a conical pendulum in the horizontal plane is a constant of motion when the origin is chosen to be at fixed at the point of suspension.

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[6] In the example of skew rod the angular velocity does not change even though the torque applied is nonzero. However there is no contradiction as in this case the law of conservation of momentum is not applicable. conservation is violated.

[7] Oscillating simple pendulum is a very good example where potential energy gets converted to kinetic energy and kinetic to potential energy. Some energy gets dissipated as heat if we consider air resistance. Energy as a whole is conserved if we consider universe as system, the energy has just changed its form.

[8] In order to apply the law of conservation of momentum we must first identify the system. Then even if there is no *net external forces* acting on the system, all the three conservation laws of momentum, angular momentum and energy may not hold due to presence of internal forces.

[9] * A non conservative force is a force that acts on a particle(or point), such that the work done by this force in moving this particle from one point to another is */dependent of path taken/* that is the work done depends on the path itself. * For example frictional force is non conservative because the work done by friction always acts in the direction of travel and therefore depends on length L of the path taken.

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[10] The motion of a bomb dropped from a plane does is not a uniform motion as it follows a parabolic path and not a straight line path.

[11] If P and Q are the initial and the final points of a path of a particle, displacement is a vector whose direction is along PQ and has magnitude is equal to the length of line PQ

[12] Assume bullet train, moving with out any jerks, is going on a circular arc of radius R with constant speed. Then an experiment is to be performed entirely within the train without any measurement on objects outside the train. Such an experiment can tell both speed of the train and radius of the track.

[13] The law of conservation of momentum does not hold in relativistic situations, i.e., where the speeds of the masses involved are close to the speed of light.

[14] The kinetic energy of a particle is continuously increasing with time, then the angle bewteen the net force and the velocity cannot be greater than or equal to 90^o at any time. SetId=338

[15] A psuedo force is an apparent force that acts on all masses whose motion is described with respect to a non-inertial frame of reference like a rotating frame of reference. This force is needed by an observer in an non-inertial frame to make all the Newtons second laws to write correct equation of motion..

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SetId=339

[1] If P and Q are the initial and the final points of a path of a particle,the displacement is the vector $\overrightarrow{PQ}$.

[2] The Law of conservation of angular momentum states that when no external torque acts on an object or a closed system of objects undergoing motion about a given axis, the change in angular momentum is zero. Therefore, considering an event where only internal torque or no torque is involved, the total angular momentum of the system before the event is equal to the total angular momentum after the event

[3] An example where law of conservation of angular momentum holds:
The Law of conservation of angular momentum holds in the case of a ballet dancer performing a pirouette.

When the dancer extends her arms outward, the angular velocity of her rotation decreases whereas when she keeps her arms close to her body, the angular velocity increases. This is because her moment of inertia changes as she moves her arms outward and inward. It can be noted that she as a system has no external torque acting upon her.

[4] For the motion of earth around sun, the angular momentum of the earth about the center of mass of the sun + earth system and perpendicular to the plane of motion of earth is conserved.

[5] The law of angular momentum of a is not applicable for the conical pendulum conserved w.r.t. the origin fixed at the point of suspension.

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[6] Example where law of conservation of angular momentum does not hold:If a particle undergoes conical motion and the only force acting on particle is central force like tension of the string.Then total external torque about fixed point A is zero,yet angular momentum is not conserved,as angular momentum keeps on changing direction.

[7] Law of conservation of momentum does not hold whenever an external force or impulse acts on the system. For example,when a body collides with earth then it bounces back to a lesser height as it loses some velocity.

In this example the momentum of a ball is not conserved due to impulsive force by ground in the normal direction.

However, strictly speaking the system that should be considered here is the ball-earth system and the total momentum is conserved.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then check we should if the laws are applicable or not.

So if there is no *external force* acting on the system all the three quantities, total momentum, total angular momentum, and total kinetic energy will be conserved independent of the nature of forces.

[9] A force with the property that the work done in moving a particle is dependent on the path followed. The work done by a conservative force in moving a body from an initial location to a final location is dependent on the path taken between the two points

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[10] A wagon sliding on a roller coaster designed in such a way that the wagon covers equal distances in equal times. As the motion of the wagon is uniform, there will be no net force acting on it.

[11] If P and Q are the initial and the final points of a path of a particle,the displacement is the vector $\overrightarrow{PQ}$.

[12] Assume bullet train, moving with out any jerks, is going on a circular arc of radius R with constant speed. Then an experiment is to be performed entirely within the train without any measurement on objects outside the train. Such an experiment can tell only speed of the track.

[13] when we are in accelerating frame if we observe any collision between two bodies then the law of conservation of momentum does not hold in that frame of reference.

[14] A heavy body is attached from a spring and is held at point A and is such that the spring is not slack nor is it stretched. It is then released. It goes down upto a point B and then it rises upto point C and executes an oscillatory motion between B and C. During the motion from A to C is first positive (from A to B) and then it is negative from B to A and again remains negative from A to C. SetId=339

[15] One indication that pseudo forces are NON-NEWTONIAN is that they violate Newton's III law and violate the Newton's third law.

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[1] If two bodies starting from a point A reach a point B, following different paths, their displacement will be, in general different, but the distances covered will always be the same.

[2] The law of conservation of angular momentum states that when no external torque acts on an object or a closed system of objects, no change of angular momentum can occur. Hence, the angular momentum before an event involving only internal torques or no torques is equal to the angular momentum after the event . Angular momentum can be calculated with the help of the formula $L = I\omega$ where L stands for Angular momentum, I stands for moment of inertia and ω stands for angular velocity

[3] In case of a skater, who can be considered an isolated system, so no torue will be acting on him/her. When the arms are extended, the moment of inertia is more. When his hands are closely held, the moment of inertia is lesser. Since the angular momentum is same, the angular acceleration changes accordingly.

[4] In the Sun Earth system the angular momentum of the Earth about the pole star is conserved

[5] The law of angular momentum of a is not applicable for the conical pendulum conserved when the origin is chosen to be at the pendulum bob itself. SetId=340

[6] A nonzero torque always causes the angular velocity to change, because a change in angular momentum means a change in angular velocity $L = I\omega$

[7] If a bullet hits a wooden board and gets embedded in the board, the total energy and the total momentum of the bullet and the board are conserved.

[8] If we want to apply the conservation laws of momentum, energy and angular momentum, we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *external force* acting on the system, the momentum and angular momentum will be conserved, and depending on the nature of the forces but total energy may or may not be conserved.

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[9] The work done by non conservative force is dependent on the path taken by the particle in reaching final position from initial position. Non conservative force depends on the distance travelled by the particle

[10] A simple pendulum moves along a circular arc and does not have constant speed and therefore its motion is not uniform.

[11] If two bodies starting from a point A reach a point B, following different paths, their displacement will be, in general different, but the distances covered will always be the same.

[12] A particle is observed from two frames S_1 and S_2. The frame S_2 moves with respect to S_1 with an acceleration a. If F_1 and F_2 be the pseudoforces when seen from S_1 and S_2 respectively it is not possible to have $F_1 = F_2 = 0$

[13] Give an example where law of conservation of momentum does not hold all cases when seen from non inertial frame of references for example when we see two cars collide from a moving bus there momentum is not conserved

[14] The kinetic energy of a body does not change if any one of the following is true
(i)force is always perpendicular to the velocity
(ii) the force is always perpendicular to the acceleration
(iii) the object remains stationary
(iv) the object moves in such a way that the point of application of the force remains fixed. SetId=340

[15] The apparent force which seems to act on an object in an accelerating frame of reference if we wish to describe the object's motion is called a pseudo force.Its a non-existent force used only to describe the motion completely using Newton's second law even though the agent causing the force is undefined.

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[1] Displacement is equal to the vector difference $\vec{r}_f - \vec{r}_i$ of the position vectors of initial and final points. The distance covered will be $|\vec{r}_f - \vec{r}_i|$

[2] Newton's Second Law of Motion is defined by the expression $F = \frac{dp}{dT}$, where F gives the force vector acting on the system and p gives its momentum vector; in linear motion. A similar expression can be written to describe angular motion, i.e. : $\tau = \frac{dL}{dt}$, where τ is the external torque vector acting on the system, and L is the angular momentum.

If the external torque on the system is zero, then we get the expression as: dL/dt=0. This points out to the fact that, when no external torque is acting on the system, then its angular momentum is constant, no matter what changes occur in the system. This is the Law of Conservation Of Angular Momentum.

[3] Example where law of conservation of angular momentum holds:
Let us assume a student seated on a stool that can rotate freely about a vertical axis. The student has been set into rotation at a modest initial angular speed ω . He holds two dumbbells in his outstretched hands. His angular momentum vector L lies along the vertical rotation axis, pointing upwards. Now he pulls in his arms;this action reduces his rotational inertia from its value I_{initial} to a final value I_{final} because he moves the mass closer to the rotational axis. His rate of rotation increases markedly, from ω_{initial} to ω_{final}. The student can then slow down by extending his arms once more,moving the dumbbells outward. No external torque acts on the system consisting of the student, stool and the dumbbells. Thus the angular momentum of the system about the rotational axis remains constant. $I_{\text{initial}} * \omega_{\text{initial}} = I_{\text{final}} * \omega_{\text{final}}$.

[4] For the motion of earth around sun, the angular momentum of the sun about the center of mass of the sun + earth system and perpendicular to the orbital plane of earth is conserved.

For the motion of earth around sun, the angular momentum of the sun about and axis passing through the Earth and perpendicular to the orbital plane of motion of earth is conserved.

[5] The three components of angular momentum of a conical pendulum is conserved w.r.t. the origin at the position of the center of mass of the pendulum. SetId=341

[6] A nonzero torque always implies change in angular momentum and may not give rise to a change in magnitude of angular velocity. A non zero torque may mean change only the direction of the angular momentum and not the angular velocity.

[7] If a bullet hits a wooden board and gets embedded in the board, the total energy of the bullet and the board system is conserved but the total momentum is not conserved.

[8] To apply the conservation laws of momentum, energy and angular momentum, we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *external force* acting on the system, the energy and momentum will be conserved. However, depending on the nature of the system and of the forces, the total angular momentum may not be conserved.

[9] The work done by non conservative force is dependent on the path taken by the particle in reaching final position from initial position. Non conservative force depends on the distance travelled by the particle

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[10] A satellite goes around the earth in a circular orbit of 600km with a time period of $5.8 \times 10^3 s$. Its motion will be uniform as it will cover equal distances in equal times.

[11] Distance is equal to the length of the path covered. Displacement is the shortest distance between initial and final points.

[12] A particle is observed from two frames S_1 and S_2. The frame S_2 moves with respect to S_1 with an acceleration a. If F_1 and F_2 be the pseudoforces when seen from S_1 and S_2 respectively and if $F_1 = 0$ then we must have $F_2 \neq 0$

[13] When a tennis ball hits the ground at an oblique angle, the angle of reflection is equal to the angle of incidence. This is a simple consequence of conservation of horizontal component of momentum.

[14] The total work done on a particle is always equal to the change in kinetic energy. SetId=341

[15] The physically apparent, but nonexistent, force needed by an observer in a noninertial frame to make Newton's laws of motion hold true is called pseudoforce.

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[1] Distance is equal to the length of the path covered. Displacement is the shortest distance between initial and final points.

[2] If the net external torque acting on a system is zero, the angular momentum L of the system remains constant, no matter what changes take place within the system.

$$\sum(T_{\text{ext}}) = \frac{dL}{dt}$$

The law states that when there is no net external torque, $\frac{dL}{dt}$ is zero implying that the total angular momentum of system is constant.

i.e. $L = a$ constant (isolated system)

[3] A bob is attached to ceiling by a string and moves in a horizontal circular plane is an example. In this case the law of conservation of angular momentum does not hold.

[4] For the motion of earth around sun, the sum of angular momenta of the Sun and the Earth about the center of mass of the sun + earth system is conserved.

[5] Only the z component of the angular momentum of a conical pendulum is conserved w.r.t. the origin fixed at the point of suspension.

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[6] In the example of a rotating skew rod the torque due to the external gravitational forces is zero , but the angular momentum is not constant Therefore the law of conservation of angular momentum is violated.

[7] If a bullet hits a wooden board and gets embedded in the board, both total energy and the total momentum of the bullet and the board are not conserved.

[8] In order to apply the law of conservation of momentum we must first identify the system. If there is no *external forces* acting on the system then conservation laws of momentum always holds. And depending on the nature of the system and of the forces, the total kinetic energy and the total angular momentum may not be conserved.

[9] Nonconservative forces are those forces in which the work done in moving a particle is dependant on the path taken to cover the distance. Some energy woul be lost to the environment in the form of heat, sound, etc. The energy in the final state is less than that in the initial state.

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[10] A uniform motion is defined to be the one in which a body covers equal distances in equal time intervals.

[11] Distance is a scalar quantity where as the displacement is a vector quantity.

[12] If K is an inertial frame, any frame that moves w.r.t. the frame K with uniform velocity is also an inertial frame.

[13] when a ball is dropped from a height, it gains momentum down if we consider the ball as our system.This is because the force of gravity acts as an external force.

However, if we change our system and consider earth as a part of our system too, then the momentum remains conserved because the earth gains momentum up.

[14] A particle is acted upon by a force of constant magnitude which is always perpendicular to the velocity of the particle and the motion of the particle takes place in a plane, Then its kinetic energy, speed, velocity acceleration will not change. SetId=342

[15] Pseudo forces come into picture when Newton's laws of motion have to be applied to describe the motion of bodies in non-inertial frames. These forces have no real existence.

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SetId=343 [1] Distance is a scalar quantity where as the displacement is a vector quantity.

[2] When the net external torque acting on a body or a system of bodies is zero about a particular axis, then the angular momentum of each body is conserved about that axis.

[3] Consider a disc rotating about an axis perpendicular to its plane. On placing a smaller disc with its surface parallel to the surface of the rotating disc, the angular momentum of the system of two discs remains constant as there is no external torque.

[4] For the motion of the Earth around the sun, the total of angular momenta of the Earth and the Sun, about in a reference frame fixed in the pole star, is conserved.

[5] The z component of angular momentum of a conical pendulum is not conserved w.r.t. the origin fixed at the point of suspension; but the x and y components are conserved. SetId=343

[6] In the example of skew rod, the angular momentum changes with time and there is a non zero torque coming from action of forces other than gravitational forces. Hence the law of conservation of angular momentum dos not apply.

[7] There are certain situations where it appears that the law of conservation of linear momentum does not hold. For example if we take some amount of a substance like construction putty, cement, cake batter, playing dough,etc and drop it on the ground, it does not bounce back like a rubber ball would and hence the momentum it had before striking the ground seems to have been lost. Hence it appears that the law of conservation of linear momentum does not hold.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then check if the laws is applicable or not.

So if there is no *net external force* acting on the system all the three conservation laws will hold.

[9] The work done by such forces depends on the path taken. The work done cannot be represented as a potential energy function.Work done by such forces is always
SetId=343 negative.

[10] A particle moves on a circular path. Then its speed, direction of force, velocity and acceleration must always change with time.

[11] Both displacement and distance tell us about the motion of a body but their study does not tell much about the forces on the body

[12] If K is an inertial frame, any frame that moves w.r.t. the frame K with uniform speed is also an inertial frame.

[13] There is no known exception to the law of conservation of momentum in classical mechanics however when two bodies collide and their mass converts to energy, an exception in nuclear physics is observed. In real life this is observed in nuclear reactions at atomic level.

[14] The kinetic energy of a particle is continuously increasing with time, then the angle bewteen the net force and the velocity cannot be greater than or equal to 90^{o} at any time. SetId=343

[15] In a non-inertial frame of reference the accelration of the body that we measure, is not the true acceleration, as the frame itself accelerates.Thus,force(F=ma) is also not the true force acting on the body.The extra force added to make it a true value is called pseudo force.Thus pseudo force does not really act on a body but just compensates the change produced by the non inertial frame, in true acceleration.

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[1] The speed is rate of change of distance and the velocity is the rate of change of displacement.

[2] The law of conservation of angular momentum states that in absence of an external torque on an object or a closed system of objects the total angular momentum of the system remains constant. Thus if $\vec{\tau} = 0 => \vec{L} =$ constant where τ is the torque and $\vec{L}$ is the angular momentum of the system.

[3] Consider a man standing on a spinning platform. Initially, the man spreads out his arms and he spins with a certain angular velocity. The next moment, he pulls his arms inwards keeping them close to his body. We will observe that the angular velocity with which he is spinning now increases. This phenomenon can be explained by the Law Of Conservation of Angular momentum. Initially, since his arms were spread wide, his moment of inertia was large. However, when he pulled them close to his body, his moment of inertia decreased.
In this example the angular velocity of the man increases and therefore the angular momentum also increases.The law of conservation of angular momentum does not apply because the torque of muscular forces is not zero.

[4] For the motion of the Earth around the sun, the total of angular momenta of the Earth and the Sun, is conserved in every inertial frame of reference; but the angular momentum of the Earth (or of the sun)is not conserved in every inertial frame.

[5] Only the z component of angular momentum of a conical pendulum is conserved w.r.t. the origin fixed at the point of suspension. SetId=344

[6] In the example of conical pendulum, the z- component of angular momentum does not change. This follows from the angular momentum conservation as there is no external torque.

[7] A tennis ball is dropped from height h and after hitting the ground and it bounces back and rises to the same height. In this case the momentum of the ball is conserved because (under ideal conditions) the momentum after it hits the ground will be equal to the momentum it had before hitting the ground.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then check we should if the laws are applicable or not.

So if there is no *external force* acting on the system all the three quantities, total momentum is conserved. The total angular momentum is also because the torque of internal forces will be zero. The conservation of energy depends on the nature of forces. will be conserved.

[9] A nonconservative force is a force with the property that the work done in moving a particle depends on the path taken.Also, the net work done in a closed loop is non zero.

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[10] A particle moves on a circular path. Then its speed, direction offorce, can remain constant by velocity and acceleration must always change with time.

[11] Displacement is the shortest distance between initial and final points with direction specified.

[12] A frame rotating w.r.t K with uniform angular velocity is also an inertial frame.

[13] When there is no external forces act on a system of many particles, and there are only internal forces acting on the particles. The third law gives that the internal forces are pairwise equal and opposite.Thus the sum of internal forces is zero and the momentum of each particle is conserved.

[14] A heavy body is attached from a spring and is held at point A and is such that the spring is not slack nor is it stretched. It is then released. It goes down upto a point B and then it rises upto point C and executes an oscillatory motion between B and C. During the motion from A to C is first positive (from A to B) and then it is negative from B to A and again remains negative from A to C.

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[15] A force is any interaction which tends to change the motion of an object. It is *equal to* the rate of change of momentum by Newton's second law.

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[1] For any type of translational motion of a body, the displacement cannot be zero, where as the distance travelled can be zero.

[2] If no net external torque acts on a system, the total angular momentum of the system remains constant.

[3] In the Sun-Earth system, angular momentum of the earth is not conserved but the total angular momentum of the sun and the earth is constant of motion.

[4] In the Sun Earth system the angular momentum of the Earth is conserved in every frame of reference

[5] The projection of angular momentum of a conical pendulum in the horizontal plane is a constant of motion when the origin is chosen to be at fixed at the point of suspension.

SetId=345

[6] In the example of conical pendulum, the x and$y$ components of angular momentum change. This follows from the angular momentum conservation as the z components external torque is zero and horizontal components of torque are non zero.

[7] Law of conservation of momentum does not hold when Newton's laws are not valid, e.g. in a non-inertial frame of reference. For example, when we consider collision between two bodies in a non-inertial frame of reference, the law of conservation of momentum cannot be applied because there will be a pseudo force acting on the frame itself.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *net external force* acting on the system, the momentum is conserved. The definition of angular momentum and torque depends on the choice of axes, and therefore it may not be be conserved. The conservation of total energy holds only for conservative forces.

When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *net external force* acting on the system, the energy and momentum will be conserved. However, the total angular momentum may not be conserved because the torque may not be zero.

[9] A force whose work done is a path function is called a non-conservative force. All the forces which do not satisfy the definition of conservative forces are non-conservative in nature. The work done by these forces dissipates into heat energy, sound energy,

light energy, etc. Therefore, law of conservation of mechanical energy cannot be applied to a system on which a non-conservative force is acting. No potential function can be defined for these forces.

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[10] A particle moves on a circular path. Then under suitable conditions its speed may remain constant, but the force, velocity and acceleration must always change with time.

[11] Displacements, being vector quantity can not compared with, a scalar quantity such as distance.

[12] The Newton's Laws of motion will hold in all frames which are at rest w.r.t. K but do not remain valid in a frame that move with respect to K.

[13] During collision of billiard balls momentum is conserved. During explosion of a bomb also momentum is conserved and the total momentum of the fragments of bomb will be zero. This is because all the forces are only internal forces.

[14] The kinetic energy of a body does not change if any one of the following is true
(i)force is always perpendicular to the velocity
(ii) the force is always perpendicular to the acceleration
(iii) the object remains stationary
(iv) the object moves in such a way that the point of application of the force remains fixed.

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[15] Newton's laws are not valid on non-inertial frame of reference. So to validate Newton's laws of motion pseudo force (fictious or virtual force) is introduced.
Pseudo force acts in non-inertial frame. Its magnitude is always mass of the body multiplied by acceleration of the frame. It is always in direction opposite to the acceleration of the frame of reference. The resultant of pseudo forces and real forces is always zero.

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[1] Displacements, being vector quantity can not compared with, a scalar quantity such as distance.

[2] The law of conservation of angular momentum states that when no external torque is applied on an object or a closed system of objects about an axis, the angular momentum about that axis remains constant.

[3] Consider a disc and a man system. man is standing on center of the disc rotating with angular velocity.initially man folded his hand.when man stretches his hands then momentum of inertia of system increases.and angular velocity decreases.and total angular momentum remains constant.

[4] In the motion of earth around sun, the angular momentum of the earth about an axis passing through the sun and perpendicular to the plane of motion of earth is conserved.

[5] The law of angular momentum of a is not applicable for the conical pendulum conserved w.r.t. the origin fixed at the point of suspension. SetId=346

[6] Example where law of conservation of angular momentum does not hold: A disc rotating on a horizontal rough surface will not have a constant angular momentum because there will be a constant torque by frictional force. Hence, its angular momentum will decrease, and the law of conservation of angular momentum does not apply.

[7] If I throw a ball upward, it's speed decreases as it rises upwards. There is an external force (gravity) acting on the ball, so the momentum conservation law does not apply. Momentum of the ball is not conserved, however the momentum of the Earth-ball system is conserved as gravity will become an internal force in this case.

[8] In order to apply the law of conservation of momentum we must first identify the system. If there is no *net external forces* acting on the system then conservation laws of momentum always holds. The total energy and the total angular momentum may not be conserved.

SetId=346

[9] *Non conservative forces* are the type of forces in which the work done by the forces is purely dependent on the path taken by the body.Thus the net work done by the forces in cyclic path is never equal to zero.

[10] A particle moves on a circular path. Then under suitable conditions its speed and acceleration may remain constant, but the force, and velocity must always change with time.

[11] Distance depends on the path where as the displacement depends on the end point only

[12] Staying inside a bullet train moving with constant velocity (no jerks etc) an experiment can always be performed which will tell us the numerical velocity of the bullet train

[13] Give an example where law of conservation of momentum holds: A mass exploding into several pieces in a conservative field like gravitational field(if air resistance is neglected), obeys law of conservation of momentum. If air resistance cannot be neglected then the law of conservation of momentum will not hold.

[14] The total work done on a particle is always equal to the change in kinetic energy. SetId=346

[15] These forces are non-real forces but must be taken into account while applying Newton's Law's of Motion in accelerating frame of reference as compared to an inertial frame of reference.

The centrifugal and centripetal forces are examples of pesudo-forces.

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[1] Distance depends on the path where as the displacement depends on the end point only.

[2] The angular momentum of a given system of bodies shall remain conserved unless acted upon by an external unbalanced torque.

[3] The conservation of angular momentum of a system of bodies requires that the the sum of torque due to all forces be equal to zero. Now consider a situation where the forces are such that the sum of torques of external forces is zero w.r.t. some axes K. Since the value of torque depends of the choices of axes, the sum of torques due to all internal forces will depend on the choice of axes and in general it will be non zero. Therefore, for a system of several bodies, for a given choice of axes K, there will be situations when the total angular momentum may not be conserved.

[4] For the motion of earth around sun, the angular momentum of the earth about the center of mass of the sun + earth system and perpendicular to the plane of motion of earth is conserved.

[5] The law of angular momentum of a is not applicable for the conical pendulum conserved when the origin is chosen to be at the pendulum bob itself. SetId=347

[6] Example where law of conservation of angular momentum does not hold:Consider a vertical stick on the ground falling to a horizontal position. During the fall, the conservation of angular momentum applied at the point of rotation on the ground and perpendicular to the plane of the stick is not applicable as, the gravitational force which acts vertically downwards assumed at the centre of mass produces an external torque about the axis of rotation

[7] A soldier accelerating away, after detonating a bomb, will find that the total momentum of the fragments of the bomb is zero. This is an example where the law of conservation of momentum holds as the forces on the fragments are internal forces only and sum of all such forces is zero.

[8] In order to apply the law of conservation of momentum we must first identify the system. Then even if there is no *net external forces* acting on the system, all the three conservation laws of momentum, angular momentum and energy may not hold due to presence of internal forces.

[9] Non-conservative forces are path-dependent forces, i.e. the work done on a body by these forces depends on the path taken by the body. Mechanical energy of a system is not conserved when a conservative force acts on it but the total energy is conserved. Therefore, the mechanical energy lost by the system is liberated in some other form such as light energy, heat energy, etc.

For example, when a body is moving along a surface, frictional force acts on the body as well. Due to this frictional force, the body loses its mechanical energy, and this loss is generally released in the form of heat energy to the surroundings. Thus, the mechanical energy will not be conserved and frictional force can be classified as a non-conservative force.

SetId=347

[10] When the force is kept constant as function of time, it is possible for a particle to move on a circular path in such a way that its speed remains constant, but the velocity and acceleration must always change with time.

[11] Distance equal to zero $\Rightarrow$ displacement=0; but Displacement=0

[12] Staying inside a bullet train moving with constant velocity (no jerks etc) an experiment can always be performed which will tell us the numerical value of the acceleration of the bullet train

[13] Also a good example of law of conservation momentum can be seen when a bullet from a rifle is fired.As the bullet is fired and gets out of the rifle, the rifle gives a backward jerk due to the phenomenon of conservation of momentum.

[14] A particle is acted upon by a force of constant magnitude which is always perpendicular to the velocity of the particle and the motion of the particle takes place in a plane, Then its kinetic energy, speed, velocity acceleration will not change.

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[15] When observing our system from a reference frame which is accelerating compared to an inertial frame,in order to make it easier to apply newtons laws, we can apply a pseudo force on all objects in the universe proportional to their mass capable of causing an acceleration equal and opposite to that of our reference frame. Hence serving to in a way "stop"(or make inertial) our reference frame, and making it easier for us to investigate the motion.

This application of pseudo force doesn't change the motion of the object because just as we can choose an arbitrary reference frame, we can choose an arbitrary force to cause the same acceleration in every object in the whole universe without changing the relative motions of objects. (as all motion is truly relative, we will still get correct answers for our investigations.

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[1] Distance equal to zero implies displacement=0; and Displacement=0 also implies distance = 0

[2] When the net external torque acting on a system about a given axis is zero, the total angular momentum of the system about that axis remains consant.

[3] Example where law of conservation of angular momentum does not hold:
When there is external force like frictional force acting on a object when it is rotating we cannot use conservation of angular momentum as the friction force acting on the object produces an external torque.

[4] In the Sun Earth system the angular momentum of the Earth about the pole star is conserved

[5] The three components of angular momentum of a conical pendulum is conserved w.r.t. the origin at the position of the center of mass of the pendulum. SetId=348

[6] We have a conical pendulum .The forces acting on the bob are tension (along the direction of the string) and gravitational force acting in the vertically downward direction.we have an additional force called the drag force which is tangential to the motion of the bob and acts in the direction opposite to the motion of the bob.The axis of rotation passes through the hinge point and is vertical.The torque due to tension is 0 because the force passes through the axis of rotation.The torque due to mg is also zero since it is parallel to the axis of rotation.but the torque due to drag force is not zero.since the net external torque acting on the bob is not zero,therefore the law of conservation of angular momentum does not hold here

[7] There is no known exception to the law of conservation of momentum in classical mechanics However, an exception to conservation of energy in nuclear physics is observed. In nuclear reactions when two nuclei collide and their mass converts to energy and energy momentum are not conserved.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then check we should if the laws are applicable or not.

So if there is no *external force* acting on the system all the three quantities, total momentum, total angular momentum, and total kinetic energy will be conserved independent of the nature of forces.

[9] It is a force for which the work done by that force on an object or a particle in moving it between any two points depends on its path travelled.This force doesn't conserves the mechanical energy.The work done by a non-conservative force on an object in moving it in a circular path is not equal to zero.

SetId=348

[10] It is not possible for a particle to move on a circular path in such a way that its speed and force remains constant, and only the velocity and acceleration may (or may not) always change with time.

[11] If P and Q are the initial and the final points of a path of a particle, displacement is a vector whose direction is along PQ and has magnitude is equal to the length of line PQ

[12] Assume bullet train, moving with out any jerks, is going on a circular arc of radius R with constant speed. Then an experiment is to be performed entirely within the train without any measurement on objects outside the train. Such an experiment can tell only radius of the track.

[13] when a man walks on the ice slab where friction does not exist between the ice block and the floor but between the feet of the man and the slab the slab moves back as per the law of conservation of momentum

[14] The kinetic energy of a particle is continuously increasing with time, then the angle bewteen the net force and the velocity cannot be greater than or equal to 90^{o} at any time. SetId=348

[15] Various types of forces in nature can be grouped in four categories:
(a)Gravitational; (b)Electromagnetic; (c)Nuclear; (d)Weak
There are also some non-fundamental forces such as:
(i)Normal reaction on bodies in contact with surfaces , (ii) Friction,(iii) Tension,(iv)Elastic force.

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[1] If P and Q are the initial and the final points of a path of a particle, displacement is a vector whose direction is along PQ and has magnitude is equal to the length of line PQ

[2] This law sates that when no net torque of all forces acts on a object or a system of objects then total angular momentum of system is conserved.The angular momentum before an event is equal to angular momentum after that event.mathematically explained by when, net torque=0 ;then, total angular momentum(L)=constant.

[3] A bob attached to a ceiling by a string moving in a horizontal circular plane is an example where the total angular momentum of the bob about the point of suspension is not conserved. This is because the the torque due to the weight of the bob about the point of suspension does not vanish and has non zero horizontal component. Only the vertical component of the angular component is conserved.

[4] For the motion of earth around sun, the angular momentum of the sun about the center of mass of the sun + earth system and perpendicular to the orbital plane of earth is conserved.

For the motion of earth around sun, the angular momentum of the sun about and axis passing through the Earth and perpendicular to the orbital plane of motion of earth is conserved.

[5] Only the z component of the angular momentum of a conical pendulum is conserved w.r.t. the origin fixed at the point of suspension. SetId=349

[6] When you release a toy gyroscope on its pedestal, it initially has no precessional rotation around that pedestal, i.e, the orientation of rotation is fixed. However, it instantaneously starts precessing around the pedestal. Both Kinetic Energy and Angular Momentum now exist where they did not exist a moment earlier. The Kinetic Energy is easy to explain, as appearing due to the body of the gyroscope dropping a tiny fraction of a millimeter in the Earth's gravitational field, giving up exactly the correct amount of Potential Energy. But the Angular Momentum of the Precession which just appeared, does not come from anywhere. This is therefore a Violation of the Conservation of Angular Momentum.

[7] In a system of a canon and a canon ball, total momentum of the system is zero before canon ball is fired. After firing the canon ball, the momentum of the system seems to be conserved as the ball moves forward and the canon moves backward.

[8] If we want to apply the conservation laws of momentum, energy and angular momentum, we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *external force* acting on the system, the momentum and angular momentum will be conserved, and depending on the nature of the forces but total energy may or may not be conserved.

[9] Explain Nonconservative force: This force is just opposite to that of conservative force. The work done by this force depends on the path taken by the particle on which the force is applied.This force does not conserve mechanical energy.If a particle travels in a closed loop, the net work done by a non consevative force is non zero.

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[10] For a particle moving on circle the acceleration is always constant in magnitude and directed towards the centre of the circle.

[11] If P and Q are the initial and the final points of a path of a particle,the displacement is the vector $\overrightarrow{PQ}$.

[12] Assume bullet train, moving with out any jerks, is going on a circular arc of radius R with constant speed. Then an experiment is to be performed entirely within the train without any measurement on objects outside the train. Such an experiment can tell both speed of the train and radius of the track.

[13] When a freely falling rigid body collides another body in its path momentum the system of two particles is not conserved in the collision as there is external force mg acting on the system.

[14] A heavy body is attached from a spring and is held at point A and is such that the spring is not slack nor is it stretched. It is then released. It goes down upto a point B and then it rises upto point C and executes an oscillatory motion between B and C. During the motion from A to C is first positive (from A to B) and then it is negative from B to A and again remains negative from A to C.

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[15] A force is agency that which changes or tends to change the state of rest or motion of a body.

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[1] If P and Q are the initial and the final points of a path of a particle,the displacement is the vector $\overrightarrow{PQ}$.

[2] Statement of Law of Conservation of Angular Momentum:
Differentiating $\vec{L} = \vec{r} \times \vec{p}$ w.r.t, time,

$$\begin{aligned} \frac{dL}{dt} &= \frac{d\vec{r} \times \vec{p}}{dt} = \frac{d\vec{r}}{dt} \times \vec{p} + \vec{r} \times \frac{d\vec{p}}{dt} = \vec{v} \times (m\vec{v}) + \vec{r} \times \vec{F} \\ &= \vec{r} \times \vec{F} (\because v \times v = 0) \\ &= \vec{\tau} \end{aligned}$$

here $\vec{\tau}$ represents the net torque acting on a rigid body rotating about a fixed axis.This torque must take into account of all the forces, be it external or internal forces

[3] Law of conservation of angular momentum holds in case of long jump. When a athlete takes off from the ground in a running long jump, the forces on the launching foot give the athlete an angular momentum with a forward rotation around a horizontal axis. Such rotation would not allow the jumper to land properly. In the landing, the legs should be together and extended forward at an angle so that the heels mark the sand at the greatest distance. Once airborne, the angular momentum cannot change (it is conserved) because no external torque acts to change it. However, the jumper can shift most of the angular momentum to the arms by rotating them in windmill fashion. Then the body remains upright in the proper orientation of landing.

[4] For the motion of earth around sun, the sum of angular momenta of the Sun and the Earth about the center of mass of the sun + earth system is conserved.

[5] The z component of angular momentum of a conical pendulum is not conserved w.r.t. the origin fixed at the point of suspension; but the x and y components are conserved.

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[6] There is no case where LAW OF CONSERVATION OF ANGULAR MOMENTUM does'nt hold.But there are cases where conservation of angular momentum does not hold.A body in vertical circular motion is an example where angular momentum is not conserved. Here the law of conservation does not apply.

[7] When applying the conservation laws of momentum, energy and angular momentum we must define the system first.Only then check if the laws is applicable or not.

As an example: when a ball is dropped from a height, it gains momentum down if we consider the ball as our system.This is because the force of gravity acts as an external force.

However, if we change our system and consider earth as a part of our system too, then the momentum remains conserved because the earth gains momentum up.

[8] To apply the conservation laws of momentum, energy and angular momentum, we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *external force* acting on the system, the energy and momentum will be conserved. However, depending on the nature of the system and of the forces, the total angular momentum may not be conserved.

[9] Non conservative force is the force in which the work done by a particle in going from one point to another is path dependent.

For non conservative forces mechanical energy is not conserved,mostly lost in the form of heat and light.The work done by a non conservative force is equal to the change in mechanical energy.

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For non conservative force $E_{\text{initial}} > E_{\text{final}}$

[10] The motion of a bomb dropped from a plane does is not a uniform motion as it follows a parabolic path and not a straight line path.

[11] If two bodies starting from a point A reach a point B, following different paths, their displacement will be, in general different, but the distances covered will always be the same.

[12] Assume bullet train, moving with out any jerks, is going on a circular arc of radius R with constant speed. Then an experiment is to be performed entirely within the train without any measurement on objects outside the train. Such an experiment can tell only speed of the track.

[13] If we take some amount of a substance like construction putty, cement, cake batter, playing dough,etc and drop it on the ground, it does not bounce back, like a rubber ball would bounce, and hence the momentum it had before striking the ground seems to have been lost. Hence it appears that the law of conservation of linear momentum does not hold.

[14] The kinetic energy of a body does not change if any one of the following is true
(i)force is always perpendicular to the velocity
(ii) the force is always perpendicular to the acceleration
(iii) the object remains stationary
(iv) the object moves in such a way that the point of application of the force remains fixed. SetId=350

[15] The forces may be of the following two types - *Contact forces* (those that act when bodies are in physical contact) eg. friction, normal reaction, bouyancy etc. and*Action-at-a-distance forces* (those that act when bodies are not in contact) eg. Gravity, electostatic forces, magnetic forces etc. There At the root level, forces are of the following fundamental types :- (a) *Gravitational forces* - weakest of all forces, always attractive
(b) *Electromagnetic forces* - stronger than gravitational forces, can be attractive or repulsive,
(c) *Nuclear forces* - exist at atomic level, have very short range,
(d) *Weak nuclear forces* associated with beta particle emission

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[1] If two bodies starting from a point A reach a point B, following different paths, their displacement will be, in general different, but the distances covered will always be the same.

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[2] Statement of Law of Conservation of Angular Momentum: For a system of many particles The net torque due all the forces, be it external or internal forces. But as the torque due to all the internal forces cancel out, it sufficient to consider the external forces acting on the system.

[3] The total angular momentum of a body remains constant of motion when the net torque of the external forces acting on the body is zero.
In general, we have a system of particles such that the net torque of the external forces on the system, w.r.t. some axes K, is zero, the total angular momentum may not remain conserved, because the torque due to the internal forces may not be zero.

[4] For the motion of the Earth around the sun, the total of angular momenta of the Earth and the Sun, about in a reference frame fixed in the pole star, is conserved.

[5] Only the z component of angular momentum of a conical pendulum is conserved w.r.t. the origin fixed at the point of suspension. SetId=351

[6] A sphere rolling on a rough surface.Due to friction there is external torque so the angular momentum changes which results in the slowing of the sphere. The angular momentum keeps changing. Even in case like this one, it is wrong to say that the Law of Angular Momentum Conservation does not hold.

[7] Statement: Law of Conservation of energy states that "ENERGY CAN NEITHER BE CREATED NOR DESTROYED",but it can be changed from one form to other.

EXPLANATION: Statement implies that the total amount of energy in an isolated system remains constant although it may change forms. viz, kinetic energy may change to potential;chemical to electrical energies etc.

[8] In order to apply the law of conservation of momentum we must first identify the system. If there is no *external forces* acting on the system then conservation laws of momentum always holds. And depending on the nature of the system and of the forces, the total kinetic energy and the total angular momentum may not be conserved.

[9] A force is said to be non-conservative, if the work done by the force is dependent on the path taken. It could also be defined as a force for which the work done during a cyclic process is non-zero.

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[10] A wagon sliding on a roller coaster designed in such a way that the wagon covers equal distances in equal times. As the motion of the wagon is uniform, there will be no net force acting on it.

[11] Distance is equal to the length of the path covered. Displacement is the shortest distance between initial and final points.

[12] A particle is observed from two frames S_1 and S_2. The frame S_2 moves with respect to S_1 with an acceleration a. If F_1 and F_2 be the pseudoforces when seen from S_1 and S_2 respectively it is not possible to have $F_1 = F_2 = 0$

[13] When we consider collision between two bodies in a non-inertial frame of reference, the law of conservation of momentum cannot be applied because there will be a pseudo force acting on the frame itself.

[14] The total work done on a particle is always equal to the change in kinetic energy. SetId=351

[15] The main differences between force and pseudo force are -
(1) Forces have a real presence while pseudo forces don't.
(2) Forces can be accounted for by Newton's laws.
(3) Pseudo forces are only taken into account when the reference frame is accelerated.

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[1] Displacement is equal to the vector difference $\vec{r}_f - \vec{r}_i$ of the position vectors of initial and final points. The distance covered will be $|\vec{r}_f - \vec{r}_i|$

[2] Depending on the torques acting on a system, the angular momentum can be conserved only in one or two directions, but may not be conserved in all. For instance, if an isolated body has no torque acting on it only in the direction along the Z axis, then the angular momentum is conserved only in that direction.

[3] An example where law of conservation of angular momentum holds:
The Law of conservation of angular momentum holds in the case of a ballet dancer performing a pirouette.

When the dancer extends her arms outward, the angular velocity of her rotation decreases whereas when she keeps her arms close to her body, the angular velocity increases. This is because her moment of inertia changes as she moves her arms outward and inward. It can be noted that she as a system has no external torque acting upon her.

[4] For the motion of the Earth around the sun, the total of angular momenta of the Earth and the Sun, is conserved in every inertial frame of reference; but the angular momentum of the Earth (or of the sun)is not conserved in every inertial frame.

[5] The projection of angular momentum of a conical pendulum in the horizontal plane is a constant of motion when the origin is chosen to be at fixed at the point of suspension. SetId=352

[6] Consider a rod of length l. Let us give an impulse to one end . Now the angular momentum about the oposite end is not zero since the impulse provides some torque . So the angular momentum is not conserved .

$$\text{torque} = \text{impulse} * \ell.$$

$d\ell/dt$ is not equal to zero and the law of conservation of angular momentum does not hold.

[7] Oscillating simple pendulum is a very good example where potential energy gets converted to kinetic energy and kinetic to potential energy. Some energy gets dissipated as heat if we consider air resistance. Energy as a whole is conserved if we consider universe as system, the energy has just changed its form.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then check if the laws is applicable or not.

So if there is no *net external force* acting on the system all the three conservation laws will hold.

[9] a force is said to be non conservative if work done is dependent on the path of the particle.potential cannot be defined in the case of non conservative forces.work done in closed loop is not equal to zero.

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[10] A simple pendulum moves along a circular arc and does not have constant speed and therefore its motion is not uniform.

[11] Distance is a scalar quantity where as the displacement is a vector quantity.

[12] A particle is observed from two frames S_1 and S_2. The frame S_2 moves with respect to S_1 with an acceleration a. If F_1 and F_2 be the pseudoforces when seen from S_1 and S_2 respectively and if $F_1 = 0$ then we must have $F_2 \neq 0$

[13] When a system is acted upon by external forces like friction etc, the conservation principle does not hold good,there will be impulse imparted and so we cant conserve momentum. This is case when a collision between two elastic balls take place on a rough horizontal table. The total momentum just after the collision will be different from the total momentum just before the collision. Here momentum is not conserved as there is external force friction is present.

[14] A particle is acted upon by a force of constant magnitude which is always perpendicular to the velocity of the particle and the motion of the particle takes place in a plane, Then its kinetic energy, speed, velocity acceleration will not change.

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[15] A force is any interaction which tends to change the motion of an object. It is also *defined* as rate of change of momentum. It is a vector quantity.

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[1] Distance is equal to the length of the path covered. Displacement is the shortest distance between initial and final points.

[2] According to Law of Conservation of Angular momentum,if no external torque acts on an object or system of objects,angular momentum of an object or system of objects remains CONSTANT or no change in angular momentum can occur.

Also it states that,only external torque can change angular momentm of the system where as the torque produced by internal forces can not change the angular momentum of the system

[3] In case of a skater, who can be considered an isolated system, so no torue will be acting on him/her. When the arms are extended, the moment of inertia is more. When his hands are closely held, the moment of inertia is lesser. Since the angular momentum is same, the angular acceleration changes accordingly.

[4] In the Sun Earth system the angular momentum of the Earth is conserved in every frame of reference

[5] The law of angular momentum of a is not applicable for the conical pendulum conserved w.r.t. the origin fixed at the point of suspension. SetId=353

[6] Let us consider a rotating skew rod. In the absence of friction or any other drag force, the rod should continuously spin without stopping. Here the net torque about the axis of rotation is 0 and hence angular momentum is conserved. It therefore follows from law of conservation of angular momentum that a spinning skew rod will keep rotating with constant angular velocity if there is no external torque. So law of conservation of angular momentum does not hold.

[7] Law of conservation of momentum does not hold whenever an external force or impulse acts on the system. For example,when a body collides with earth then it bounces back to a lesser height as it loses some velocity.

In this example the momentum of a ball is not conserved due to impulsive force by ground in the normal direction.

However, strictly speaking the system that should be considered here is the ball-earth system and the total momentum is conserved.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then check we should if the laws are applicable or not.

So if there is no *external force* acting on the system all the three quantities, total momentum is conserved. The total angular momentum is also because the torque of internal forces will be zero. The conservation of energy depends on the nature of forces. will be conserved.

[9] Explain Nonconservative Forces:

The forces that depend on the path taken by the particle are called non-conservative forces.

Mechanical energy is not conserved during the action of a non conservative force, instead, it is lost as other forms of enery like heat, light, etc.

Potential energy is not defined for a non-conservative force.

The initial and final kinetic energy in a closed loop is not equal.

The work done by a non conservative force in a closed loop is non zero. In practice, the net work is invariably negative.

Work done by a non conservative force cannot be completely recovered.

For a non conservative force,

$/text(KE)//_f//+\text{(PE)}//_f// = \text{(KE)}_i+\text{(PE)}_i//+//\text{Work Done)//non-conservative force//}$

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[10] A satellite goes around the earth in a circular orbit of 600km with a time period of $5.8\times10^3 s$. Its motion will be uniform as it will cover equal distances in equal times.

[11] Both displacement and distance tell us about the motion of a body but their study does not tell much about the forces on the body

[12] If K is an inertial frame, any frame that moves w.r.t. the frame K with uniform velocity is also an inertial frame.

[13] When we are in accelerating frame if we observe any collision between two bodies then the law of conservation of momentum does not hold in that frame of reference. On the other hand the law of conservation of momentum holds in all inertial frames.

[14] The kinetic energy of a particle is continuously increasing with time, then the angle bewteen the net force and the velocity cannot be greater than or equal to 90^o at any time. SetId=353

[15] Explain Pseudo Force: While applying Newton's laws of motion in non-inertial frame of reference it gives answers which contradict observations. Thus, to account for this,using Newton's Laws, we introduce a "fake" or pseudo force which gives answers that match the observations in a non-inertial frame.

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[1] Distance is a scalar quantity where as the displacement is a vector quantity.

[2] The law of conservation of angular momentum states that when the net external torque acting on the system is zero, then the angular momentum of the system remains constant.both the initial and final momentum should be taken from a fixed inertial frame of reference provided.

[3] Example where law of conservation of angular momentum holds:
Let us assume a student seated on a stool that can rotate freely about a vertical axis. The student has been set into rotation at a modest initial angular speed ω . He holds two dumbbells in his outstretched hands. His angular momentum vector L lies along the vertical rotation axis, pointing upwards. Now he pulls in his arms;this action reduces his rotational inertia from its value I_{initial} to a final value I_{final} because he moves the mass closer to the rotational axis. His rate of rotation increases markedly, from ω_{initial} to ω_{final}. The student can then slow down by extending his arms once more,moving the dumbbells outward. No external torque acts on the system consisting of the student, stool and the dumbbells. Thus the angular momentum of the system about the rotational axis remains constant. $I_{\text{initial}} * \omega_{\text{initial}} = I_{\text{final}} * \omega_{\text{final}}$.

[4] In the motion of earth around sun, the angular momentum of the earth about an axis passing through the sun and perpendicular to the plane of motion of earth is conserved.

[5] The law of angular momentum of a is not applicable for the conical pendulum conserved when the origin is chosen to be at the pendulum bob itself. SetId=354

[6] In the example of skew rod the angular velocity does not change even though the torque applied is nonzero. However there is no contradiction as in this case the law of conservation of momentum is not applicable. conservation is violated.

[7] If a bullet hits a wooden board and gets embedded in the board, the total energy and the total momentum of the bullet and the board are conserved.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *net external force* acting on the system, the momentum is conserved. The definition of angular momentum and torque depends on the choice of axes, and therefore it may not be be conserved. The conservation of total energy holds only for conservative forces.

When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *net external force* acting on the system, the energy and momentum will be conserved. However, the total angular momentum may not be conserved because the torque may not be zero.

[9] A non conservative force is one where the mechanical energy is not conserved.Here the work done is dependent on the path taken .Different amounts of work need to be done in different paths.Here potential energy would have no meaning as it would keep changing with the path.Here some amount of mechanical energy is lost as sound energy or heat energy and hence is not conserved.

SetId=354

[10] A uniform motion is defined to be the one in which a body covers equal distances in equal time intervals.

[11] Displacement is the shortest distance between initial and final points with direction specified.

[12] If K is an inertial frame, any frame that moves w.r.t. the frame K with uniform speed is also an inertial frame.

[13] When a freely falling body hits another rigid body in its path then momentum is not conserved as external force mg acts on both the bodies. The total momentum after the collision will be different from the total momentum before the hit.

[14] A heavy body is attached from a spring and is held at point A and is such that the spring is not slack nor is it stretched. It is then released. It goes down upto a point B and then it rises upto point C and executes an oscillatory motion between B and C. During the motion from A to C is first positive (from A to B) and then it is negative from B to A and again remains negative from A to C. SetId=354

[15] When a train is at rest and a ball is hung from the ceiling with a string, an observer in the train sees that the string is vertical. But when the train starts moving, the observer sees that the string makes an angle with the vertical and is tilted in forward direction . This means that some force other than gravity and tension must act on the ball. That force is the pseudo force.

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[1] The speed is rate of change of distance and the velocity is the rate of change of displacement.

[2] The law of conservation of angular momentum states that The total angular momentum of a system is constant in both magnitude and direction if the resultant torque, of the external forces acting on the system, is zero.

[3] A bob is attached to ceiling by a string and moves in a horizontal circular plane is an example. In this case the law of conservation of angular momentum does not hold.

[4] For the motion of earth around sun, the angular momentum of the earth about the center of mass of the sun + earth system and perpendicular to the plane of motion of earth is conserved.

[5] The three components of angular momentum of a conical pendulum is conserved w.r.t. the origin at the position of the center of mass of the pendulum. SetId=355

[6] Example where law of conservation of angular momentum does not hold:If a particle undergoes conical motion and the only force acting on particle is central force like tension of the string.Then total external torque about fixed point A is zero,yet angular momentum is not conserved,as angular momentum keeps on changing direction.

[7] If a bullet hits a wooden board and gets embedded in the board, the total energy of the bullet and the board system is conserved but the total momentum is not conserved.

[8] In order to apply the law of conservation of momentum we must first identify the system. If there is no *net external forces* acting on the system then conservation laws of momentum always holds. The total energy and the total angular momentum may not be conserved.

[9] The force whose work depends on path taken is called a non conservative force.friction for example does less work on a book dragged across a table if the book is dragged straight across than if the book is dragged in a curved path.

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[10] A particle moves on a circular path. Then its speed, direction of force, velocity and acceleration must always change with time.

[11] Displacements, being vector quantity can not compared with, a scalar quantity such as distance.

[12] A frame rotating w.r.t K with uniform angular velocity is also an inertial frame.

[13] .The law of conservation of momentum does not hold good when net external forces acting on the system is not zero.when two bodies collide law of conservation of momentum is applicable on system of two bodies but on not individual bodies because external impulse acts on them.

[14] The kinetic energy of a body does not change if any one of the following is true
(i)force is always perpendicular to the velocity
(ii) the force is always perpendicular to the acceleration
(iii) the object remains stationary
(iv) the object moves in such a way that the point of application of the force remains fixed. SetId=355

[15] Since newton's laws are not valid in non-inertial frames, pseudoforces (which do not exist in reality) are used to help us formualate and use Newton's laws of motion in non-inertial frames.

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[1] For any type of translational motion of a body, the displacement cannot be zero, where as the distance travelled can be zero.

[2] If the net external torque acting on a system is zero,the angular momentum L(vector) of the system remains constant,no matter what changes take place within the system.L(vector)=a constant (net external torque acting on system is zero)

[3] Consider a disc rotating about an axis perpendicular to its plane. On placing a smaller disc with its surface parallel to the surface of the rotating disc, the angular momentum of the system of two discs remains constant as there is no external torque.

[4] In the Sun Earth system the angular momentum of the Earth about the pole star is conserved

[5] Only the z component of the angular momentum of a conical pendulum is conserved w.r.t. the origin fixed at the point of suspension. SetId=356

[6] A nonzero torque always causes the angular velocity to change, because a change in angular momentum means a change in angular velocity $L = I\omega$

[7] If a bullet hits a wooden board and gets embedded in the board, both total energy and the total momentum of the bullet and the board are not conserved.

[8] In order to apply the law of conservation of momentum we must first identify the system. Then even if there is no *net external forces* acting on the system, all the three conservation laws of momentum, angular momentum and energy may not hold due to presence of internal forces.

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[9] ** Nonconservative force is a force in which the amount of work done by the force is dependent of the path taken to change a state of a system.

[10] A particle moves on a circular path. Then its speed, direction offorce, can remain constant by velocity and acceleration must always change with time.

[11] Distance depends on the path where as the displacement depends on the end point only

[12] The Newton's Laws of motion will hold in all frames which are at rest w.r.t. K but do not remain valid in a frame that move with respect to K.

[13] A block moving in the air breaks up into two parts and the parts separate, then the total momentum must be the same before and after the break.

[14] The total work done on a particle is always equal to the change in kinetic energy. SetId=356

[15] Force is defined as the rate of change of linear momentum. In other words it is the agency which changes or tends to change the (a) State of rest; (b)State of uniform motion (c) Direction of body's motion; (d) Shape of the body

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[1] Displacements, being vector quantity can not compared with, a scalar quantity such as distance.

[2] The Law of conservation of angular momentum states that when no external torque acts on an object or a closed system of objects undergoing motion about a given axis, the change in angular momentum is zero. Therefore, considering an event where only internal torque or no torque is involved, the total angular momentum of the system before the event is equal to the total angular momentum after the event

[3] Consider a man standing on a spinning platform. Initially, the man spreads out his arms and he spins with a certain angular velocity. The next moment, he pulls his arms inwards keeping them close to his body. We will observe that the angular velocity with which he is spinning now increases. This phenomenon can be explained by the Law Of Conservation of Angular momentum. Initially, since his arms were spread wide, his moment of inertia was large. However, when he pulled them close to his body, his moment of inertia decreased.
In this example the angular velocity of the man increases and therefore the angular momentum also increases.The law of conservation of angular momentum does not apply because the torque of muscular forces is not zero.

[4] For the motion of earth around sun, the angular momentum of the sun about the center of mass of the sun + earth system and perpendicular to the orbital plane of earth is conserved.

For the motion of earth around sun, the angular momentum of the sun about and axis passing through the Earth and perpendicular to the orbital plane of motion of earth is conserved.

[5] The z component of angular momentum of a conical pendulum is not conserved w.r.t. the origin fixed at the point of suspension; but the x and y components are conserved. SetId=357

[6] A nonzero torque always implies change in angular momentum and may not give rise to a change in magnitude of angular velocity. A non zero torque may mean change only the direction of the angular momentum and not the angular velocity.

[7] There are certain situations where it appears that the law of conservation of linear momentum does not hold. For example if we take some amount of a substance like construction putty, cement, cake batter, playing dough,etc and drop it on the ground, it does not bounce back like a rubber ball would and hence the momentum it had before striking the ground seems to have been lost. Hence it appears that the law of conservation of linear momentum does not hold.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then check we should if the laws are applicable or not.

So if there is no *external force* acting on the system all the three quantities, total momentum, total angular momentum, and total kinetic energy will be conserved independent of the nature of forces.

[9] Nonconservative force is any force where the work done by the force on the object depends on the path of motion of the object.the work done by the frictional force results in to loss of the energy of the system in the form of heat or other form of energy.

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[10] A particle moves on a circular path. Then under suitable conditions its speed may remain constant, but the force, velocity and acceleration must always change with time.

[11] Distance equal to zero $\Rightarrow$ displacement=0; but Displacement=0

[12] Staying inside a bullet train moving with constant velocity (no jerks etc) an experiment can always be performed which will tell us the numerical velocity of the bullet train

[13] A ball hits the floor and rebounds after an inelastic collision. In this case the total momentum of the ball before and after the collsion is conserved. Also the total enrgy of the ball and the earth remains the same

[14] A particle is acted upon by a force of constant magnitude which is always perpendicular to the velocity of the particle and the motion of the particle takes place in a plane, Then its kinetic energy, speed, velocity acceleration will not change. SetId=357

[15] Real forces have their origin in matter such as electricity, gravitation etc., while pseudo forces are caused by inertial motion.

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[1] Distance depends on the path where as the displacement depends on the end point only.

[2] The law of conservation of angular momentum states that when no external torque acts on an object or a closed system of objects, no change of angular momentum can occur. Hence, the angular momentum before an event involving only internal torques or no torques is equal to the angular momentum after the event . Angular momentum can be calculated with the help of the formula $L = I\omega$ where L stands for Angular momentum, I stands for moment of inertia and ω stands for angular velocity

[3] In the Sun-Earth system, angular momentum of the earth is not conserved but the total angular momentum of the sun and the earth is constant of motion.

[4] For the motion of earth around sun, the sum of angular momenta of the Sun and the Earth about the center of mass of the sun + earth system is conserved.

[5] Only the z component of angular momentum of a conical pendulum is conserved w.r.t. the origin fixed at the point of suspension. SetId=358

[6] In the example of a rotating skew rod the torque due to the external gravitational forces is zero , but the angular momentum is not constant Therefore the law of conservation of angular momentum is violated.

[7] A tennis ball is dropped from height h and after hitting the ground and it bounces back and rises to the same height. In this case the momentum of the ball is conserved because (under ideal conditions) the momentum after it hits the ground will be equal to the momentum it had before hitting the ground.

[8] If we want to apply the conservation laws of momentum, energy and angular momentum, we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *external force* acting on the system, the momentum and angular momentum will be conserved, and depending on the nature of the forces but total energy may or may not be conserved.

[9] nonconservative force is any force ,where the work done by the force depends on the path of motion of the body.The work done by such a force is equal to the change in mechanical energy of the system.Energy mostly observed to be lost in form of heat,
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by the action of non conservative force.

[10] A particle moves on a circular path. Then under suitable conditions its speed and acceleration may remain constant, but the force, and velocity must always change with time.

[11] If P and Q are the initial and the final points of a path of a particle, displacement is a vector whose direction is along PQ and has magnitude is equal to the length of line PQ

[12] Staying inside a bullet train moving with constant velocity (no jerks etc) an experiment can always be performed which will tell us the numerical value of the acceleration of the bullet train

[13] In a head on elastic collision of two identical bodies of equal masses the velocities, the speeds, the momenta and the kinetic energy are all exchanged.

[14] The kinetic energy of a particle is continuously increasing with time, then the angle bewteen the net force and the velocity cannot be greater than or equal to 90^o at any time.

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[15] 1)When we start rolling a body on a rough ground, it stops rolling after certain period because of frictional force.
2)When we leave a body from a certain height, it falls due to the act of gravitational force.

1)When a body is rotating in a circular path due to the centrifugal force which is the pseudo force. 2) When the lift is accelerating upwards, the upwards force felt by passengers a pseudo force.

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[1] Distance equal to zero implies displacement=0; and Displacement=0 also implies distance = 0

[2] Newton's Second Law of Motion is defined by the expression $F = \frac{dp}{dT}$, where F gives the force vector acting on the system and p gives its momentum vector; in linear motion. A similar expression can be written to describe angular motion, i.e. : $\tau = \frac{dL}{dt}$, where τ is the external torque vector acting on the system, and L is the angular momentum.

If the external torque on the system is zero, then we get the expression as: dL/dt=0. This points out to the fact that, when no external torque is acting on the system, then its angular momentum is constant, no matter what changes occur in the system. This is the Law of Conservation Of Angular Momentum.

[3] Consider a disc and a man system. man is standing on center of the disc rotating with angular velocity.initially man folded his hand.when man stretches his hands then momentum of inertia of system increases.and angular velocity decreases.and total angular momentum remains constant.

[4] For the motion of the Earth around the sun, the total of angular momenta of the Earth and the Sun, about in a reference frame fixed in the pole star, is conserved.

[5] The projection of angular momentum of a conical pendulum in the horizontal plane is a constant of motion when the origin is chosen to be at fixed at the point of suspension. SetId=359

[6] In the example of skew rod, the angular momentum changes with time and there is a non zero torque coming from action of forces other than gravitational forces. Hence the law of conservation of angular momentum dos not apply.

[7] Law of conservation of momentum does not hold when Newton's laws are not valid, e.g. in a non-inertial frame of reference. For example, when we consider collision between two bodies in a non-inertial frame of reference, the law of conservation of momentum cannot be applied because there will be a pseudo force acting on the frame itself.

[8] To apply the conservation laws of momentum, energy and angular momentum, we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *external force* acting on the system, the energy and momentum will be conserved. However, depending on the nature of the system and of the forces, the total angular momentum may not be conserved.

[9] The work done by a "non-conservative" force does depend on the path taken. Non-conservative forces cannot be associated with a potential energy. If some of the internal forces of a system are non-conservative, the mechanical energy of the system is not constant.Work-energy theorem is valid even in the presence of some non-conservative forces.

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[10] When the force is kept constant as function of time, it is possible for a particle to move on a circular path in such a way that its speed remains constant, but the velocity and acceleration must always change with time.

[11] If P and Q are the initial and the final points of a path of a particle,the displacement is the vector $\overrightarrow{PQ}$.

[12] Assume bullet train, moving with out any jerks, is going on a circular arc of radius R with constant speed. Then an experiment is to be performed entirely within the train without any measurement on objects outside the train. Such an experiment can tell only radius of the track.

[13] For a system of several particles the conservation of total linear momentum is equivalent to the statement that their centre of mass moves like a free particle.

[14] A heavy body is attached from a spring and is held at point A and is such that the spring is not slack nor is it stretched. It is then released. It goes down upto a point B and then it rises upto point C and executes an oscillatory motion between B and C. During the motion from A to C is first positive (from A to B) and then it is negative from B to A and again remains negative from A to C.

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[15] Newton's first law defines inertial frame. An inertial frame is a frame in which the first law hold. It also makes it possible to compare and tell two force being equal or not. The second law defines the force.

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[1] If P and Q are the initial and the final points of a path of a particle, displacement is a vector whose direction is along PQ and has magnitude is equal to the length of line PQ

[2] If the net external torque acting on a system is zero, the angular momentum L of the system remains constant, no matter what changes take place within the system.

$$\sum(T_{\text{ext}}) = \frac{dL}{dt}$$

The law states that when there is no net external torque, $\frac{dL}{dt}$ is zero implying that the total angular momentum of system is constant.

i.e. $L = a$ constant (isolated system)

[3] The conservation of angular momentum of a system of bodies requires that the the sum of torque due to all forces be equal to zero. Now consider a situation where the forces are such that the sum of torques of external forces is zero w.r.t. some axes K. Since the value of torque depends of the choices of axes, the sum of torques due to all internal forces will depend on the choice of axes and in general it will be non zero. Therefore, for a system of several bodies, for a given choice of axes K, there will be situations when the total angular momentum may not be conserved.

[4] For the motion of the Earth around the sun, the total of angular momenta of the Earth and the Sun, is conserved in every inertial frame of reference; but the angular momentum of the Earth (or of the sun)is not conserved in every inertial frame.

[5] The law of angular momentum of a is not applicable for the conical pendulum conserved w.r.t. the origin fixed at the point of suspension. SetId=360

[6] In the example of conical pendulum, the z- component of angular momentum does not change. This follows from the angular momentum conservation as there is no external torque.

[7] If I throw a ball upward, it's speed decreases as it rises upwards. There is an external force (gravity) acting on the ball, so the momentum conservation law does not apply. Momentum of the ball is not conserved, however the momentum of the Earth-ball system is conserved as gravity will become an internal force in this case.

[8] In order to apply the law of conservation of momentum we must first identify the system. If there is no *external forces* acting on the system then conservation laws of momentum always holds. And depending on the nature of the system and of the forces, the total kinetic energy and the total angular momentum may not be conserved.

[9] Non conservative forces are forces with the property that the work done by the force in moving a particle between two points is dependent on the path taken.Also the work done over a closed loop is not zero.Defining of scalar potential is not possible in case of non conservative forces because the change in potential energy between two points will depend on path taken.

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[10] It is not possible for a particle to move on a circular path in such a way that its speed and force remains constant, and only the velocity and acceleration may (or may not) always change with time.

[11] If two bodies starting from a point A reach a point B, following different paths, their displacement will be, in general different, but the distances covered will always be the same.

[12] Assume bullet train, moving with out any jerks, is going on a circular arc of radius R with constant speed. Then an experiment is to be performed entirely within the train without any measurement on objects outside the train. Such an experiment can tell both speed of the train and radius of the track.

[13] The total mechanical energy of a system may not be conserved if there are no external forces and the internal forces are conservative.

[14] The kinetic energy of a body does not change if any one of the following is true
(i)force is always perpendicular to the velocity
(ii) the force is always perpendicular to the acceleration
(iii) the object remains stationary
(iv) the object moves in such a way that the point of application of the force remains fixed.

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[15] The magnitude of the pseudo force arising in a non-inertial frame is always equal to the mass of the body under consideration multiplied by the acceleration of the frame of reference and the direction of pseudoforce is always opposite to the direction of acceleration of the frame.

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[1] If P and Q are the initial and the final points of a path of a particle,the displacement is the vector $\overrightarrow{PQ}$.

[2] When the net external torque acting on a body or a system of bodies is zero about a particular axis, then the angular momentum of each body is conserved about that axis.

[3] Example where law of conservation of angular momentum does not hold:
When there is external force like frictional force acting on a object when it is rotating we cannot use conservation of angular momentum as the friction force acting on the object produces an external torque.

[4] In the Sun Earth system the angular momentum of the Earth is conserved in every frame of reference

[5] The law of angular momentum of a is not applicable for the conical pendulum conserved when the origin is chosen to be at the pendulum bob itself. SetId=361

[6] In the example of conical pendulum, the x and$y$ components of angular momentum change. This follows from the angular momentum conservation as the z components external torque is zero and horizontal components of torque are non zero.

[7] A soldier accelerating away, after detonating a bomb, will find that the total momentum of the fragments of the bomb is zero. This is an example where the law of conservation of momentum holds as the forces on the fragments are internal forces only and sum of all such forces is zero.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then check if the laws is applicable or not.

So if there is no *net external force* acting on the system all the three conservation laws will hold.

[9] A non conservative force is the force with the property that the work done in moving a particle between two points is dependent of the path taken.If a particle travels in a closed path, the net work done(the some of the forces acting along the path multiplied by the distance travelled) by a non conservative force is non zero. When an object moves from one location to another, the force changes the potential energy of the object by an amount that depends on the path taken.Non conservative force depends only on the path followed by the object.

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[10] For a particle moving on circle the acceleration is always constant in magnitude and directed towards the centre of the circle.

[11] Distance is equal to the length of the path covered. Displacement is the shortest distance between initial and final points.

[12] Assume bullet train, moving with out any jerks, is going on a circular arc of radius R with constant speed. Then an experiment is to be performed entirely within the train without any measurement on objects outside the train. Such an experiment can tell only speed of the track.

[13] When a bullet fired on a wooden block, some energy is transferred to the block and the total mechanical energy of the block and the bullet is conserved.

[14] The total work done on a particle is always equal to the change in kinetic energy. SetId=361

[15] A force is any interaction which tends to change the motion of an object. It is also *defined* as rate of change of momentum.It is a vector quantity.
A physically apparent but nonexistent force felt by an observer in a noninertial frame (that is, a frame undergoing acceleration).

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[1] If two bodies starting from a point A reach a point B, following different paths, their displacement will be, in general different, but the distances covered will always be the same.

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[2] The law of conservation of angular momentum states that in absence of an external torque on an object or a closed system of objects the total angular momentum of the system remains constant. Thus if $\vec{\tau} = 0 => \vec{L} =$ constant where τ is the torque and $\vec{L}$ is the angular momentum of the system.

[3] A bob attached to a ceiling by a string moving in a horizontal circular plane is an example where the total angular momentum of the bob about the point of suspension is not conserved. This is because the the torque due to the weight of the bob about the point of suspension does not vanish and has non zero horizontal component. Only the vertical component of the angular component is conserved.

[4] In the motion of earth around sun, the angular momentum of the earth about an axis passing through the sun and perpendicular to the plane of motion of earth is conserved.

[5] The three components of angular momentum of a conical pendulum is conserved w.r.t. the origin at the position of the center of mass of the pendulum. SetId=362

[6] Example where law of conservation of angular momentum does not hold: A disc rotating on a horizontal rough surface will not have a constant angular momentum because there will be a constant torque by frictional force. Hence, its angular momentum will decrease, and the law of conservation of angular momentum does not apply.

[7] There is no known exception to the law of conservation of momentum in classical mechanics However, an exception to conservation of energy in nuclear physics is observed. In nuclear reactions when two nuclei collide and their mass converts to energy and energy momentum are not conserved.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then check we should if the laws are applicable or not.

So if there is no *external force* acting on the system all the three quantities, total momentum is conserved. The total angular momentum is also because the torque of internal forces will be zero. The conservation of energy depends on the nature of forces. will be conserved.

[9] In this type of force the work done depends on the path taken by the body.Mechanical energy is not conserved in the system if non conservative force acts on it.

SetId=362

[10] The motion of a bomb dropped from a plane does is not a uniform motion as it follows a parabolic path and not a straight line path.

[11] Distance is a scalar quantity where as the displacement is a vector quantity.

[12] A particle is observed from two frames S_1 and S_2. The frame S_2 moves with respect to S_1 with an acceleration a. If F_1 and F_2 be the pseudoforces when seen from S_1 and S_2 respectively it is not possible to have $F_1 = F_2 = 0$

[13] When a moving car hits a parked lorry and causes the parked lorry to move ,energy is transferred from moving the car to the lorry and the total energy of the lorry and the car is conserved.

[14] A particle is acted upon by a force of constant magnitude which is always perpendicular to the velocity of the particle and the motion of the particle takes place in a plane, Then its kinetic energy, speed, velocity acceleration will not change. SetId=362

[15] Psuedo Force is defined as an apparent force that acts in only non-inertial frames. Pseudo Forces are also called Fictitious Forces. It is an Imaginary force. It is independent of mass.

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[1] Displacement is equal to the vector difference $\vec{r}_f - \vec{r}_i$ of the position vectors of initial and final points. The distance covered will be $|\vec{r}_f - \vec{r}_i|$

[2] If no net external torque acts on a system, the total angular momentum of the system remains constant.

[3] Law of conservation of angular momentum holds in case of long jump. When a athlete takes off from the ground in a running long jump, the forces on the launching foot give the athlete an angular momentum with a forward rotation around a horizontal axis. Such rotation would not allow the jumper to land properly. In the landing, the legs should be together and extended forward at an angle so that the heels mark the sand at the greatest distance. Once airborne, the angular momentum cannot change (it is conserved) because no external torque acts to change it. However, the jumper can shift most of the angular momentum to the arms by rotating them in windmill fashion. Then the body remains upright in the proper orientation of landing.

[4] For the motion of earth around sun, the angular momentum of the earth about the center of mass of the sun + earth system and perpendicular to the plane of motion of earth is conserved.

[5] Only the z component of the angular momentum of a conical pendulum is conserved w.r.t. the origin fixed at the point of suspension.

SetId=363

[6] Example where law of conservation of angular momentum does not hold:Consider a vertical stick on the ground falling to a horizontal position. During the fall, the conservation of angular momentum applied at the point of rotation on the ground and perpendicular to the plane of the stick is not applicable as, the gravitational force which acts vertically downwards assumed at the centre of mass produces an external torque about the axis of rotation

[7] In a system of a canon and a canon ball, total momentum of the system is zero before canon ball is fired. After firing the canon ball, the momentum of the system seems to be conserved as the ball moves forward and the canon moves backward.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *net external force* acting on the system, the momentum is conserved. The definition of angular momentum and torque depends on the choice of axes, and therefore it may not be be conserved. The conservation of total energy holds only for conservative forces.

When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *net external force* acting on the system, the energy and momentum will be conserved. However, the total angular momentum may not be conserved because the torque may not be zero.

[9] A force is said to be a non-conservative force if the work done by the force in a closed path is non-zero;(i.e) the cyclic integral of the work done is non-zero.

Work done by a non-conservative force is equal to change in total energy of the system.Work-Energy theorem is not applicable in the case of a non-conservative force.Work done by conservative force depends on the path.It differs with the paths taken by the partical even if the initial and final points are same.In case of non-conservative forces,the total mechanical energy is not constant as the energy is dissipated in various forms such as heat energy,sound energy,etc and cannot be recovered.

SetId=363

[10] A wagon sliding on a roller coaster designed in such a way that the wagon covers equal distances in equal times. As the motion of the wagon is uniform, there will be no net force acting on it.

[11] Both displacement and distance tell us about the motion of a body but their study does not tell much about the forces on the body

[12] A particle is observed from two frames S_1 and S_2. The frame S_2 moves with respect to S_1 with an acceleration a. If F_1 and F_2 be the pseudoforces when seen from S_1 and S_2 respectively and if $F_1 = 0$ then we must have $F_2 \neq 0$

[13] When a bomb explodes the total mechanical energy is not conserved. But the total chemical energy and the mechanical energy is conserved.

[14] The kinetic energy of a particle is continuously increasing with time, then the angle bewteen the net force and the velocity cannot be greater than or equal to 90^o at any time.

SetId=363

[15] Psuedo Force is defined as an apparent force that acts in only non-inertial frames. Pseudo Forces are also called Fictious Forces. It is an Imaginary force. It is always proportional to mass. It is sometimes dependent on speed.

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[1] Distance is equal to the length of the path covered. Displacement is the shortest distance between initial and final points.

[2] The law of conservation of angular momentum states that when no external torque is applied on an object or a closed system of objects about an axis, the angular momentum about that axis remains constant.

[3] The total angular momentum of a body remains constant of motion when the net torque of the external forces acting on the body is zero.
In general, we have a system of particles such that the net torque of the external forces on the system, w.r.t. some axes K, is zero, the total angular momentum may not remain conserved, because the torque due to the internal forces may not be zero.

[4] In the Sun Earth system the angular momentum of the Earth about the pole star is conserved

[5] The z component of angular momentum of a conical pendulum is not conserved w.r.t. the origin fixed at the point of suspension; but the x and y components are conserved.

SetId=364

[6] We have a conical pendulum .The forces acting on the bob are tension (along the direction of the string) and gravitational force acting in the vertically downward direction.we have an additional force called the drag force which is tangential to the motion of the bob and acts in the direction opposite to the motion of the bob.The axis of rotation passes through the hinge point and is vertical.The torque due to tension is 0 because the force passes through the axis of rotation.The torque due to mg is also zero since it is parallel to the axis of rotation.but the torque due to drag force is not zero.since the net external torque acting on the bob is not zero,therefore the law of conservation of angular momentum does not hold here

[7] When applying the conservation laws of momentum, energy and angular momentum we must define the system first.Only then check if the laws is applicable or not.

As an example: when a ball is dropped from a height, it gains momentum down if we consider the ball as our system.This is because the force of gravity acts as an external force.

However, if we change our system and consider earth as a part of our system too, then the momentum remains conserved because the earth gains momentum up.

[8] In order to apply the law of conservation of momentum we must first identify the system. If there is no *net external forces* acting on the system then conservation laws of momentum always holds. The total energy and the total angular momentum may not be conserved.

[9] A non conservative force is a force where work done in moving a particle between two points depends on the path through which it is taken.Friction is an example of non conservative force.Mechanical energy is not conserved in case of a non conservative force

SetId=364

[10] A simple pendulum moves along a circular arc and does not have constant speed and therefore its motion is not uniform.

[11] Displacement is the shortest distance between initial and final points with direction specified.

[12] If K is an inertial frame, any frame that moves w.r.t. the frame K with uniform velocity is also an inertial frame.

[13] When a ball rolls over a rough surface, it comes to stop after some time. This is because transational and rotational kinetic energy initially present in the ball continuosly gets converted to heat due to friction. When all the kinetic energy changes to heat, the ball stops. The total mechanical energy of the ball is not conserved.

[14] A heavy body is attached from a spring and is held at point A and is such that the spring is not slack nor is it stretched. It is then released. It goes down upto a point B and then it rises upto point C and executes an oscillatory motion between B and C. During the motion from A to C is first positive (from A to B) and then it is negative from B to A and again remains negative from A to C. SetId=364

[15] Since pseudo forces are not real forces, they do not affect the conservation laws and all the three conservation laws hold in noninertial frames.

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[1] Distance is a scalar quantity where as the displacement is a vector quantity.

[2] The angular momentum of a given system of bodies shall remain conserved unless acted upon by an external unbalanced torque.

[3] An example where law of conservation of angular momentum holds:
The Law of conservation of angular momentum holds in the case of a ballet dancer performing a pirouette.

When the dancer extends her arms outward, the angular velocity of her rotation decreases whereas when she keeps her arms close to her body, the angular velocity increases. This is because her moment of inertia changes as she moves her arms outward and inward. It can be noted that she as a system has no external torque acting upon her.

[4] For the motion of earth around sun, the angular momentum of the sun about the center of mass of the sun + earth system and perpendicular to the orbital plane of earth is conserved.

For the motion of earth around sun, the angular momentum of the sun about and axis passing through the Earth and perpendicular to the orbital plane of motion of earth is conserved.

[5] Only the z component of angular momentum of a conical pendulum is conserved w.r.t. the origin fixed at the point of suspension. SetId=365

[6] When you release a toy gyroscope on its pedestal, it initially has no precessional rotation around that pedestal, i.e, the orientation of rotation is fixed. However, it instantaneously starts precessing around the pedestal. Both Kinetic Energy and Angular Momentum now exist where they did not exist a moment earlier. The Kinetic Energy is easy to explain, as appearing due to the body of the gyroscope dropping a tiny fraction of a millimeter in the Earth's gravitational field, giving up exactly the correct amount of Potential Energy. But the Angular Momentum of the Precession which just appeared, does not come from anywhere. This is therefore a Violation of the Conservation of Angular Momentum.

[7] Statement: Law of Conservation of energy states that "ENERGY CAN NEITHER BE CREATED NOR DESTROYED",but it can be changed from one form to other.

EXPLANATION: Statement implies that the total amount of energy in an isolated system remains constant although it may change forms. viz, kinetic energy may change to potential;chemical to electrical energies etc.

[8] In order to apply the law of conservation of momentum we must first identify the system. Then even if there is no *net external forces* acting on the system, all the

three conservation laws of momentum, angular momentum and energy may not hold due to presence of internal forces.

[9] A force:A force is said to be a *non-//**conservative force* if the*/ work done by it in a closed path is/*/ non-zero./For such forces,potential energy cannot be defined. SetId=365

[10] A satellite goes around the earth in a circular orbit of 600km with a time period of $5.8 \times 10^3 s$. Its motion will be uniform as it will cover equal distances in equal times.

[11] Displacements, being vector quantity can not compared with, a scalar quantity such as distance.

[12] If K is an inertial frame, any frame that moves w.r.t. the frame K with uniform speed is also an inertial frame.

[13] Let us consider that a pendulum is oscillating moving in a vertical plane. Mean while let another bob which is attached to a spring and is executing a simple harmonic motion in horizontal direction comes and hits the pendulum. Here conservation of momentum does not hold good as tension(external force) is acting on the system.(pendulum)

[14] The kinetic energy of a body does not change if any one of the following is true
(i)force is always perpendicular to the velocity
(ii) the force is always perpendicular to the acceleration
(iii) the object remains stationary
(iv) the object moves in such a way that the point of application of the force remains fixed. SetId=365

[15] A force is any interaction which tends to change the motion of an object. Newtons' second tell us that it is *equal* to the rate of change of momentum.It is a vector quantity. Real forces can be distinguished from pseudo forces because the pseudo forces always proportional to the mass of the body. All real forces, except the gravitational force, do not depend on the mass of the body.

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[1] The speed is rate of change of distance and the velocity is the rate of change of displacement.

[2] When the net external torque acting on a system about a given axis is zero, the total angular momentum of the system about that axis remains consant.

[3] In case of a skater, who can be considered an isolated system, so no torue will be acting on him/her. When the arms are extended, the moment of inertia is more. When his hands are closely held, the moment of inertia is lesser. Since the angular momentum is same, the angular acceleration changes accordingly.

[4] For the motion of earth around sun, the sum of angular momenta of the Sun and the Earth about the center of mass of the sun + earth system is conserved.

[5] The projection of angular momentum of a conical pendulum in the horizontal plane is a constant of motion when the origin is chosen to be at fixed at the point of suspension.

SetId=366

[6] There is no case where LAW OF CONSERVATION OF ANGULAR MOMENTUM does'nt hold.But there are cases where conservation of angular momentum does not hold.A body in vertical circular motion is an example where angular momentum is not conserved. Here the law of conservation does not apply.

[7] Oscillating simple pendulum is a very good example where potential energy gets converted to kinetic energy and kinetic to potential energy. Some energy gets dissipated as heat if we consider air resistance. Energy as a whole is conserved if we consider universe as system, the energy has just changed its form.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then check we should if the laws are applicable or not.

So if there is no *external force* acting on the system all the three quantities, total momentum, total angular momentum, and total kinetic energy will be conserved independent of the nature of forces.

[9] A force that is not conservative is nonconservative force. The work done by a noconservative force cannot be represented by a potential energy function. That is work done by a nonconservative force is dependent on the path through which the system is moved. Some nonconservative forces cause the mechanical energy to be lost or dissipiated. Such forces are called dissipiative forces. There is no way to get back the lost mechanical energy. Nonconservative forces can also increase the mechanical energy. This is arrived from the concept of irreversible process.

SetId=366

[10] A uniform motion is defined to be the one in which a body covers equal distances in equal time intervals.

[11] Distance depends on the path where as the displacement depends on the end point only

[12] A frame rotating w.r.t K with uniform angular velocity is also an inertial frame.

[13] The law of conservation of momentum does not hold in relativistic situations, i.e., where the speeds of the masses involved are close to the speed of light.

[14] The total work done on a particle is always equal to the change in kinetic energy. SetId=366

[15] Examples of pseudoforce are Coriolis Force, Centrifugal Force, and magnetic force on currents.
Psuedo force also called as fictitious force is an apparent force that are needed for masses whose their motion is described using a non inertial frame of reference.

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[1] For any type of translational motion of a body, the displacement cannot be zero, where as the distance travelled can be zero.

[2] This law sates that when no net torque of all forces acts on a object or a system of objects then total angular momentum of system is conserved.The angular momentum before an event is equal to angular momentum after that event.mathematically explained by when, net torque=0 ;then, total angular momentum(L)=constant.

[3] Example where law of conservation of angular momentum holds:
Let us assume a student seated on a stool that can rotate freely about a vertical axis. The student has been set into rotation at a modest initial angular speed ω . He holds two dumbbells in his outstretched hands. His angular momentum vector L lies along the vertical rotation axis, pointing upwards. Now he pulls in his arms;this action reduces his rotational inertia from its value I_{initial} to a final value I_{final} because he moves the mass closer to the rotational axis. His rate of rotation increases markedly, from ω_{initial} to ω_{final}. The student can then slow down by extending his arms once more,moving the dumbbells outward. No external torque acts on the system consisting of the student, stool and the dumbbells. Thus the angular momentum of the system about the rotational axis remains constant. $I_{\text{initial}} * \omega_{\text{initial}} = I_{\text{final}} * \omega_{\text{final}}$.

[4] For the motion of the Earth around the sun, the total of angular momenta of the Earth and the Sun, about in a reference frame fixed in the pole star, is conserved.

[5] The law of angular momentum of a is not applicable for the conical pendulum conserved w.r.t. the origin fixed at the point of suspension. SetId=367

[6] A sphere rolling on a rough surface.Due to friction there is external torque so the angular momentum changes which results in the slowing of the sphere. The angular momentum keeps changing. Even in case like this one, it is wrong to say that the Law of Angular Momentum Conservation does not hold.

[7] Law of conservation of momentum does not hold whenever an external force or impulse acts on the system. For example,when a body collides with earth then it bounces back to a lesser height as it loses some velocity.

In this example the momentum of a ball is not conserved due to impulsive force by ground in the normal direction.

However, strictly speaking the system that should be considered here is the ball-earth system and the total momentum is conserved.

[8] If we want to apply the conservation laws of momentum, energy and angular momentum, we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *external force* acting on the system, the momentum and angular momentum will be conserved, and depending on the nature of the forces but total energy may or may not be conserved.

[9] Nonconservative forces are forces, such that the work done by these forces are path dependent. Work done by these forces around a close path is not necessarily equal to zero. Hence if a particle is acted on by a non-conservative force and that particle returns to its original position, that particle will experience a net loss of energy. Energy will thus not be conserved for particle. Potential Energy can not be defined for these type of forces.

SetId=367

[10] A particle moves on a circular path. Then its speed, direction of force, velocity and acceleration must always change with time.

[11] Distance equal to zero $\Rightarrow$ displacement=0; but Displacement=0

[12] The Newton's Laws of motion will hold in all frames which are at rest w.r.t. K but do not remain valid in a frame that move with respect to K.

[13] when we are in accelerating frame if we observe any collision between two bodies then the law of conservation of momentum does not hold in that frame of reference.

[14] A particle is acted upon by a force of constant magnitude which is always perpendicular to the velocity of the particle and the motion of the particle takes place in a plane, Then its kinetic energy, speed, velocity acceleration will not change. SetId=367

[15] Examples of pseudo-force are Coriolis Force, Centrifugal Force, Centripetal force and magnetic force on currents. The pseudo forces do not obey Newton's third law and therefore the total momentum does not appear to be conserved in a non-inertial frame.

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[1] Displacements, being vector quantity can not compared with, a scalar quantity such as distance.

[2] Statement of Law of Conservation of Angular Momentum:

Differentiating $\vec{L} = \vec{r} \times \vec{p}$ w.r.t, time,

$$\begin{aligned} \frac{dL}{dt} &= \frac{d\vec{r} \times \vec{p}}{dt} = \frac{d\vec{r}}{dt} \times \vec{p} + \vec{r} \times \frac{d\vec{p}}{dt} = \vec{v} \times (m\vec{v}) + \vec{r} \times \vec{F} \\ &= \vec{r} \times \vec{F} (\because v \times v = 0) \\ &= \vec{\tau} \end{aligned}$$

here $\vec{\tau}$ represents the net torque acting on a rigid body rotating about a fixed axis.This torque must take into account of all the forces, be it external or internal forces

[3] A bob is attached to ceiling by a string and moves in a horizontal circular plane is an example. In this case the law of conservation of angular momentum does not hold.

[4] For the motion of the Earth around the sun, the total of angular momenta of the Earth and the Sun, is conserved in every inertial frame of reference; but the angular momentum of the Earth (or of the sun)is not conserved in every inertial frame.

[5] The law of angular momentum of a is not applicable for the conical pendulum conserved when the origin is chosen to be at the pendulum bob itself. SetId=368

[6] Consider a rod of length l. Let us give an impulse to one end . Now the angular momentum about the oposite end is not zero since the impulse provides some torque . So the angular momentum is not conserved .

$$\text{torque} = \text{impulse} * \ell.$$

$d\ell/dt$ is not equal to zero and the law of conservation of angular momentum does not hold.

[7] If a bullet hits a wooden board and gets embedded in the board, the total energy and the total momentum of the bullet and the board are conserved.

[8] To apply the conservation laws of momentum, energy and angular momentum, we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *external force* acting on the system, the energy and momentum will be conserved. However, depending on the nature of the system and of the forces, the total angular momentum may not be conserved.

[9] Non Conservative force is a force with the property that workdone in moving an object from one point to another is dependent on the path taken .

Non Conservative Force can arise in classical physics due to neglected degrees of freedom or time dependent potentials.

Friction may be treated without resorting the use of non conservative forces by considering the motion of individual molecules.

SetId=368

[10] A particle moves on a circular path. Then its speed, direction offorce, can remain constant by velocity and acceleration must always change with time.

[11] If P and Q are the initial and the final points of a path of a particle, displacement is a vector whose direction is along PQ and has magnitude is equal to the length of line PQ

[12] Staying inside a bullet train moving with constant velocity (no jerks etc) an experiment can always be performed which will tell us the numerical velocity of the bullet train

[13] Give an example where law of conservation of momentum does not hold all cases when seen from non inertial frame of references for example when we see two cars collide from a moving bus there momentum is not conserved

[14] The kinetic energy of a particle is continuously increasing with time, then the angle bewteen the net force and the velocity cannot be greater than or equal to 90^{o} at any time.

SetId=368

[15] FORCE is any interaction which tends to change the motion of an object.It has both magnitude and direction,making it a vector quantity.

A psuedo force is an apparent force that acts on all masses whose motion is described with respect to a non-inertial frame of reference like a rotating frame of reference.This force is needed by an observer in an non-inertial frame to make all the Newtons Laws of motion hold true.

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[1] Distance depends on the path where as the displacement depends on the end point only.

[2] Statement of Law of Conservation of Angular Momentum: For a system of many particles The net torque due all the forces, be it external or internal forces. But as the torque due to all the internal forces cancel out, it sufficient to consider the external forces acting on the system.

[3] Consider a disc rotating about an axis perpendicular to its plane. On placing a smaller disc with its surface parallel to the surface of the rotating disc, the angular momentum of the system of two discs remains constant as there is no external torque.

[4] In the Sun Earth system the angular momentum of the Earth is conserved in every frame of reference

[5] The three components of angular momentum of a conical pendulum is conserved w.r.t. the origin at the position of the center of mass of the pendulum. SetId=369

[6] Let us consider a rotating skew rod. In the absence of friction or any other drag force, the rod should continuously spin without stopping. Here the net torque about the axis of rotation is 0 and hence angular momentum is conserved. It therefore follows from law of conservation of angular momentum that a spinning skew rod will keep rotating with constant angular velocity if there is no external torque. So law of conservation of angular momentum does not hold.

[7] If a bullet hits a wooden board and gets embedded in the board, the total energy of the bullet and the board system is conserved but the total momentum is not conserved.

[8] In order to apply the law of conservation of momentum we must first identify the system. If there is no *external forces* acting on the system then conservation laws of momentum always holds. And depending on the nature of the system and of the forces, the total kinetic energy and the total angular momentum may not be conserved.

[9] A non-conservative force is a force with the property that the work done in moving a particle between two points is dependent of the path taken . Mostly the enery of the particle in a non conservative force field dissipates in the form of heat or sound . Since the lost energy cannot be bought back ,conservation of mechanical energy does not hold true .

SetId=369

[10] A particle moves on a circular path. Then under suitable conditions its speed may remain constant, but the force, velocity and acceleration must always change with time.

[11] If P and Q are the initial and the final points of a path of a particle,the displacement is the vector $\overrightarrow{PQ}$.

[12] Staying inside a bullet train moving with constant velocity (no jerks etc) an experiment can always be performed which will tell us the numerical value of the acceleration of the bullet train

[13] When a tennis ball hits the ground at an oblique angle, the angle of reflection is equal to the angle of incidence. This is a simple consequence of conservation of horizontal component of momentum.

[14] A heavy body is attached from a spring and is held at point A and is such that the spring is not slack nor is it stretched. It is then released. It goes down upto a point B and then it rises upto point C and executes an oscillatory motion between B and C. During the motion from A to C is first positive (from A to B) and then it is negative from B to A and again remains negative from A to C. SetId=369

[15] FORCE is any interaction which tends to change the motion of an object.It has both magnitude and direction,making it a vector quantity. A pseudo-force F doesn't arise from any physical interaction between two objects, but rather from the acceleration 'a' of the non-inertial reference frame itself. These forces have no real existence but must be taken into account in an accelerating frame of reference to make all the three Newton's Laws of motion applicable to the system

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[1] Distance equal to zero implies displacement=0; and Displacement=0 also implies distance = 0

[2] Depending on the torques acting on a system, the angular momentum can be conserved only in one or two directions, but may not be conserved in all. For instance, if an isolated body has no torque acting on it only in the direction along the Z axis, then the angular momentum is conserved only in that direction.

[3] Consider a man standing on a spinning platform. Initially, the man spreads out his arms and he spins with a certain angular velocity. The next moment, he pulls his arms inwards keeping them close to his body. We will observe that the angular velocity with which he is spinning now increases. This phenomenon can be explained by the Law Of Conservation of Angular momentum. Initially, since his arms were spread wide, his moment of inertia was large. However, when he pulled them close to his body, his moment of inertia decreased.
In this example the angular velocity of the man increases and therefore the angular momentum also increases.The law of conservation of angular momentum does not apply because the torque of muscular forces is not zero.

[4] In the motion of earth around sun, the angular momentum of the earth about an axis passing through the sun and perpendicular to the plane of motion of earth is conserved.

[5] Only the z component of the angular momentum of a conical pendulum is conserved w.r.t. the origin fixed at the point of suspension. SetId=370

[6] In the example of skew rod the angular velocity does not change even though the torque applied is nonzero. However there is no contradiction as in this case the law of conservation of momentum is not applicable. conservation is violated.

[7] If a bullet hits a wooden board and gets embedded in the board, both total energy and the total momentum of the bullet and the board are not conserved.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then check if the laws is applicable or not.

So if there is no *net external force* acting on the system all the three conservation laws will hold.

[9] If the work done by a force depends on the path followed by the particle, it is called a Non conservative force. Work done by a non conservative force is not zero in round trip.

SetId=370

[10] A particle moves on a circular path. Then under suitable conditions its speed and acceleration may remain constant, but the force, and velocity must always change with time.

[11] If two bodies starting from a point A reach a point B, following different paths, their displacement will be, in general different, but the distances covered will always be the same.

[12] Assume bullet train, moving with out any jerks, is going on a circular arc of radius R with constant speed. Then an experiment is to be performed entirely within the train without any measurement on objects outside the train. Such an experiment can tell only radius of the track.

[13] when a ball is dropped from a height, it gains momentum down if we consider the ball as our system.This is because the force of gravity acts as an external force.

However, if we change our system and consider earth as a part of our system too, then the momentum remains conserved because the earth gains momentum up.

[14] The kinetic energy of a body does not change if any one of the following is true
(i)force is always perpendicular to the velocity
(ii) the force is always perpendicular to the acceleration
(iii) the object remains stationary
(iv) the object moves in such a way that the point of application of the force remains fixed. SetId=370

[15] FORCE is any interaction which tends to change the motion of an object.It has both magnitude and direction,making it a vector quantity.
A pseudo-force results from acceleration of the frame of reference in which the objects reside. It is taken into account so that Newton's second law isn't invalidated. The pseudo force acting on an object can always be mathematically expressed as the product of the mass of the object and the acceleration of the frame of reference.

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[1] If P and Q are the initial and the final points of a path of a particle, displacement is a vector whose direction is along PQ and has magnitude is equal to the length of line PQ

SetId=371

[2] According to Law of Conservation of Angular momentum,if no external torque acts on an object or system of objects,angular momentum of an object or system of objects remains CONSTANT or no change in angular momentum can occur.

Also it states that,only external torque can change angular momentm of the system where as the torque produced by internal forces can not change the angular momentum of the system

[3] In the Sun-Earth system, angular momentum of the earth is not conserved but the total angular momentum of the sun and the earth is constant of motion.

[4] For the motion of earth around sun, the angular momentum of the earth about the center of mass of the sun + earth system and perpendicular to the plane of motion of earth is conserved.

[5] The z component of angular momentum of a conical pendulum is not conserved w.r.t. the origin fixed at the point of suspension; but the x and y components are conserved.

SetId=371

[6] Example where law of conservation of angular momentum does not hold:If a particle undergoes conical motion and the only force acting on particle is central force like tension of the string.Then total external torque about fixed point A is zero,yet angular momentum is not conserved,as angular momentum keeps on changing direction.

[7] There are certain situations where it appears that the law of conservation of linear momentum does not hold. For example if we take some amount of a substance like construction putty, cement, cake batter, playing dough,etc and drop it on the ground, it does not bounce back like a rubber ball would and hence the momentum it had before striking the ground seems to have been lost. Hence it appears that the law of conservation of linear momentum does not hold.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then check we should if the laws are applicable or not.

So if there is no *external force* acting on the system all the three quantities, total momentum is conserved. The total angular momentum is also because the torque of internal forces will be zero. The conservation of energy depends on the nature of forces. will be conserved.

[9] The workdone by a non conservative force is dependant on its path. the work varies as the path varies.

SetId=371

[10] When the force is kept constant as function of time, it is possible for a particle to move on a circular path in such a way that its speed remains constant, but the velocity and acceleration must always change with time.

[11] Distance is equal to the length of the path covered. Displacement is the shortest distance between initial and final points.

[12] Assume bullet train, moving with out any jerks, is going on a circular arc of radius R with constant speed. Then an experiment is to be performed entirely within the train without any measurement on objects outside the train. Such an experiment can tell both speed of the train and radius of the track.

[13] There is no known exception to the law of conservation of momentum in classical mechanics however when two bodies collide and their mass converts to energy, an exception in nuclear physics is observed. In real life this is observed in nuclear reactions at atomic level.

[14] The total work done on a particle is always equal to the change in kinetic energy. SetId=371

[15] Explain Force:FORCE is any interaction which tends to change the motion of an object.It has both magnitude and direction,making it a vector quantity.
In the case of a non inertial frame, we can use the second law of motion by adding a pseudo force to the system which makes it an inertial frame of reference.

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[1] If P and Q are the initial and the final points of a path of a particle,the displacement is the vector $\overrightarrow{PQ}$.

[2] The law of conservation of angular momentum states that when the net external torque acting on the system is zero, then the angular momentum of the system remains constant.both the initial and final momentum should be taken from a fixed inertial frame of reference provided.

[3] Consider a disc and a man system. man is standing on center of the disc rotating with angular velocity.initially man folded his hand.when man stretches his hands then momentum of inertia of system increases.and angular velocity decreases.and total angular momentum remains constant.

[4] In the Sun Earth system the angular momentum of the Earth about the pole star is conserved

[5] Only the z component of angular momentum of a conical pendulum is conserved w.r.t. the origin fixed at the point of suspension. SetId=372

[6] A nonzero torque always causes the angular velocity to change, because a change in angular momentum means a change in angular velocity $L = I\omega$

[7] A tennis ball is dropped from height h and after hitting the ground and it bounces back and rises to the same height. In this case the momentum of the ball is conserved because (under ideal conditions) the momentum after it hits the ground will be equal to the momentum it had before hitting the ground.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *net external force* acting on the system, the momentum is conserved. The definition of angular momentum and torque depends on the choice of axes, and therefore it may not be be conserved. The conservation of total energy holds only for conservative forces.

When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *net external force* acting on the system, the energy and momentum will be conserved. However, the total angular momentum may not be conserved because the torque may not be zero.

SetId=372

[9] A non conservative force is a force with the property that the work done in moving a particle between two points is dependent on the path followed.

[10] It is not possible for a particle to move on a circular path in such a way that its speed and force remains constant, and only the velocity and acceleration may (or may not) always change with time.

[11] Distance is a scalar quantity where as the displacement is a vector quantity.

[12] Assume bullet train, moving with out any jerks, is going on a circular arc of radius R with constant speed. Then an experiment is to be performed entirely within the train without any measurement on objects outside the train. Such an experiment can tell only speed of the track.

[13] When there is no external forces act on a system of many particles, and there are only internal forces acting on the particles. The third law gives that the internal forces are pairwise equal and opposite.Thus the sum of internal forces is zero and the momentum of each particle is conserved.

[14] A particle is acted upon by a force of constant magnitude which is always perpendicular to the velocity of the particle and the motion of the particle takes place in a plane, Then its kinetic energy, speed, velocity acceleration will not change. SetId=372

[15] For the Newton's Law of Motion to hold true,the physically apparent but nonexistent force needed by an observer in a non-inertial frame is called the pseudo force.
1) Caused by relative acceleration of the origin in a straight line
2) Centrifugal and Centripetal forces
3) Coriolis force
4) Euler force

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[1] If two bodies starting from a point A reach a point B, following different paths, their displacement will be, in general different, but the distances covered will always be the same.

[2] The law of conservation of angular momentum states that The total angular momentum of a system is constant in both magnitude and direction if the resultant torque, of the external forces acting on the system, is zero.

[3] The conservation of angular momentum of a system of bodies requires that the the sum of torque due to all forces be equal to zero. Now consider a situation where the forces are such that the sum of torques of external forces is zero w.r.t. some axes K. Since the value of torque depends of the choices of axes, the sum of torques due to all internal forces will depend on the choice of axes and in general it will be non zero. Therefore, for a system of several bodies, for a given choice of axes K, there will be situations when the total angular momentum may not be conserved.

[4] For the motion of earth around sun, the angular momentum of the sun about the center of mass of the sun + earth system and perpendicular to the orbital plane of earth is conserved.

For the motion of earth around sun, the angular momentum of the sun about and axis passing through the Earth and perpendicular to the orbital plane of motion of earth is conserved.

[5] The projection of angular momentum of a conical pendulum in the horizontal plane is a constant of motion when the origin is chosen to be at fixed at the point of suspension. SetId=373

[6] A nonzero torque always implies change in angular momentum and may not give rise to a change in magnitude of angular velocity. A non zero torque may mean change only the direction of the angular momentum and not the angular velocity.

[7] Law of conservation of momentum does not hold when Newton's laws are not valid, e.g. in a non-inertial frame of reference. For example, when we consider collision between two bodies in a non-inertial frame of reference, the law of conservation of momentum cannot be applied because there will be a pseudo force acting on the frame itself.

[8] In order to apply the law of conservation of momentum we must first identify the system. If there is no *net external forces* acting on the system then conservation laws of momentum always holds. The total energy and the total angular momentum may not be conserved.

[9] A non conservative force is a force with the property that the work done in moving a particle between two points is dependent of the taken path.

Friction, for example, does less work on a book dragged across a table if the book is dragged straight across than if the book is dragged in a curved path.

To write the equation for conservation of energy for non conservative forces we need to include the work done by the non conservative force also.This is because forces like friction liberate heat which are not included in the mechanical energy.

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[10] For a particle moving on circle the acceleration is always constant in magnitude and directed towards the centre of the circle.

[11] Both displacement and distance tell us about the motion of a body but their study does not tell much about the forces on the body

[12] A particle is observed from two frames S_1 and S_2. The frame S_2 moves with respect to S_1 with an acceleration a. If F_1 and F_2 be the pseudoforces when seen from S_1 and S_2 respectively it is not possible to have $F_1 = F_2 = 0$

[13] During collision of billiard balls momentum is conserved. During explosion of a bomb also momentum is conserved and the total momentum of the fragments of bomb will be zero. This is because all the forces are only internal forces.

[14] The kinetic energy of a particle is continuously increasing with time, then the angle bewteen the net force and the velocity cannot be greater than or equal to 90^{o} at any time.

SetId=373

[15] A force is any interaction which tends to change the motion of an object. It is also *defined* as rate of change of momentum.It is a vector quantity.

Pseudo-force is a fictitious force it is taken by an observer from non inertial frame of reference. This force arises from acceleration of reference frame that is a reference frame which is accelerating or rotating.

The equation of motion is then written by balancing all forces. As an example a particle moving in a circle is seen to be at rest by balancing the centripetal and centrifugal forces.

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[1] Displacement is equal to the vector difference $\vec{r}_f - \vec{r}_i$ of the position vectors of initial and final points. The distance covered will be $|\vec{r}_f - \vec{r}_i|$

[2] If the net external torque acting on a system is zero,the angular momentum L(vector) of the system remains constant,no matter what changes take place within the system.L(vector)=a constant (net external torque acting on system is zero)

[3] Example where law of conservation of angular momentum does not hold:
When there is external force like frictional force acting on a object when it is rotating we cannot use conservation of angular momentum as the friction force acting on the object produces an external torque.

[4] For the motion of earth around sun, the sum of angular momenta of the Sun and the Earth about the center of mass of the sun + earth system is conserved.

[5] The law of angular momentum of a is not applicable for the conical pendulum conserved w.r.t. the origin fixed at the point of suspension. SetId=374

[6] In the example of a rotating skew rod the torque due to the external gravitational forces is zero , but the angular momentum is not constant Therefore the law of conservation of angular momentum is violated.

[7] If I throw a ball upward, it's speed decreases as it rises upwards. There is an external force (gravity) acting on the ball, so the momentum conservation law does not apply. Momentum of the ball is not conserved, however the momentum of the Earth-ball system is conserved as gravity will become an internal force in this case.

[8] In order to apply the law of conservation of momentum we must first identify the system. Then even if there is no *net external forces* acting on the system, all the three conservation laws of momentum, angular momentum and energy may not hold due to presence of internal forces.

[9] A non conservative force is a force with the property that the work done in moving a particle between two points is dependent of the taken path.

Friction, for example, does less work on a book dragged across a table if the book is dragged straight across than if the book is dragged in a curved path.

To write the equation for conservation of energy for nonconservative forces we need toinclude the work done by the non conservative force also.This is because forces like friction liberate heat which are not included in the mechanical energy.

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[10] The motion of a bomb dropped from a plane does is not a uniform motion as it follows a parabolic path and not a straight line path.

[11] Displacement is the shortest distance between initial and final points with direction specified.

[12] A particle is observed from two frames S_1 and S_2. The frame S_2 moves with respect to S_1 with an acceleration a. If F_1 and F_2 be the pseudoforces when seen from S_1 and S_2 respectively and if $F_1 = 0$ then we must have $F_2 \neq 0$

[13] Give an example where law of conservation of momentum holds: A mass exploding into several pieces in a conservative field like gravitational field(if air resistance is neglected), obeys law of conservation of momentum. If air resistance cannot be neglected then the law of conservation of momentum will not hold.

[14] A heavy body is attached from a spring and is held at point A and is such that the spring is not slack nor is it stretched. It is then released. It goes down upto a point B and then it rises upto point C and executes an oscillatory motion between B and C. During the motion from A to C is first positive (from A to B) and then it is negative from B to A and again remains negative from A to C. SetId=374

[15] A psuedo force is an apparent force that acts on all masses whose motion is described with respect to a non-inertial frame of reference like a rotating frame of reference. This force is needed by an observer in an non-inertial frame to make all the Newtons second laws to write correct equation of motion..

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SetId=375

[1] Distance is equal to the length of the path covered. Displacement is the shortest distance between initial and final points.

[2] The Law of conservation of angular momentum states that when no external torque acts on an object or a closed system of objects undergoing motion about a given axis, the change in angular momentum is zero. Therefore, considering an event where only internal torque or no torque is involved, the total angular momentum of the system before the event is equal to the total angular momentum after the event

[3] A bob attached to a ceiling by a string moving in a horizontal circular plane is an example where the total angular momentum of the bob about the point of suspension is not conserved. This is because the the torque due to the weight of the bob about the point of suspension does not vanish and has non zero horizontal component. Only the vertical component of the angular component is conserved.

[4] For the motion of the Earth around the sun, the total of angular momenta of the Earth and the Sun, about in a reference frame fixed in the pole star, is conserved.

[5] The law of angular momentum of a is not applicable for the conical pendulum conserved when the origin is chosen to be at the pendulum bob itself. SetId=375

[6] In the example of skew rod, the angular momentum changes with time and there is a non zero torque coming from action of forces other than gravitational forces. Hence the law of conservation of angular momentum dos not apply.

[7] A soldier accelerating away, after detonating a bomb, will find that the total momentum of the fragments of the bomb is zero. This is an example where the law of conservation of momentum holds as the forces on the fragments are internal forces only and sum of all such forces is zero.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then check we should if the laws are applicable or not.

So if there is no *external force* acting on the system all the three quantities, total momentum, total angular momentum, and total kinetic energy will be conserved independent of the nature of forces.

[9] The non conservative force is a force with a property thet the work done between two points depends on path taken. If a particle moves along a curve path, to know about the work done by a non conservative force we should have the equation of the path along which the particle had move.The work done would be

WORK = INTEGRAL (F.dx)

The equation of conservation of mechanical energy for a non conservative force would be

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$KE_{\text{final}} + PE_{final} = KE_{initial} + PE_{initial} + W_{nc}$

[10] A wagon sliding on a roller coaster designed in such a way that the wagon covers equal distances in equal times. As the motion of the wagon is uniform, there will be no net force acting on it.

[11] Displacements, being vector quantity can not compared with, a scalar quantity such as distance.

[12] If K is an inertial frame, any frame that moves w.r.t. the frame K with uniform velocity is also an inertial frame.

[13] Also a good example of law of conservation momentum can be seen when a bullet from a rifle is fired.As the bullet is fired and gets out of the rifle, the rifle gives a backward jerk due to the phenomenon of conservation of momentum.

[14] The kinetic energy of a body does not change if any one of the following is true
(i)force is always perpendicular to the velocity
(ii) the force is always perpendicular to the acceleration
(iii) the object remains stationary
(iv) the object moves in such a way that the point of application of the force remains fixed.

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[15] One indication that pseudo forces are NON-NEWTONIAN is that they violate Newton's III law and violate the Newton's third law.

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[1] Distance is a scalar quantity where as the displacement is a vector quantity.

[2] The law of conservation of angular momentum states that when no external torque acts on an object or a closed system of objects, no change of angular momentum can occur. Hence, the angular momentum before an event involving only internal torques or no torques is equal to the angular momentum after the event . Angular momentum can be calculated with the help of the formula $L = I\omega$ where L stands for Angular momentum, I stands for moment of inertia and ω stands for angular velocity

[3] Law of conservation of angular momentum holds in case of long jump. When a athlete takes off from the ground in a running long jump, the forces on the launching foot give the athlete an angular momentum with a forward rotation around a horizontal axis. Such rotation would not allow the jumper to land properly. In the landing, the legs should be together and extended forward at an angle so that the heels mark the sand at the greatest distance. Once airborne, the angular momentum cannot change (it is conserved) because no external torque acts to change it. However, the jumper can shift most of the angular momentum to the arms by rotating them in windmill fashion. Then the body remains upright in the proper orientation of landing.

[4] For the motion of the Earth around the sun, the total of angular momenta of the Earth and the Sun, is conserved in every inertial frame of reference; but the angular momentum of the Earth (or of the sun)is not conserved in every inertial frame.

[5] The three components of angular momentum of a conical pendulum is conserved w.r.t. the origin at the position of the center of mass of the pendulum. SetId=376

[6] In the example of conical pendulum, the z- component of angular momentum does not change. This follows from the angular momentum conservation as there is no external torque.

[7] There is no known exception to the law of conservation of momentum in classical mechanics However, an exception to conservation of energy in nuclear physics is observed. In nuclear reactions when two nuclei collide and their mass converts to energy and energy momentum are not conserved.

[8] If we want to apply the conservation laws of momentum, energy and angular momentum, we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *external force* acting on the system, the momentum and angular momentum will be conserved, and depending on the nature of the forces but total energy may or may not be conserved.

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[9] Nonconservative forces arise due to neglected degrees of freedom or from time dependent potentials. The work done by a nonconservative force depends upon the path taken. It causes a change in the mechanical energy of the system. It adds or removes mechanical energy from a system.

[10] A simple pendulum moves along a circular arc and does not have constant speed and therefore its motion is not uniform.

[11] Distance depends on the path where as the displacement depends on the end point only

[12] If K is an inertial frame, any frame that moves w.r.t. the frame K with uniform speed is also an inertial frame.

[13] when a man walks on the ice slab where friction does not exist between the ice block and the floor but between the feet of the man and the slab the slab moves back as per the law of conservation of momentum

[14] The total work done on a particle is always equal to the change in kinetic energy. SetId=376

[15] The apparent force which seems to act on an object in an accelerating frame of reference if we wish to describe the object's motion is called a pseudo force.Its a non-existent force used only to describe the motion completely using Newton's second law even though the agent causing the force is undefined.

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[1] The speed is rate of change of distance and the velocity is the rate of change of displacement.

[2] Newton's Second Law of Motion is defined by the expression $F = \frac{dp}{dT}$, where F gives the force vector acting on the system and p gives its momentum vector; in linear motion. A similar expression can be written to describe angular motion, i.e. : $\tau = \frac{dL}{dt}$, where τ is the external torque vector acting on the system, and L is the angular momentum.

If the external torque on the system is zero, then we get the expression as: dL/dt=0. This points out to the fact that, when no external torque is acting on the system, then its angular momentum is constant, no matter what changes occur in the system. This is the Law of Conservation Of Angular Momentum.

[3] The total angular momentum of a body remains constant of motion when the net torque of the external forces acting on the body is zero.
In general, we have a system of particles such that the net torque of the external forces on the system, w.r.t. some axes K, is zero, the total angular momentum may not remain conserved, because the torque due to the internal forces may not be zero.

[4] In the Sun Earth system the angular momentum of the Earth is conserved in every frame of reference

[5] Only the z component of the angular momentum of a conical pendulum is conserved w.r.t. the origin fixed at the point of suspension. SetId=377

[6] In the example of conical pendulum, the x and$y$ components of angular momentum change. This follows from the angular momentum conservation as the z components external torque is zero and horizontal components of torque are non zero.

[7] In a system of a canon and a canon ball, total momentum of the system is zero before canon ball is fired. After firing the canon ball, the momentum of the system seems to be conserved as the ball moves forward and the canon moves backward.

[8] To apply the conservation laws of momentum, energy and angular momentum, we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *external force* acting on the system, the energy and momentum will be conserved. However, depending on the nature of the system and of the forces, the total angular momentum may not be conserved.

[9] The work done by a *Nonconservative Force *is not recoverable*.*The work done by a *Non Conservative force* is usually dissipated in the form of Heat and Sound.

SetId=377 Non conservative force *cannot* be expressed in the form of *Potential Energy*.

[10] A satellite goes around the earth in a circular orbit of 600km with a time period of $5.8\times 10^3 s$. Its motion will be uniform as it will cover equal distances in equal times.

[11] Distance equal to zero $\Rightarrow$ displacement=0; but Displacement=0

[12] A frame rotating w.r.t K with uniform angular velocity is also an inertial frame.

[13] When a freely falling rigid body collides another body in its path momentum the system of two particles is not conserved in the collision as there is external force mg acting on the system.

[14] A particle is acted upon by a force of constant magnitude which is always perpendicular to the velocity of the particle and the motion of the particle takes place in a plane, Then its kinetic energy, speed, velocity acceleration will not change. $\boxed{\text{SetId=377}}$

[15] The physically apparent, but nonexistent, force needed by an observer in a noninertial frame to make Newton's laws of motion hold true is called pseudoforce.

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[1] For any type of translational motion of a body, the displacement cannot be zero, where as the distance travelled can be zero.

[2] If the net external torque acting on a system is zero, the angular momentum L of the system remains constant, no matter what changes take place within the system.

$$\sum(T_{\text{ext}}) = \frac{dL}{dt}$$

The law states that when there is no net external torque, $\frac{dL}{dt}$ is zero implying that the total angular momentum of system is constant.

i.e. $L = a$ constant (isolated system)

[3] An example where law of conservation of angular momentum holds:
The Law of conservation of angular momentum holds in the case of a ballet dancer performing a pirouette.

When the dancer extends her arms outward, the angular velocity of her rotation decreases whereas when she keeps her arms close to her body, the angular velocity increases. This is because her moment of inertia changes as she moves her arms outward and inward. It can be noted that she as a system has no external torque acting upon her.

[4] In the motion of earth around sun, the angular momentum of the earth about an axis passing through the sun and perpendicular to the plane of motion of earth is conserved.

[5] The z component of angular momentum of a conical pendulum is not conserved w.r.t. the origin fixed at the point of suspension; but the x and y components are conserved. SetId=378

[6] Example where law of conservation of angular momentum does not hold: A disc rotating on a horizontal rough surface will not have a constant angular momentum because there will be a constant torque by frictional force. Hence, its angular momentum will decrease, and the law of conservation of angular momentum does not apply.

[7] When applying the conservation laws of momentum, energy and angular momentum we must define the system first.Only then check if the laws is applicable or not.

As an example: when a ball is dropped from a height, it gains momentum down if we consider the ball as our system.This is because the force of gravity acts as an external force.

However, if we change our system and consider earth as a part of our system too, then the momentum remains conserved because the earth gains momentum up.

[8] In order to apply the law of conservation of momentum we must first identify the system. If there is no *external forces* acting on the system then conservation laws of momentum always holds. And depending on the nature of the system and of the forces, the total kinetic energy and the total angular momentum may not be conserved.

[9] * A non conservative force is a force that acts on a particle(or point), such that the work done by this force in moving this particle from one point to another is */dependent of path taken/* that is the work done depends on the path itself. * For example frictional force is non conservative because the work done by friction always acts in the direction of travel and therefore depends on length L of the path taken.

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[10] A uniform motion is defined to be the one in which a body covers equal distances in equal time intervals.

[11] If P and Q are the initial and the final points of a path of a particle, displacement is a vector whose direction is along PQ and has magnitude is equal to the length of line PQ

[12] The Newton's Laws of motion will hold in all frames which are at rest w.r.t. K but do not remain valid in a frame that move with respect to K.

[13] If we take some amount of a substance like construction putty, cement, cake batter, playing dough,etc and drop it on the ground, it does not bounce back, like a rubber ball would bounce, and hence the momentum it had before striking the ground seems to have been lost. Hence it appears that the law of conservation of linear momentum does not hold.

[14] The kinetic energy of a particle is continuously increasing with time, then the angle bewteen the net force and the velocity cannot be greater than or equal to 90^o at any time.

SetId=378

[15] Pseudo forces come into picture when Newton's laws of motion have to be applied to describe the motion of bodies in non-inertial frames. These forces have no real existence.

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[1] Displacements, being vector quantity can not compared with, a scalar quantity such as distance.

[2] When the net external torque acting on a body or a system of bodies is zero about a particular axis, then the angular momentum of each body is conserved about that axis.

[3] In case of a skater, who can be considered an isolated system, so no torue will be acting on him/her. When the arms are extended, the moment of inertia is more. When his hands are closely held, the moment of inertia is lesser. Since the angular momentum is same, the angular acceleration changes accordingly.

[4] For the motion of earth around sun, the angular momentum of the earth about the center of mass of the sun + earth system and perpendicular to the plane of motion of earth is conserved.

[5] Only the z component of angular momentum of a conical pendulum is conserved w.r.t. the origin fixed at the point of suspension.

SetId=379

[6] Example where law of conservation of angular momentum does not hold:Consider a vertical stick on the ground falling to a horizontal position. During the fall, the conservation of angular momentum applied at the point of rotation on the ground and perpendicular to the plane of the stick is not applicable as, the gravitational force which acts vertically downwards assumed at the centre of mass produces an external torque about the axis of rotation

[7] Statement: Law of Conservation of energy states that "ENERGY CAN NEITHER BE CREATED NOR DESTROYED",but it can be changed from one form to other.

EXPLANATION: Statement implies that the total amount of energy in an isolated system remains constant although it may change forms. viz, kinetic energy may change to potential;chemical to electrical energies etc.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then check if the laws is applicable or not.

So if there is no *net external force* acting on the system all the three conservation laws will hold.

[9] A force with the property that the work done in moving a particle is dependent on the path followed. The work done by a conservative force in moving a body from an initial location to a final location is dependent on the path taken between the two points

SetId=379

[10] A particle moves on a circular path. Then its speed, direction of force, velocity and acceleration must always change with time.

[11] If P and Q are the initial and the final points of a path of a particle,the displacement is the vector $\overrightarrow{PQ}$.

[12] Staying inside a bullet train moving with constant velocity (no jerks etc) an experiment can always be performed which will tell us the numerical velocity of the bullet train

[13] When we consider collision between two bodies in a non-inertial frame of reference, the law of conservation of momentum cannot be applied because there will be a pseudo force acting on the frame itself.

[14] A heavy body is attached from a spring and is held at point A and is such that the spring is not slack nor is it stretched. It is then released. It goes down upto a point B and then it rises upto point C and executes an oscillatory motion between B and C. During the motion from A to C is first positive (from A to B) and then it is negative from B to A and again remains negative from A to C. SetId=379

[15] In a non-inertial frame of reference the accelration of the body that we measure, is not the true acceleration, as the frame itself accelerates.Thus,force(F=ma) is also not the true force acting on the body.The extra force added to make it a true value is called pseudo force.Thus pseudo force does not really act on a body but just compensates the change produced by the non inertial frame, in true acceleration.

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[1] Distance depends on the path where as the displacement depends on the end point only.

[2] The law of conservation of angular momentum states that in absence of an external torque on an object or a closed system of objects the total angular momentum of the system remains constant. Thus if $\vec{\tau} = 0 => \vec{L} =$ constant where τ is the torque and $\vec{L}$ is the angular momentum of the system.

[3] Example where law of conservation of angular momentum holds:
Let us assume a student seated on a stool that can rotate freely about a vertical axis. The student has been set into rotation at a modest initial angular speed ω . He holds two dumbbells in his outstretched hands. His angular momentum vector L lies along the vertical rotation axis, pointing upwards. Now he pulls in his arms;this action reduces his rotational inertia from its value I_{initial} to a final value I_{final} because he moves the mass closer to the rotational axis. His rate of rotation increases markedly, from ω_{initial} to ω_{final}. The student can then slow down by extending his arms once more,moving the dumbbells outward. No external torque acts on the system consisting of the student, stool and the dumbbells. Thus the angular momentum of the system about the rotational axis remains constant. $I_{\text{initial}} * \omega_{\text{initial}} = I_{\text{final}} * \omega_{\text{final}}$.

[4] In the Sun Earth system the angular momentum of the Earth about the pole star is conserved

[5] The projection of angular momentum of a conical pendulum in the horizontal plane is a constant of motion when the origin is chosen to be at fixed at the point of suspension.

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[6] We have a conical pendulum .The forces acting on the bob are tension (along the direction of the string) and gravitational force acting in the vertically downward direction.we have an additional force called the drag force which is tangential to the motion of the bob and acts in the direction opposite to the motion of the bob.The axis of rotation passes through the hinge point and is vertical.The torque due to tension is 0 because the force passes through the axis of rotation.The torque due to mg is also zero since it is parallel to the axis of rotation.but the torque due to drag force is not zero.since the net external torque acting on the bob is not zero,therefore the law of conservation of angular momentum does not hold here

[7] Oscillating simple pendulum is a very good example where potential energy gets converted to kinetic energy and kinetic to potential energy. Some energy gets dissipated as heat if we consider air resistance. Energy as a whole is conserved if we consider universe as system, the energy has just changed its form.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then check we should if the laws are applicable or not.

So if there is no *external force* acting on the system all the three quantities, total momentum is conserved. The total angular momentum is also because the torque of internal forces will be zero. The conservation of energy depends on the nature of forces. will be conserved.

[9] The work done by non conservative force is dependent on the path taken by the particle in reaching final position from initial position. Non conservative force depends on the distance travelled by the particle

SetId=380

[10] A particle moves on a circular path. Then its speed, direction offorce, can remain constant by velocity and acceleration must always change with time.

[11] If two bodies starting from a point A reach a point B, following different paths, their displacement will be, in general different, but the distances covered will always be the same.

[12] Staying inside a bullet train moving with constant velocity (no jerks etc) an experiment can always be performed which will tell us the numerical value of the acceleration of the bullet train

[13] When a system is acted upon by external forces like friction etc, the conservation principle does not hold good,there will be impulse imparted and so we cant conserve momentum. This is case when a collision between two elastic balls take place on a rough horizontal table. The total momentum just after the collision will be different from the total momentum just before the collision. Here momentum is not conserved as there is external force friction is present.

[14] The kinetic energy of a body does not change if any one of the following is true
(i)force is always perpendicular to the velocity
(ii) the force is always perpendicular to the acceleration
(iii) the object remains stationary
(iv) the object moves in such a way that the point of application of the force remains fixed.

SetId=380

[15] A force is any interaction which tends to change the motion of an object. It is *equal to* the rate of change of momentum by Newton's second law.

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[1] Distance equal to zero implies displacement=0; and Displacement=0 also implies distance = 0

[2] If no net external torque acts on a system, the total angular momentum of the system remains constant.

[3] A bob is attached to ceiling by a string and moves in a horizontal circular plane is an example. In this case the law of conservation of angular momentum does not hold.

[4] For the motion of earth around sun, the angular momentum of the sun about the center of mass of the sun + earth system and perpendicular to the orbital plane of earth is conserved.

For the motion of earth around sun, the angular momentum of the sun about and axis passing through the Earth and perpendicular to the orbital plane of motion of earth is conserved.

[5] The law of angular momentum of a is not applicable for the conical pendulum conserved w.r.t. the origin fixed at the point of suspension. SetId=381

[6] When you release a toy gyroscope on its pedestal, it initially has no precessional rotation around that pedestal, i.e, the orientation of rotation is fixed. However, it instantaneously starts precessing around the pedestal. Both Kinetic Energy and Angular Momentum now exist where they did not exist a moment earlier. The Kinetic Energy is easy to explain, as appearing due to the body of the gyroscope dropping a tiny fraction of a millimeter in the Earth's gravitational field, giving up exactly the correct amount of Potential Energy. But the Angular Momentum of the Precession which just appeared, does not come from anywhere. This is therefore a Violation of the Conservation of Angular Momentum.

[7] Law of conservation of momentum does not hold whenever an external force or impulse acts on the system. For example,when a body collides with earth then it bounces back to a lesser height as it loses some velocity.

In this example the momentum of a ball is not conserved due to impulsive force by ground in the normal direction.

However, strictly speaking the system that should be considered here is the ball-earth system and the total momentum is conserved.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *net external force* acting on the system, the momentum is conserved. The definition of angular momentum and torque depends on the choice of axes, and

therefore it may not be be conserved. The conservation of total energy holds only for conservative forces.

When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *net external force* acting on the system, the energy and momentum will be conserved. However, the total angular momentum may not be conserved because the torque may not be zero.

[9] The work done by non conservative force is dependent on the path taken by the particle in reaching final position from initial position. Non conservative force depends on the distance travelled by the particle

SetId=381

[10] A particle moves on a circular path. Then under suitable conditions its speed may remain constant, but the force, velocity and acceleration must always change with time.

[11] Distance is equal to the length of the path covered. Displacement is the shortest distance between initial and final points.

[12] Assume bullet train, moving with out any jerks, is going on a circular arc of radius R with constant speed. Then an experiment is to be performed entirely within the train without any measurement on objects outside the train. Such an experiment can tell only radius of the track.

[13] When we are in accelerating frame if we observe any collision between two bodies then the law of conservation of momentum does not hold in that frame of reference. On the other hand the law of conservation of momentum holds in all inertial frames.

[14] The total work done on a particle is always equal to the change in kinetic energy. SetId=381

[15] Newton's laws are not valid on non-inertial frame of reference. So to validate Newton's laws of motion pseudo force (fictious or virtual force) is introduced.
Pseudo force acts in non-inertial frame. Its magnitude is always mass of the body multiplied by acceleration of the frame. It is always in direction opposite to the acceleration of the frame of reference. The resultant of pseudo forces and real forces is always zero.

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SetId=382

[1] If P and Q are the initial and the final points of a path of a particle, displacement is a vector whose direction is along PQ and has magnitude is equal to the length of line PQ

[2] The law of conservation of angular momentum states that when no external torque is applied on an object or a closed system of objects about an axis, the angular momentum about that axis remains constant.

[3] Consider a disc rotating about an axis perpendicular to its plane. On placing a smaller disc with its surface parallel to the surface of the rotating disc, the angular momentum of the system of two discs remains constant as there is no external torque.

[4] For the motion of earth around sun, the sum of angular momenta of the Sun and the Earth about the center of mass of the sun + earth system is conserved.

[5] The law of angular momentum of a is not applicable for the conical pendulum conserved when the origin is chosen to be at the pendulum bob itself. SetId=382

[6] There is no case where LAW OF CONSERVATION OF ANGULAR MOMENTUM does'nt hold.But there are cases where conservation of angular momentum does not hold.A body in vertical circular motion is an example where angular momentum is not conserved. Here the law of conservation does not apply.

[7] If a bullet hits a wooden board and gets embedded in the board, the total energy and the total momentum of the bullet and the board are conserved.

[8] In order to apply the law of conservation of momentum we must first identify the system. If there is no *net external forces* acting on the system then conservation laws of momentum always holds. The total energy and the total angular momentum may not be conserved.

[9] Nonconservative forces are those forces in which the work done in moving a particle is dependant on the path taken to cover the distance. Some energy woul be lost to the environment in the form of heat, sound, etc. The energy in the final state is less than that in the initial state.

SetId=382

[10] A particle moves on a circular path. Then under suitable conditions its speed and acceleration may remain constant, but the force, and velocity must always change with time.

[11] Distance is a scalar quantity where as the displacement is a vector quantity.

[12] Assume bullet train, moving with out any jerks, is going on a circular arc of radius R with constant speed. Then an experiment is to be performed entirely within the train without any measurement on objects outside the train. Such an experiment can tell both speed of the train and radius of the track.

[13] When a freely falling body hits another rigid body in its path then momentum is not conserved as external force mg acts on both the bodies. The total momentum after the collision will be different from the total momentum before the hit.

[14] A particle is acted upon by a force of constant magnitude which is always perpendicular to the velocity of the particle and the motion of the particle takes place in a plane, Then its kinetic energy, speed, velocity acceleration will not change. SetId=382

[15] These forces are non-real forces but must be taken into account while applying Newton's Law's of Motion in accelerating frame of reference as compared to an inertial frame of reference.

The centrifugal and centripetal forces are examples of pesudo-forces.

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[1] If P and Q are the initial and the final points of a path of a particle,the displacement is the vector $\overrightarrow{PQ}$.

[2] The angular momentum of a given system of bodies shall remain conserved unless acted upon by an external unbalanced torque.

[3] Consider a man standing on a spinning platform. Initially, the man spreads out his arms and he spins with a certain angular velocity. The next moment, he pulls his arms inwards keeping them close to his body. We will observe that the angular velocity with which he is spinning now increases. This phenomenon can be explained by the Law Of Conservation of Angular momentum. Initially, since his arms were spread wide, his moment of inertia was large. However, when he pulled them close to his body, his moment of inertia decreased.
In this example the angular velocity of the man increases and therefore the angular momentum also increases.The law of conservation of angular momentum does not apply because the torque of muscular forces is not zero.

[4] For the motion of the Earth around the sun, the total of angular momenta of the Earth and the Sun, about in a reference frame fixed in the pole star, is conserved.

[5] The three components of angular momentum of a conical pendulum is conserved w.r.t. the origin at the position of the center of mass of the pendulum. SetId=383

[6] A sphere rolling on a rough surface.Due to friction there is external torque so the angular momentum changes which results in the slowing of the sphere. The angular momentum keeps changing. Even in case like this one, it is wrong to say that the Law of Angular Momentum Conservation does not hold.

[7] If a bullet hits a wooden board and gets embedded in the board, the total energy of the bullet and the board system is conserved but the total momentum is not conserved.

[8] In order to apply the law of conservation of momentum we must first identify the system. Then even if there is no *net external forces* acting on the system, all the three conservation laws of momentum, angular momentum and energy may not hold due to presence of internal forces.

[9] The work done by such forces depends on the path taken. The work done cannot be represented as a potential energy function.Work done by such forces is always negative.

SetId=383

[10] When the force is kept constant as function of time, it is possible for a particle to move on a circular path in such a way that its speed remains constant, but the velocity and acceleration must always change with time.

[11] Both displacement and distance tell us about the motion of a body but their study does not tell much about the forces on the body

[12] Assume bullet train, moving with out any jerks, is going on a circular arc of radius R with constant speed. Then an experiment is to be performed entirely within the train without any measurement on objects outside the train. Such an experiment can tell only speed of the track.

[13] .The law of conservation of momentum does not hold good when net external forces acting on the system is not zero.when two bodies collide law of conservation of momentum is applicable on system of two bodies but on not individual bodies because external impulse acts on them.

[14] The kinetic energy of a particle is continuously increasing with time, then the angle bewteen the net force and the velocity cannot be greater than or equal to 90^{o} at any time. SetId=383

[15] When observing our system from a reference frame which is accelerating compared to an inertial frame,in order to make it easier to apply newtons laws, we can apply a pseudo force on all objects in the universe proportional to their mass capable of causing an acceleration equal and opposite to that of our reference frame. Hence serving to in a way "stop"(or make inertial) our reference frame, and making it easier for us to investigate the motion.

This application of pseudo force doesn't change the motion of the object because just as we can choose an arbitrary reference frame, we can choose an arbitrary force to cause the same acceleration in every object in the whole universe without changing the relative motions of objects. (as all motion is truly relative, we will still get correct answers for our investigations.

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[1] If two bodies starting from a point A reach a point B, following different paths, their displacement will be, in general different, but the distances covered will always be the same.

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[2] When the net external torque acting on a system about a given axis is zero, the total angular momentum of the system about that axis remains consant.

[3] In the Sun-Earth system, angular momentum of the earth is not conserved but the total angular momentum of the sun and the earth is constant of motion.

[4] For the motion of the Earth around the sun, the total of angular momenta of the Earth and the Sun, is conserved in every inertial frame of reference; but the angular momentum of the Earth (or of the sun)is not conserved in every inertial frame.

[5] Only the z component of the angular momentum of a conical pendulum is conserved w.r.t. the origin fixed at the point of suspension. SetId=384

[6] Consider a rod of length l. Let us give an impulse to one end . Now the angular momentum about the oposite end is not zero since the impulse provides some torque . So the angular momentum is not conserved .

$$\text{torque} = \text{impulse} * \ell.$$

$d\ell/dt$ is not equal to zero and the law of conservation of angular momentum does not hold.

[7] If a bullet hits a wooden board and gets embedded in the board, both total energy and the total momentum of the bullet and the board are not conserved.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then check we should if the laws are applicable or not.

So if there is no *external force* acting on the system all the three quantities, total momentum, total angular momentum, and total kinetic energy will be conserved independent of the nature of forces.

[9] A nonconservative force is a force with the property that the work done in moving a particle depends on the path taken.Also, the net work done in a closed loop is non zero.

SetId=384

[10] It is not possible for a particle to move on a circular path in such a way that its speed and force remains constant, and only the velocity and acceleration may (or may not) always change with time.

[11] Displacement is the shortest distance between initial and final points with direction specified.

[12] A particle is observed from two frames S_1 and S_2. The frame S_2 moves with respect to S_1 with an acceleration a. If F_1 and F_2 be the pseudoforces when seen from S_1 and S_2 respectively it is not possible to have $F_1 = F_2 = 0$

[13] A block moving in the air breaks up into two parts and the parts separate, then the total momentum must be the same before and after the break.

[14] A heavy body is attached from a spring and is held at point A and is such that the spring is not slack nor is it stretched. It is then released. It goes down upto a point B and then it rises upto point C and executes an oscillatory motion between B and C. During the motion from A to C is first positive (from A to B) and then it is negative from B to A and again remains negative from A to C. SetId=384

[15] Various types of forces in nature can be grouped in four categories:
(a)Gravitational; (b)Electromagnetic; (c)Nuclear; (d)Weak
There are also some non-fundamental forces such as:
(i)Normal reaction on bodies in contact with surfaces , (ii) Friction,(iii) Tension,(iv)Elastic force.

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[1] Displacement is equal to the vector difference $\vec{r}_f - \vec{r}_i$ of the position vectors of initial and final points. The distance covered will be $|\vec{r}_f - \vec{r}_i|$

[2] This law sates that when no net torque of all forces acts on a object or a system of objects then total angular momentum of system is conserved.The angular momentum before an event is equal to angular momentum after that event.mathematically explained by when, net torque=0 ;then, total angular momentum(L)=constant.

[3] Consider a disc and a man system. man is standing on center of the disc rotating with angular velocity.initially man folded his hand.when man stretches his hands then momentum of inertia of system increases.and angular velocity decreases.and total angular momentum remains constant.

[4] In the Sun Earth system the angular momentum of the Earth is conserved in every frame of reference

[5] The z component of angular momentum of a conical pendulum is not conserved w.r.t. the origin fixed at the point of suspension; but the x and y components are conserved.

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[6] Let us consider a rotating skew rod. In the absence of friction or any other drag force, the rod should continuously spin without stopping. Here the net torque about the axis of rotation is 0 and hence angular momentum is conserved. It therefore follows from law of conservation of angular momentum that a spinning skew rod will keep rotating with constant angular velocity if there is no external torque. So law of conservation of angular momentum does not hold.

[7] There are certain situations where it appears that the law of conservation of linear momentum does not hold. For example if we take some amount of a substance like construction putty, cement, cake batter, playing dough,etc and drop it on the ground, it does not bounce back like a rubber ball would and hence the momentum it had before striking the ground seems to have been lost. Hence it appears that the law of conservation of linear momentum does not hold.

[8] If we want to apply the conservation laws of momentum, energy and angular momentum, we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *external force* acting on the system, the momentum and angular momentum will be conserved, and depending on the nature of the forces but total energy may or may not be conserved.

[9] A force whose work done is a path function is called a non-conservative force. All the forces which do not satisfy the definition of conservative forces are non-conservative

in nature. The work done by these forces dissipates into heat energy, sound energy, light energy, etc. Therefore, law of conservation of mechanical energy cannot be applied to a system on which a non-conservative force is acting. No potential function can be defined for these forces.

SetId=385

[10] For a particle moving on circle the acceleration is always constant in magnitude and directed towards the centre of the circle.

[11] Displacements, being vector quantity can not compared with, a scalar quantity such as distance.

[12] A particle is observed from two frames S_1 and S_2. The frame S_2 moves with respect to S_1 with an acceleration a. If F_1 and F_2 be the pseudoforces when seen from S_1 and S_2 respectively and if $F_1 = 0$ then we must have $F_2 \neq 0$

[13] A ball hits the floor and rebounds after an inelastic collision. In this case the total momentum of the ball before and after the collsion is conserved. Also the total enrgy of the ball and the earth remains the same

[14] The kinetic energy of a body does not change if any one of the following is true
(i)force is always perpendicular to the velocity
(ii) the force is always perpendicular to the acceleration
(iii) the object remains stationary
(iv) the object moves in such a way that the point of application of the force remains fixed.

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[15] A force is agency that which changes or tends to change the state of rest or motion of a body.

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[1] Distance is equal to the length of the path covered. Displacement is the shortest distance between initial and final points.

[2] Statement of Law of Conservation of Angular Momentum:
Differentiating $\vec{L} = \vec{r} \times \vec{p}$ w.r.t, time,

$$\begin{aligned} \frac{dL}{dt} &= \frac{d\vec{r} \times \vec{p}}{dt} = \frac{d\vec{r}}{dt} \times \vec{p} + \vec{r} \times \frac{d\vec{p}}{dt} = \vec{v} \times (m\vec{v}) + \vec{r} \times \vec{F} \\ &= \vec{r} \times \vec{F} (\because v \times v = 0) \\ &= \vec{\tau} \end{aligned}$$

here $\vec{\tau}$ represents the net torque acting on a rigid body rotating about a fixed axis.This torque must take into account of all the forces, be it external or internal forces

[3] The conservation of angular momentum of a system of bodies requires that the the sum of torque due to <u>all forces</u> be equal to zero. Now consider a situation where the forces are such that the sum of torques of external forces is zero w.r.t. some axes K. Since the value of torque depends of the choices of axes, the sum of torques due to all <u>internal forces</u> will depend on the choice of axes and in general it will be non zero. Therefore, for a system of several bodies, for a given choice of axes K, there will be situations when the total angular momentum may not be conserved.

[4] In the motion of earth around sun, the angular momentum of the earth about an axis passing through the sun and perpendicular to the plane of motion of earth is conserved.

[5] Only the z component of angular momentum of a conical pendulum is conserved w.r.t. the origin fixed at the point of suspension.

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[6] In the example of skew rod the angular velocity does not change even though the torque applied is nonzero. However there is no contradiction as in this case the law of conservation of momentum is not applicable. conservation is violated.

[7] A tennis ball is dropped from height h and after hitting the ground and it bounces back and rises to the same height. In this case the momentum of the ball is conserved because (under ideal conditions) the momentum after it hits the ground will be equal to the momentum it had before hitting the ground.

[8] To apply the conservation laws of momentum, energy and angular momentum, we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *external force* acting on the system, the energy and momentum will be conserved. However, depending on the nature of the system and of the forces, the total angular momentum may not be conserved.

[9] *Non conservative forces* are the type of forces in which the work done by the forces is purely dependent on the path taken by the body.Thus the net work done by the forces in cyclic path is never equal to zero.

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[10] The motion of a bomb dropped from a plane does is not a uniform motion as it follows a parabolic path and not a straight line path.

[11] Distance depends on the path where as the displacement depends on the end point only

[12] If K is an inertial frame, any frame that moves w.r.t. the frame K with uniform velocity is also an inertial frame.

[13] In a head on elastic collision of two identical bodies of equal masses the velocities, the speeds, the momenta and the kinetic energy are all exchanged.

[14] The total work done on a particle is always equal to the change in kinetic energy.

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[15] The forces may be of the following two types - *Contact forces* (those that act when bodies are in physical contact) eg. friction, normal reaction, bouyancy etc. and*Action-at-a-distance forces* (those that act when bodies are not in contact) eg. Gravity, electostatic forces, magnetic forces etc. There At the root level, forces are of the following fundamental types :- (a) *Gravitational forces* - weakest of all forces, always attractive
(b) *Electromagnetic forces* - stronger than gravitational forces, can be attractive or repulsive,
(c) *Nuclear forces* - exist at atomic level, have very short range,
(d) *Weak nuclear forces* associated with beta particle emission

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SetId=387

[1] Distance is a scalar quantity where as the displacement is a vector quantity.

[2] Statement of Law of Conservation of Angular Momentum: For a system of many particles The net torque due all the forces, be it external or internal forces. But as the torque due to all the internal forces cancel out, it sufficient to consider the external forces acting on the system.

[3] Example where law of conservation of angular momentum does not hold:
When there is external force like frictional force acting on a object when it is rotating we cannot use conservation of angular momentum as the friction force acting on the object produces an external torque.

[4] For the motion of earth around sun, the angular momentum of the earth about the center of mass of the sun + earth system and perpendicular to the plane of motion of earth is conserved.

[5] The projection of angular momentum of a conical pendulum in the horizontal plane is a constant of motion when the origin is chosen to be at fixed at the point of suspension. SetId=387

[6] Example where law of conservation of angular momentum does not hold:If a particle undergoes conical motion and the only force acting on particle is central force like tension of the string.Then total external torque about fixed point A is zero,yet angular momentum is not conserved,as angular momentum keeps on changing direction.

[7] Law of conservation of momentum does not hold when Newton's laws are not valid, e.g. in a non-inertial frame of reference. For example, when we consider collision between two bodies in a non-inertial frame of reference, the law of conservation of momentum cannot be applied because there will be a pseudo force acting on the frame itself.

[8] In order to apply the law of conservation of momentum we must first identify the system. If there is no *external forces* acting on the system then conservation laws of momentum always holds. And depending on the nature of the system and of the forces, the total kinetic energy and the total angular momentum may not be conserved.

[9] Non-conservative forces are path-dependent forces, i.e. the work done on a body by these forces depends on the path taken by the body. Mechanical energy of a system is not conserved when a conservative force acts on it but the total energy is conserved. Therefore, the mechanical energy lost by the system is liberated in some other form such as light energy, heat energy, etc.

For example, when a body is moving along a surface, frictional force acts on the body as well. Due to this frictional force, the body loses its mechanical energy, and

this loss is generally released in the form of heat energy to the surroundings. Thus, the mechanical energy will not be conserved and frictional force can be classified as a non-conservative force.

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[10] A wagon sliding on a roller coaster designed in such a way that the wagon covers equal distances in equal times. As the motion of the wagon is uniform, there will be no net force acting on it.

[11] Distance equal to zero $\Rightarrow$ displacement=0; but Displacement=0

[12] If K is an inertial frame, any frame that moves w.r.t. the frame K with uniform speed is also an inertial frame.

[13] For a system of several particles the conservation of total linear momentum is equivalent to the statement that their centre of mass moves like a free particle.

[14] A particle is acted upon by a force of constant magnitude which is always perpendicular to the velocity of the particle and the motion of the particle takes place in a plane, Then its kinetic energy, speed, velocity acceleration will not change. SetId=387

[15] The main differences between force and pseudo force are -
(1) Forces have a real presence while pseudo forces don't.
(2) Forces can be accounted for by Newton's laws.
(3) Pseudo forces are only taken into account when the reference frame is accelerated.

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[1] The speed is rate of change of distance and the velocity is the rate of change of displacement.

[2] Depending on the torques acting on a system, the angular momentum can be conserved only in one or two directions, but may not be conserved in all. For instance, if an isolated body has no torque acting on it only in the direction along the Z axis, then the angular momentum is conserved only in that direction.

[3] A bob attached to a ceiling by a string moving in a horizontal circular plane is an example where the total angular momentum of the bob about the point of suspension is not conserved. This is because the the torque due to the weight of the bob about the point of suspension does not vanish and has non zero horizontal component. Only the vertical component of the angular component is conserved.

[4] In the Sun Earth system the angular momentum of the Earth about the pole star is conserved

[5] The law of angular momentum of a is not applicable for the conical pendulum conserved w.r.t. the origin fixed at the point of suspension. SetId=388

[6] A nonzero torque always causes the angular velocity to change, because a change in angular momentum means a change in angular velocity $L = I\omega$

[7] If I throw a ball upward, it's speed decreases as it rises upwards. There is an external force (gravity) acting on the ball, so the momentum conservation law does not apply. Momentum of the ball is not conserved, however the momentum of the Earth-ball system is conserved as gravity will become an internal force in this case.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then check if the laws is applicable or not.

So if there is no *net external force* acting on the system all the three conservation laws will hold.

[9] It is a force for which the work done by that force on an object or a particle in moving it between any two points depends on its path travelled.This force doesn't conserves the mechanical energy.The work done by a non-conservative force on an object in moving it in a circular path is not equal to zero.

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[10] A simple pendulum moves along a circular arc and does not have constant speed and therefore its motion is not uniform.

[11] If P and Q are the initial and the final points of a path of a particle, displacement is a vector whose direction is along PQ and has magnitude is equal to the length of line PQ

[12] A frame rotating w.r.t K with uniform angular velocity is also an inertial frame.

[13] The total mechanical energy of a system may not be conserved if there are no external forces and the internal forces are conservative.

[14] The kinetic energy of a particle is continuously increasing with time, then the angle bewteen the net force and the velocity cannot be greater than or equal to 90^o at any time. SetId=388

[15] A force is any interaction which tends to change the motion of an object. It is also *defined* as rate of change of momentum. It is a vector quantity.

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[1] For any type of translational motion of a body, the displacement cannot be zero, where as the distance travelled can be zero.

[2] According to Law of Conservation of Angular momentum,if no external torque acts on an object or system of objects,angular momentum of an object or system of objects remains CONSTANT or no change in angular momentum can occur.

Also it states that,only external torque can change angular momentm of the system where as the torque produced by internal forces can not change the angular momentum of the system

[3] Law of conservation of angular momentum holds in case of long jump. When a athlete takes off from the ground in a running long jump, the forces on the launching foot give the athlete an angular momentum with a forward rotation around a horizontal axis. Such rotation would not allow the jumper to land properly. In the landing, the legs should be together and extended forward at an angle so that the heels mark the sand at the greatest distance. Once airborne, the angular momentum cannot change (it is conserved) because no external torque acts to change it. However, the jumper can shift most of the angular momentum to the arms by rotating them in windmill fashion. Then the body remains upright in the proper orientation of landing.

[4] For the motion of earth around sun, the angular momentum of the sun about the center of mass of the sun + earth system and perpendicular to the orbital plane of earth is conserved.

For the motion of earth around sun, the angular momentum of the sun about and axis passing through the Earth and perpendicular to the orbital plane of motion of earth is conserved.

[5] The law of angular momentum of a is not applicable for the conical pendulum conserved when the origin is chosen to be at the pendulum bob itself. SetId=389

[6] A nonzero torque always implies change in angular momentum and may not give rise to a change in magnitude of angular velocity. A non zero torque may mean change only the direction of the angular momentum and not the angular velocity.

[7] A soldier accelerating away, after detonating a bomb, will find that the total momentum of the fragments of the bomb is zero. This is an example where the law of conservation of momentum holds as the forces on the fragments are internal forces only and sum of all such forces is zero.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then check we should if the laws are applicable or not.

So if there is no *external force* acting on the system all the three quantities, total momentum is conserved. The total angular momentum is also because the torque of internal forces will be zero. The conservation of energy depends on the nature of forces. will be conserved.

[9] Explain Nonconservative force: This force is just opposite to that of conservative force. The work done by this force depends on the path taken by the particle on which the force is applied.This force does not conserve mechanical energy.If a particle travels in a closed loop, the net work done by a non consevative force is non zero.

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[10] A satellite goes around the earth in a circular orbit of 600km with a time period of $5.8 \times 10^3 s$. Its motion will be uniform as it will cover equal distances in equal times.

[11] If P and Q are the initial and the final points of a path of a particle,the displacement is the vector $\overrightarrow{PQ}$.

[12] The Newton's Laws of motion will hold in all frames which are at rest w.r.t. K but do not remain valid in a frame that move with respect to K.

[13] When a bullet fired on a wooden block, some energy is transferred to the block and the total mechanical energy of the block and the bullet is conserved.

[14] A heavy body is attached from a spring and is held at point A and is such that the spring is not slack nor is it stretched. It is then released. It goes down upto a point B and then it rises upto point C and executes an oscillatory motion between B and C. During the motion from A to C is first positive (from A to B) and then it is negative from B to A and again remains negative from A to C. SetId=389

[15] Explain Pseudo Force: While applying Newton's laws of motion in non-inertial frame of reference it gives answers which contradict observations. Thus, to account for this,using Newton's Laws, we introduce a "fake" or pseudo force which gives answers that match the observations in a non-inertial frame.

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[1] Displacements, being vector quantity can not compared with, a scalar quantity such as distance.

[2] The law of conservation of angular momentum states that when the net external torque acting on the system is zero, then the angular momentum of the system remains constant.both the initial and final momentum should be taken from a fixed inertial frame of reference provided.

[3] The total angular momentum of a body remains constant of motion when the net torque of the external forces acting on the body is zero.
In general, we have a system of particles such that the net torque of the external forces on the system, w.r.t. some axes K, is zero, the total angular momentum may not remain conserved, because the torque due to the internal forces may not be zero.

[4] For the motion of earth around sun, the sum of angular momenta of the Sun and the Earth about the center of mass of the sun + earth system is conserved.

[5] The three components of angular momentum of a conical pendulum is conserved w.r.t. the origin at the position of the center of mass of the pendulum. SetId=390

[6] In the example of a rotating skew rod the torque due to the external gravitational forces is zero , but the angular momentum is not constant Therefore the law of conservation of angular momentum is violated.

[7] There is no known exception to the law of conservation of momentum in classical mechanics However, an exception to conservation of energy in nuclear physics is observed. In nuclear reactions when two nuclei collide and their mass converts to energy and energy momentum are not conserved.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *net external force* acting on the system, the momentum is conserved. The definition of angular momentum and torque depends on the choice of axes, and therefore it may not be be conserved. The conservation of total energy holds only for conservative forces.

When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *net external force* acting on the system, the energy and momentum will be conserved. However, the total angular momentum may not be conserved because the torque may not be zero.

[9] Non conservative force is the force in which the work done by a particle in going from one point to another is path dependent.

For non conservative forces mechanical energy is not conserved,mostly lost in the form of heat and light.The work done by a non conservative force is equal to the change in mechanical energy.

SetId=390 For non conservative force $E_{\text{initial}} > E_{\text{final}}$

[10] A uniform motion is defined to be the one in which a body covers equal distances in equal time intervals.

[11] If two bodies starting from a point A reach a point B, following different paths, their displacement will be, in general different, but the distances covered will always be the same.

[12] Staying inside a bullet train moving with constant velocity (no jerks etc) an experiment can always be performed which will tell us the numerical velocity of the bullet train

[13] When a moving car hits a parked lorry and causes the parked lorry to move ,energy is transferred from moving the car to the lorry and the total energy of the lorry and the car is conserved.

[14] The kinetic energy of a body does not change if any one of the following is true
(i)force is always perpendicular to the velocity
(ii) the force is always perpendicular to the acceleration
(iii) the object remains stationary
(iv) the object moves in such a way that the point of application of the force remains fixed. SetId=390

[15] When a train is at rest and a ball is hung from the ceiling with a string, an observer in the train sees that the string is vertical. But when the train starts moving, the observer sees that the string makes an angle with the vertical and is tilted in forward direction . This means that some force other than gravity and tension must act on the ball. That force is the pseudo force.

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[1] Distance depends on the path where as the displacement depends on the end point only.

[2] The law of conservation of angular momentum states that The total angular momentum of a system is constant in both magnitude and direction if the resultant torque, of the external forces acting on the system, is zero.

[3] An example where law of conservation of angular momentum holds:
The Law of conservation of angular momentum holds in the case of a ballet dancer performing a pirouette.

When the dancer extends her arms outward, the angular velocity of her rotation decreases whereas when she keeps her arms close to her body, the angular velocity increases. This is because her moment of inertia changes as she moves her arms outward and inward. It can be noted that she as a system has no external torque acting upon her.

[4] For the motion of the Earth around the sun, the total of angular momenta of the Earth and the Sun, about in a reference frame fixed in the pole star, is conserved.

[5] Only the z component of the angular momentum of a conical pendulum is conserved w.r.t. the origin fixed at the point of suspension.

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[6] In the example of skew rod, the angular momentum changes with time and there is a non zero torque coming from action of forces other than gravitational forces. Hence the law of conservation of angular momentum dos not apply.

[7] In a system of a canon and a canon ball, total momentum of the system is zero before canon ball is fired. After firing the canon ball, the momentum of the system seems to be conserved as the ball moves forward and the canon moves backward.

[8] In order to apply the law of conservation of momentum we must first identify the system. If there is no *net external forces* acting on the system then conservation laws of momentum always holds. The total energy and the total angular momentum may not be conserved.

[9] A force is said to be non-conservative, if the work done by the force is dependent on the path taken. It could also be defined as a force for which the work done during a cyclic process is non-zero.

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[10] A particle moves on a circular path. Then its speed, direction of force, velocity and acceleration must always change with time.

[11] Distance is equal to the length of the path covered. Displacement is the shortest distance between initial and final points.

[12] Staying inside a bullet train moving with constant velocity (no jerks etc) an experiment can always be performed which will tell us the numerical value of the acceleration of the bullet train

[13] When a bomb explodes the total mechanical energy is not conserved. But the total chemical energy and the mechanical energy is conserved.

[14] The total work done on a particle is always equal to the change in kinetic energy. $\boxed{\text{SetId=391}}$

[15] Since newton's laws are not valid in non-inertial frames, pseudoforces (which do not exist in reality) are used to help us formualate and use Newton's laws of motion in non-inertial frames.

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[1] Distance equal to zero implies displacement=0; and Displacement=0 also implies distance = 0

[2] If the net external torque acting on a system is zero,the angular momentum L(vector) of the system remains constant,no matter what changes take place within the system.L(vector)=a constant (net external torque acting on system is zero)

[3] In case of a skater, who can be considered an isolated system, so no torue will be acting on him/her. When the arms are extended, the moment of inertia is more. When his hands are closely held, the moment of inertia is lesser. Since the angular momentum is same, the angular acceleration changes accordingly.

[4] For the motion of the Earth around the sun, the total of angular momenta of the Earth and the Sun, is conserved in every inertial frame of reference; but the angular momentum of the Earth (or of the sun)is not conserved in every inertial frame.

[5] The z component of angular momentum of a conical pendulum is not conserved w.r.t. the origin fixed at the point of suspension; but the x and y components are conserved.

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[6] In the example of conical pendulum, the z- component of angular momentum does not change. This follows from the angular momentum conservation as there is no external torque.

[7] When applying the conservation laws of momentum, energy and angular momentum we must define the system first.Only then check if the laws is applicable or not.

As an example: when a ball is dropped from a height, it gains momentum down if we consider the ball as our system.This is because the force of gravity acts as an external force.

However, if we change our system and consider earth as a part of our system too, then the momentum remains conserved because the earth gains momentum up.

[8] In order to apply the law of conservation of momentum we must first identify the system. Then even if there is no *net external forces* acting on the system, all the three conservation laws of momentum, angular momentum and energy may not hold due to presence of internal forces.

[9] a force is said to be non conservative if work done is dependent on the path of the particle.potential cannot be defined in the case of non conservative forces.work done in closed loop is not equal to zero.

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[10] A particle moves on a circular path. Then its speed, direction offorce, can remain constant by velocity and acceleration must always change with time.

[11] Distance is a scalar quantity where as the displacement is a vector quantity.

[12] Assume bullet train, moving with out any jerks, is going on a circular arc of radius R with constant speed. Then an experiment is to be performed entirely within the train without any measurement on objects outside the train. Such an experiment can tell only radius of the track.

[13] When a ball rolls over a rough surface, it comes to stop after some time. This is because transational and rotational kinetic energy initially present in the ball continuosly gets converted to heat due to friction. When all the kinetic energy changes to heat, the ball stops. The total mechanical energy of the ball is not conserved.

[14] A particle is acted upon by a force of constant magnitude which is always perpendicular to the velocity of the particle and the motion of the particle takes place in a plane, Then its kinetic energy, speed, velocity acceleration will not change. SetId=392

[15] Force is defined as the rate of change of linear momentum. In other words it is the agency which changes or tends to change the (a) State of rest; (b)State of uniform motion (c) Direction of body's motion; (d) Shape of the body

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[1] If P and Q are the initial and the final points of a path of a particle, displacement is a vector whose direction is along PQ and has magnitude is equal to the length of line PQ

[2] The Law of conservation of angular momentum states that when no external torque acts on an object or a closed system of objects undergoing motion about a given axis, the change in angular momentum is zero. Therefore, considering an event where only internal torque or no torque is involved, the total angular momentum of the system before the event is equal to the total angular momentum after the event

[3] Example where law of conservation of angular momentum holds:
Let us assume a student seated on a stool that can rotate freely about a vertical axis. The student has been set into rotation at a modest initial angular speed ω . He holds two dumbbells in his outstretched hands. His angular momentum vector L lies along the vertical rotation axis, pointing upwards. Now he pulls in his arms;this action reduces his rotational inertia from its value I_{initial} to a final value I_{final} because he moves the mass closer to the rotational axis. His rate of rotation increases markedly, from ω_{initial} to ω_{final}. The student can then slow down by extending his arms once more,moving the dumbbells outward. No external torque acts on the system consisting of the student, stool and the dumbbells. Thus the angular momentum of the system about the rotational axis remains constant. $I_{\text{initial}} * \omega_{\text{initial}} = I_{\text{final}} * \omega_{\text{final}}$.

[4] In the Sun Earth system the angular momentum of the Earth is conserved in every frame of reference

[5] Only the z component of angular momentum of a conical pendulum is conserved w.r.t. the origin fixed at the point of suspension. SetId=393

[6] In the example of conical pendulum, the x and$y$ components of angular momentum change. This follows from the angular momentum conservation as the z components external torque is zero and horizontal components of torque are non zero.

[7] Statement: Law of Conservation of energy states that "ENERGY CAN NEITHER BE CREATED NOR DESTROYED",but it can be changed from one form to other.

EXPLANATION: Statement implies that the total amount of energy in an isolated system remains constant although it may change forms. viz, kinetic energy may change to potential;chemical to electrical energies etc.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then check we should if the laws are applicable or not.

So if there is no *external force* acting on the system all the three quantities, total momentum, total angular momentum, and total kinetic energy will be conserved independent of the nature of forces.

[9] Explain Nonconservative Forces:

The forces that depend on the path taken by the particle are called non-conservative forces.

Mechanical energy is not conserved during the action of a non conservative force, instead, it is lost as other forms of enery like heat, light, etc.

Potential energy is not defined for a non-conservative force.

The initial and final kinetic energy in a closed loop is not equal.

The work done by a non conservative force in a closed loop is non zero. In practice, the net work is invariably negative.

Work done by a non conservative force cannot be completely recovered.

For a non conservative force,

$$/text(KE)//_f//+(\text{PE})//_f// = (\text{KE})_i+(\text{PE})_i//+//\text{Work Done})//\text{non-conservative force}//$$

SetId=393

[10] A particle moves on a circular path. Then under suitable conditions its speed may remain constant, but the force, velocity and acceleration must always change with time.

[11] Both displacement and distance tell us about the motion of a body but their study does not tell much about the forces on the body

[12] Assume bullet train, moving with out any jerks, is going on a circular arc of radius R with constant speed. Then an experiment is to be performed entirely within the train without any measurement on objects outside the train. Such an experiment can tell both speed of the train and radius of the track.

[13] Let us consider that a pendulum is oscillating moving in a vertical plane. Mean while let another bob which is attached to a spring and is executing a simple harmonic motion in horizontal direction comes and hits the pendulum. Here conservation of momentum does not hold good as tension(external force) is acting on the system.(pendulum)

[14] The kinetic energy of a particle is continuously increasing with time, then the angle bewteen the net force and the velocity cannot be greater than or equal to 90° at any time. SetId=393

[15] Real forces have their origin in matter such as electricity, gravitation etc., while pseudo forces are caused by inertial motion.

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[1] If P and Q are the initial and the final points of a path of a particle,the displacement is the vector $\overrightarrow{PQ}$.

[2] The law of conservation of angular momentum states that when no external torque acts on an object or a closed system of objects, no change of angular momentum can occur. Hence, the angular momentum before an event involving only internal torques or no torques is equal to the angular momentum after the event . Angular momentum can be calculated with the help of the formula $L = I\omega$ where L stands for Angular momentum, I stands for moment of inertia and ω stands for angular velocity

[3] A bob is attached to ceiling by a string and moves in a horizontal circular plane is an example. In this case the law of conservation of angular momentum does not hold.

[4] In the motion of earth around sun, the angular momentum of the earth about an axis passing through the sun and perpendicular to the plane of motion of earth is conserved.

[5] The projection of angular momentum of a conical pendulum in the horizontal plane is a constant of motion when the origin is chosen to be at fixed at the point of suspension.

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[6] Example where law of conservation of angular momentum does not hold: A disc rotating on a horizontal rough surface will not have a constant angular momentum because there will be a constant torque by frictional force. Hence, its angular momentum will decrease, and the law of conservation of angular momentum does not apply.

[7] Oscillating simple pendulum is a very good example where potential energy gets converted to kinetic energy and kinetic to potential energy. Some energy gets dissipated as heat if we consider air resistance. Energy as a whole is conserved if we consider universe as system, the energy has just changed its form.

[8] If we want to apply the conservation laws of momentum, energy and angular momentum, we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *external force* acting on the system, the momentum and angular momentum will be conserved, and depending on the nature of the forces but total energy may or may not be conserved.

[9] A non conservative force is one where the mechanical energy is not conserved.Here the work done is dependent on the path taken .Different amounts of work need to be done in different paths.Here potential energy would have no meaning as it would

keep changing with the path.Here some amount of mechanical energy is lost as sound energy or heat energy and hence is not conserved.

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[10] A particle moves on a circular path. Then under suitable conditions its speed and acceleration may remain constant, but the force, and velocity must always change with time.

[11] Displacement is the shortest distance between initial and final points with direction specified.

[12] Assume bullet train, moving with out any jerks, is going on a circular arc of radius R with constant speed. Then an experiment is to be performed entirely within the train without any measurement on objects outside the train. Such an experiment can tell only speed of the track.

[13] The law of conservation of momentum does not hold in relativistic situations, i.e., where the speeds of the masses involved are close to the speed of light.

[14] A heavy body is attached from a spring and is held at point A and is such that the spring is not slack nor is it stretched. It is then released. It goes down upto a point B and then it rises upto point C and executes an oscillatory motion between B and C. During the motion from A to C is first positive (from A to B) and then it is negative from B to A and again remains negative from A to C. SetId=394

[15] 1)When we start rolling a body on a rough ground, it stops rolling after certain period because of frictional force.
2)When we leave a body from a certain height, it falls due to the act of gravitational force.

1)When a body is rotating in a circular path due to the centrifugal force which is the pseudo force. 2) When the lift is accelerating upwards, the upwards force felt by passengers a pseudo force.

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[1] If two bodies starting from a point A reach a point B, following different paths, their displacement will be, in general different, but the distances covered will always be the same.

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[2] Newton's Second Law of Motion is defined by the expression $F = \frac{dp}{dT}$, where F gives the force vector acting on the system and p gives its momentum vector; in linear motion. A similar expression can be written to describe angular motion, i.e. : $\tau = \frac{dL}{dt}$, where τ is the external torque vector acting on the system, and L is the angular momentum.

If the external torque on the system is zero, then we get the expression as: dL/dt=0. This points out to the fact that, when no external torque is acting on the system, then its angular momentum is constant, no matter what changes occur in the system. This is the Law of Conservation Of Angular Momentum.

[3] Consider a disc rotating about an axis perpendicular to its plane. On placing a smaller disc with its surface parallel to the surface of the rotating disc, the angular momentum of the system of two discs remains constant as there is no external torque.

[4] For the motion of earth around sun, the angular momentum of the earth about the center of mass of the sun + earth system and perpendicular to the plane of motion of earth is conserved.

[5] The law of angular momentum of a is not applicable for the conical pendulum conserved w.r.t. the origin fixed at the point of suspension. SetId=395

[6] Example where law of conservation of angular momentum does not hold:Consider a vertical stick on the ground falling to a horizontal position. During the fall, the conservation of angular momentum applied at the point of rotation on the ground and perpendicular to the plane of the stick is not applicable as, the gravitational force which acts vertically downwards assumed at the centre of mass produces an external torque about the axis of rotation

[7] Law of conservation of momentum does not hold whenever an external force or impulse acts on the system. For example,when a body collides with earth then it bounces back to a lesser height as it loses some velocity.

In this example the momentum of a ball is not conserved due to impulsive force by ground in the normal direction.

However, strictly speaking the system that should be considered here is the ball-earth system and the total momentum is conserved.

[8] To apply the conservation laws of momentum, energy and angular momentum, we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *external force* acting on the system, the energy and momentum will be conserved. However, depending on the nature of the system and of the forces, the total angular momentum may not be conserved.

[9] The force whose work depends on path taken is called a non conservative force.friction for example does less work on a book dragged across a table if the book is dragged straight across than if the book is dragged in a curved path.

SetId=395

[10] When the force is kept constant as function of time, it is possible for a particle to move on a circular path in such a way that its speed remains constant, but the velocity and acceleration must always change with time.

[11] Displacements, being vector quantity can not compared with, a scalar quantity such as distance.

[12] A particle is observed from two frames S_1 and S_2. The frame S_2 moves with respect to S_1 with an acceleration a. If F_1 and F_2 be the pseudoforces when seen from S_1 and S_2 respectively it is not possible to have $F_1 = F_2 = 0$

[13] when we are in accelerating frame if we observe any collision between two bodies then the law of conservation of momentum does not hold in that frame of reference.

[14] The kinetic energy of a body does not change if any one of the following is true
(i)force is always perpendicular to the velocity
(ii) the force is always perpendicular to the acceleration
(iii) the object remains stationary
(iv) the object moves in such a way that the point of application of the force remains fixed.

SetId=395

[15] Newton's first law defines inertial frame. An inertial frame is a frame in which the first law hold. It also makes it possible to compare and tell two force being equal or not. The second law defines the force.

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[1] Displacement is equal to the vector difference $\vec{r}_f - \vec{r}_i$ of the position vectors of initial and final points. The distance covered will be $|\vec{r}_f - \vec{r}_i|$

[2] If the net external torque acting on a system is zero, the angular momentum L of the system remains constant, no matter what changes take place within the system.

$$\sum(T_{\text{ext}}) = \frac{dL}{dt}$$

The law states that when there is no net external torque, $\frac{dL}{dt}$ is zero implying that the total angular momentum of system is constant.

i.e. $L = a$ constant (isolated system)

[3] Consider a man standing on a spinning platform. Initially, the man spreads out his arms and he spins with a certain angular velocity. The next moment, he pulls his arms inwards keeping them close to his body. We will observe that the angular velocity with which he is spinning now increases. This phenomenon can be explained by the Law Of Conservation of Angular momentum. Initially, since his arms were spread wide, his moment of inertia was large. However, when he pulled them close to his body, his moment of inertia decreased.
In this example the angular velocity of the man increases and therefore the angular momentum also increases.The law of conservation of angular momentum does not apply because the torque of muscular forces is not zero.

[4] In the Sun Earth system the angular momentum of the Earth about the pole star is conserved

[5] The law of angular momentum of a is not applicable for the conical pendulum conserved when the origin is chosen to be at the pendulum bob itself. SetId=396

[6] We have a conical pendulum .The forces acting on the bob are tension (along the direction of the string) and gravitational force acting in the vertically downward direction.we have an additional force called the drag force which is tangential to the motion of the bob and acts in the direction opposite to the motion of the bob.The axis of rotation passes through the hinge point and is vertical.The torque due to tension is 0 because the force passes through the axis of rotation.The torque due to mg is also zero since it is parallel to the axis of rotation.but the torque due to drag force is not zero.since the net external torque acting on the bob is not zero,therefore the law of conservation of angular momentum does not hold here

[7] If a bullet hits a wooden board and gets embedded in the board, the total energy and the total momentum of the bullet and the board are conserved.

[8] In order to apply the law of conservation of momentum we must first identify the system. If there is no *external forces* acting on the system then conservation laws of momentum always holds. And depending on the nature of the system and of the forces, the total kinetic energy and the total angular momentum may not be conserved.

[9] ** Nonconservative force is a force in which the amount of work done by the force is dependent of the path taken to change a state of a system.

SetId=396

[10] It is not possible for a particle to move on a circular path in such a way that its speed and force remains constant, and only the velocity and acceleration may (or may not) always change with time.

[11] Distance depends on the path where as the displacement depends on the end point only

[12] A particle is observed from two frames S_1 and S_2. The frame S_2 moves with respect to S_1 with an acceleration a. If F_1 and F_2 be the pseudoforces when seen from S_1 and S_2 respectively and if $F_1 = 0$ then we must have $F_2 \neq 0$

[13] Give an example where law of conservation of momentum does not hold all cases when seen from non inertial frame of references for example when we see two cars collide from a moving bus there momentum is not conserved

[14] The total work done on a particle is always equal to the change in kinetic energy. SetId=396

[15] The magnitude of the pseudo force arising in a non-inertial frame is always equal to the mass of the body under consideration multiplied by the acceleration of the frame of reference and the direction of pseudoforce is always opposite to the direction of acceleration of the frame.

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[1] Distance is equal to the length of the path covered. Displacement is the shortest distance between initial and final points.

[2] When the net external torque acting on a body or a system of bodies is zero about a particular axis, then the angular momentum of each body is conserved about that axis.

[3] In the Sun-Earth system, angular momentum of the earth is not conserved but the total angular momentum of the sun and the earth is constant of motion.

[4] For the motion of earth around sun, the angular momentum of the sun about the center of mass of the sun + earth system and perpendicular to the orbital plane of earth is conserved.

For the motion of earth around sun, the angular momentum of the sun about and axis passing through the Earth and perpendicular to the orbital plane of motion of earth is conserved.

[5] The three components of angular momentum of a conical pendulum is conserved w.r.t. the origin at the position of the center of mass of the pendulum. SetId=397

[6] When you release a toy gyroscope on its pedestal, it initially has no precessional rotation around that pedestal, i.e, the orientation of rotation is fixed. However, it instantaneously starts precessing around the pedestal. Both Kinetic Energy and Angular Momentum now exist where they did not exist a moment earlier. The Kinetic Energy is easy to explain, as appearing due to the body of the gyroscope dropping a tiny fraction of a millimeter in the Earth's gravitational field, giving up exactly the correct amount of Potential Energy. But the Angular Momentum of the Precession which just appeared, does not come from anywhere. This is therefore a Violation of the Conservation of Angular Momentum.

[7] If a bullet hits a wooden board and gets embedded in the board, the total energy of the bullet and the board system is conserved but the total momentum is not conserved.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then check if the laws is applicable or not.

So if there is no *net external force* acting on the system all the three conservation laws will hold.

SetId=397

[9] Nonconservative force is any force where the work done by the force on the object depends on the path of motion of the object.the work done by the frictional force results in to loss of the energy of the system in the form of heat or other form of energy.

[10] For a particle moving on circle the acceleration is always constant in magnitude and directed towards the centre of the circle.

[11] Distance equal to zero $\Rightarrow$ displacement=0; but Displacement=0

[12] If K is an inertial frame, any frame that moves w.r.t. the frame K with uniform velocity is also an inertial frame.

[13] When a tennis ball hits the ground at an oblique angle, the angle of reflection is equal to the angle of incidence. This is a simple consequence of conservation of horizontal component of momentum.

[14] A particle is acted upon by a force of constant magnitude which is always perpendicular to the velocity of the particle and the motion of the particle takes place in a plane, Then its kinetic energy, speed, velocity acceleration will not change. SetId=397

[15] A force is any interaction which tends to change the motion of an object. It is also *defined* as rate of change of momentum.It is a vector quantity.
A physically apparent but nonexistent force felt by an observer in a noninertial frame (that is, a frame undergoing acceleration).

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[1] Distance is a scalar quantity where as the displacement is a vector quantity.

[2] The law of conservation of angular momentum states that in absence of an external torque on an object or a closed system of objects the total angular momentum of the system remains constant. Thus if $\vec{\tau} = 0 => \vec{L} =$ constant where τ is the torque and $\vec{L}$ is the angular momentum of the system.

[3] Consider a disc and a man system. man is standing on center of the disc rotating with angular velocity.initially man folded his hand.when man stretches his hands then momentum of inertia of system increases.and angular velocity decreases.and total angular momentum remains constant.

[4] For the motion of earth around sun, the sum of angular momenta of the Sun and the Earth about the center of mass of the sun + earth system is conserved.

[5] Only the z component of the angular momentum of a conical pendulum is conserved w.r.t. the origin fixed at the point of suspension. SetId=398

[6] There is no case where LAW OF CONSERVATION OF ANGULAR MOMENTUM does'nt hold.But there are cases where conservation of angular momentum does not hold.A body in vertical circular motion is an example where angular momentum is not conserved. Here the law of conservation does not apply.

[7] If a bullet hits a wooden board and gets embedded in the board, both total energy and the total momentum of the bullet and the board are not conserved.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then check we should if the laws are applicable or not.

So if there is no *external force* acting on the system all the three quantities, total momentum is conserved. The total angular momentum is also because the torque of internal forces will be zero. The conservation of energy depends on the nature of forces. will be conserved.

[9] nonconservative force is any force ,where the work done by the force depends on the path of motion of the body.The work done by such a force is equal to the change in mechanical energy of the system.Energy mostly observed to be lost in form of heat, by the action of non conservative force.

SetId=398

[10] The motion of a bomb dropped from a plane does is not a uniform motion as it follows a parabolic path and not a straight line path.

[11] If P and Q are the initial and the final points of a path of a particle, displacement is a vector whose direction is along PQ and has magnitude is equal to the length of line PQ

[12] If K is an inertial frame, any frame that moves w.r.t. the frame K with uniform speed is also an inertial frame.

[13] when a ball is dropped from a height, it gains momentum down if we consider the ball as our system.This is because the force of gravity acts as an external force.

However, if we change our system and consider earth as a part of our system too, then the momentum remains conserved because the earth gains momentum up.

[14] The kinetic energy of a particle is continuously increasing with time, then the angle bewteen the net force and the velocity cannot be greater than or equal to 90^o at any time. SetId=398

[15] Psuedo Force is defined as an apparent force that acts in only non-inertial frames. Pseudo Forces are also called Fictitious Forces. It is an Imaginary force. It is independent of mass.

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[1] The speed is rate of change of distance and the velocity is the rate of change of displacement.

[2] If no net external torque acts on a system, the total angular momentum of the system remains constant.

[3] The conservation of angular momentum of a system of bodies requires that the the sum of torque due to all forces be equal to zero. Now consider a situation where the forces are such that the sum of torques of external forces is zero w.r.t. some axes K. Since the value of torque depends of the choices of axes, the sum of torques due to all internal forces will depend on the choice of axes and in general it will be non zero. Therefore, for a system of several bodies, for a given choice of axes K, there will be situations when the total angular momentum may not be conserved.

[4] For the motion of the Earth around the sun, the total of angular momenta of the Earth and the Sun, about in a reference frame fixed in the pole star, is conserved.

[5] The z component of angular momentum of a conical pendulum is not conserved w.r.t. the origin fixed at the point of suspension; but the x and y components are conserved. SetId=399

[6] A sphere rolling on a rough surface.Due to friction there is external torque so the angular momentum changes which results in the slowing of the sphere. The angular momentum keeps changing. Even in case like this one, it is wrong to say that the Law of Angular Momentum Conservation does not hold.

[7] There are certain situations where it appears that the law of conservation of linear momentum does not hold. For example if we take some amount of a substance like construction putty, cement, cake batter, playing dough,etc and drop it on the ground, it does not bounce back like a rubber ball would and hence the momentum it had before striking the ground seems to have been lost. Hence it appears that the law of conservation of linear momentum does not hold.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *net external force* acting on the system, the momentum is conserved. The definition of angular momentum and torque depends on the choice of axes, and therefore it may not be be conserved. The conservation of total energy holds only for conservative forces.

When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *net external force* acting on the system, the energy and momentum will be conserved. However, the total angular momentum may not be conserved because the torque may not be zero.

[9] The work done by a "non-conservative" force does depend on the path taken. Non-conservative forces cannot be associated with a potential energy. If some of the internal forces of a system are non-conservative, the mechanical energy of the system is not constant.Work-energy theorem is valid even in the presence of some non-conservative forces.

SetId=399

[10] A wagon sliding on a roller coaster designed in such a way that the wagon covers equal distances in equal times. As the motion of the wagon is uniform, there will be no net force acting on it.

[11] If P and Q are the initial and the final points of a path of a particle,the displacement is the vector $\overrightarrow{PQ}$.

[12] A frame rotating w.r.t K with uniform angular velocity is also an inertial frame.

[13] There is no known exception to the law of conservation of momentum in classical mechanics however when two bodies collide and their mass converts to energy, an exception in nuclear physics is observed. In real life this is observed in nuclear reactions at atomic level.

[14] A heavy body is attached from a spring and is held at point A and is such that the spring is not slack nor is it stretched. It is then released. It goes down upto a point B and then it rises upto point C and executes an oscillatory motion between B and C. During the motion from A to C is first positive (from A to B) and then it is negative from B to A and again remains negative from A to C. SetId=399

[15] Psuedo Force is defined as an apparent force that acts in only non-inertial frames. Pseudo Forces are also called Fictious Forces. It is an Imaginary force. It is always proportional to mass. It is sometimes dependent on speed.

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SetId=400

[1] For any type of translational motion of a body, the displacement cannot be zero, where as the distance travelled can be zero.

[2] The law of conservation of angular momentum states that when no external torque is applied on an object or a closed system of objects about an axis, the angular momentum about that axis remains constant.

[3] Example where law of conservation of angular momentum does not hold:
When there is external force like frictional force acting on a object when it is rotating we cannot use conservation of angular momentum as the friction force acting on the object produces an external torque.

[4] For the motion of the Earth around the sun, the total of angular momenta of the Earth and the Sun, is conserved in every inertial frame of reference; but the angular momentum of the Earth (or of the sun)is not conserved in every inertial frame.

[5] Only the z component of angular momentum of a conical pendulum is conserved w.r.t. the origin fixed at the point of suspension. SetId=400

[6] Consider a rod of length l. Let us give an impulse to one end . Now the angular momentum about the oposite end is not zero since the impulse provides some torque . So the angular momentum is not conserved .

$$\text{torque} = \text{impulse} * \ell.$$

$d\ell/dt$ is not equal to zero and the law of conservation of angular momentum does not hold.

[7] A tennis ball is dropped from height h and after hitting the ground and it bounces back and rises to the same height. In this case the momentum of the ball is conserved because (under ideal conditions) the momentum after it hits the ground will be equal to the momentum it had before hitting the ground.

[8] In order to apply the law of conservation of momentum we must first identify the system. If there is no *net external forces* acting on the system then conservation laws of momentum always holds. The total energy and the total angular momentum may not be conserved.

[9] Non conservative forces are forces with the property that the work done by the force in moving a particle between two points is dependent on the path taken.Also the work done over a closed loop is not zero.Defining of scalar potential is not possible in case of non conservative forces because the change in potential energy between two points will depend on path taken.

SetId=400

[10] A simple pendulum moves along a circular arc and does not have constant speed and therefore its motion is not uniform.

[11] If two bodies starting from a point A reach a point B, following different paths, their displacement will be, in general different, but the distances covered will always be the same.

[12] The Newton's Laws of motion will hold in all frames which are at rest w.r.t. K but do not remain valid in a frame that move with respect to K.

[13] When there is no external forces act on a system of many particles, and there are only internal forces acting on the particles. The third law gives that the internal forces are pairwise equal and opposite.Thus the sum of internal forces is zero and the momentum of each particle is conserved.

[14] The kinetic energy of a body does not change if any one of the following is true
(i)force is always perpendicular to the velocity
(ii) the force is always perpendicular to the acceleration
(iii) the object remains stationary
(iv) the object moves in such a way that the point of application of the force remains fixed. SetId=400

[15] Since pseudo forces are not real forces, they do not affect the conservation laws and all the three conservation laws hold in noninertial frames.

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SetId=401

[1] Displacements, being vector quantity can not compared with, a scalar quantity such as distance.

[2] The angular momentum of a given system of bodies shall remain conserved unless acted upon by an external unbalanced torque.

[3] A bob attached to a ceiling by a string moving in a horizontal circular plane is an example where the total angular momentum of the bob about the point of suspension is not conserved. This is because the the torque due to the weight of the bob about the point of suspension does not vanish and has non zero horizontal component. Only the vertical component of the angular component is conserved.

[4] In the Sun Earth system the angular momentum of the Earth is conserved in every frame of reference

[5] The projection of angular momentum of a conical pendulum in the horizontal plane is a constant of motion when the origin is chosen to be at fixed at the point of suspension. SetId=401

[6] Let us consider a rotating skew rod. In the absence of friction or any other drag force, the rod should continuously spin without stopping. Here the net torque about the axis of rotation is 0 and hence angular momentum is conserved. It therefore follows from law of conservation of angular momentum that a spinning skew rod will keep rotating with constant angular velocity if there is no external torque. So law of conservation of angular momentum does not hold.

[7] Law of conservation of momentum does not hold when Newton's laws are not valid, e.g. in a non-inertial frame of reference. For example, when we consider collision between two bodies in a non-inertial frame of reference, the law of conservation of momentum cannot be applied because there will be a pseudo force acting on the frame itself.

[8] In order to apply the law of conservation of momentum we must first identify the system. Then even if there is no *net external forces* acting on the system, all the three conservation laws of momentum, angular momentum and energy may not hold due to presence of internal forces.

[9] A non conservative force is the force with the property that the work done in moving a particle between two points is dependent of the path taken.If a particle travels in a closed path, the net work done(the some of the forces acting along the path multiplied by the distance travelled) by a non conservative force is non zero. When an object moves from one location to another, the force changes the potential energy of the object by an amount that depends on the path taken.Non conservative force depends only on the path followed by the object.

SetId=401

[10] A satellite goes around the earth in a circular orbit of 600km with a time period of $5.8 \times 10^3 s$. Its motion will be uniform as it will cover equal distances in equal times.

[11] Distance is equal to the length of the path covered. Displacement is the shortest distance between initial and final points.

[12] Staying inside a bullet train moving with constant velocity (no jerks etc) an experiment can always be performed which will tell us the numerical velocity of the bullet train

[13] During collision of billiard balls momentum is conserved. During explosion of a bomb also momentum is conserved and the total momentum of the fragments of bomb will be zero. This is because all the forces are only internal forces.

[14] The total work done on a particle is always equal to the change in kinetic energy. SetId=401

[15] A force is any interaction which tends to change the motion of an object. Newtons' second tell us that it is *equal* to the rate of change of momentum.It is a vector quantity. Real forces can be distinguished from pseudo forces because the pseudo forces always proportional to the mass of the body. All real forces, except the gravitational force, do not depend on the mass of the body.

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[1] Distance depends on the path where as the displacement depends on the end point only.

[2] When the net external torque acting on a system about a given axis is zero, the total angular momentum of the system about that axis remains consant.

[3] Law of conservation of angular momentum holds in case of long jump. When a athlete takes off from the ground in a running long jump, the forces on the launching foot give the athlete an angular momentum with a forward rotation around a horizontal axis. Such rotation would not allow the jumper to land properly. In the landing, the legs should be together and extended forward at an angle so that the heels mark the sand at the greatest distance. Once airborne, the angular momentum cannot change (it is conserved) because no external torque acts to change it. However, the jumper can shift most of the angular momentum to the arms by rotating them in windmill fashion. Then the body remains upright in the proper orientation of landing.

[4] In the motion of earth around sun, the angular momentum of the earth about an axis passing through the sun and perpendicular to the plane of motion of earth is conserved.

[5] The law of angular momentum of a is not applicable for the conical pendulum conserved w.r.t. the origin fixed at the point of suspension. SetId=402

[6] In the example of skew rod the angular velocity does not change even though the torque applied is nonzero. However there is no contradiction as in this case the law of conservation of momentum is not applicable. conservation is violated.

[7] If I throw a ball upward, it's speed decreases as it rises upwards. There is an external force (gravity) acting on the ball, so the momentum conservation law does not apply. Momentum of the ball is not conserved, however the momentum of the Earth-ball system is conserved as gravity will become an internal force in this case.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then check we should if the laws are applicable or not.

So if there is no *external force* acting on the system all the three quantities, total momentum, total angular momentum, and total kinetic energy will be conserved independent of the nature of forces.

SetId=402

[9] In this type of force the work done depends on the path taken by the body.Mechanical energy is not conserved in the system if non conservative force acts on it.

[10] A uniform motion is defined to be the one in which a body covers equal distances in equal time intervals.

[11] Distance is a scalar quantity where as the displacement is a vector quantity.

[12] Staying inside a bullet train moving with constant velocity (no jerks etc) an experiment can always be performed which will tell us the numerical value of the acceleration of the bullet train

[13] Give an example where law of conservation of momentum holds: A mass exploding into several pieces in a conservative field like gravitational field(if air resistance is neglected), obeys law of conservation of momentum. If air resistance cannot be neglected then the law of conservation of momentum will not hold.

[14] A particle is acted upon by a force of constant magnitude which is always perpendicular to the velocity of the particle and the motion of the particle takes place in a plane, Then its kinetic energy, speed, velocity acceleration will not change. SetId=402

[15] Examples of pseudoforce are Coriolis Force, Centrifugal Force, and magnetic force on currents.
Psuedo force also called as fictitious force is an apparent force that are needed for masses whose their motion is described using a non inertial frame of reference.

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[1] Distance equal to zero implies displacement=0; and Displacement=0 also implies distance = 0

[2] This law sates that when no net torque of all forces acts on a object or a system of objects then total angular momentum of system is conserved.The angular momentum before an event is equal to angular momentum after that event.mathematically explained by when, net torque=0 ;then, total angular momentum(L)=constant.

[3] The total angular momentum of a body remains constant of motion when the net torque of the external forces acting on the body is zero.
In general, we have a system of particles such that the net torque of the external forces on the system, w.r.t. some axes K, is zero, the total angular momentum may not remain conserved, because the torque due to the internal forces may not be zero.

[4] For the motion of earth around sun, the angular momentum of the earth about the center of mass of the sun + earth system and perpendicular to the plane of motion of earth is conserved.

[5] The law of angular momentum of a is not applicable for the conical pendulum conserved when the origin is chosen to be at the pendulum bob itself. SetId=403

[6] Example where law of conservation of angular momentum does not hold:If a particle undergoes conical motion and the only force acting on particle is central force like tension of the string.Then total external torque about fixed point A is zero,yet angular momentum is not conserved,as angular momentum keeps on changing direction.

[7] A soldier accelerating away, after detonating a bomb, will find that the total momentum of the fragments of the bomb is zero. This is an example where the law of conservation of momentum holds as the forces on the fragments are internal forces only and sum of all such forces is zero.

[8] If we want to apply the conservation laws of momentum, energy and angular momentum, we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *external force* acting on the system, the momentum and angular momentum will be conserved, and depending on the nature of the forces but total energy may or may not be conserved.

[9] A force is said to be a non-conservative force if the work done by the force in a closed path is non-zero;(i.e) the cyclic integral of the work done is non-zero.

Work done by a non-conservative force is equal to change in total energy of the system.Work-Energy theorem is not applicable in the case of a non-conservative

force.Work done by conservative force depends on the path.It differs with the paths taken by the partical even if the initial and final points are same.In case of non-conservative forces,the total mechanical energy is not constant as the energy is dissipated in various forms such as heat energy,sound energy,etc and cannot be recovered. SetId=403

[10] A particle moves on a circular path. Then its speed, direction of force, velocity and acceleration must always change with time.

[11] Both displacement and distance tell us about the motion of a body but their study does not tell much about the forces on the body

[12] Assume bullet train, moving with out any jerks, is going on a circular arc of radius R with constant speed. Then an experiment is to be performed entirely within the train without any measurement on objects outside the train. Such an experiment can tell only radius of the track.

[13] Also a good example of law of conservation momentum can be seen when a bullet from a rifle is fired.As the bullet is fired and gets out of the rifle, the rifle gives a backward jerk due to the phenomenon of conservation of momentum.

[14] The kinetic energy of a particle is continuously increasing with time, then the angle bewteen the net force and the velocity cannot be greater than or equal to 90^o at any time. SetId=403

[15] Examples of pseudo-force are Coriolis Force, Centrifugal Force, Centripetal force and magnetic force on currents. The pseudo forces do not obey Newton's third law and therefore the total momentum does not appear to be conserved in a non-inertial frame.

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[1] If P and Q are the initial and the final points of a path of a particle, displacement is a vector whose direction is along PQ and has magnitude is equal to the length of line PQ

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[2] Statement of Law of Conservation of Angular Momentum:
Differentiating $\vec{L} = \vec{r} \times \vec{p}$ w.r.t, time,

$$\begin{aligned} \frac{dL}{dt} &= \frac{d\vec{r} \times \vec{p}}{dt} = \frac{d\vec{r}}{dt} \times \vec{p} + \vec{r} \times \frac{d\vec{p}}{dt} = \vec{v} \times (m\vec{v}) + \vec{r} \times \vec{F} \\ &= \vec{r} \times \vec{F} (\because v \times v = 0) \\ &= \vec{\tau} \end{aligned}$$

here $\vec{\tau}$ represents the net torque acting on a rigid body rotating about a fixed axis.This torque must take into account of all the forces, be it external or internal forces

[3] An example where law of conservation of angular momentum holds:
The Law of conservation of angular momentum holds in the case of a ballet dancer performing a pirouette.

When the dancer extends her arms outward, the angular velocity of her rotation decreases whereas when she keeps her arms close to her body, the angular velocity increases. This is because her moment of inertia changes as she moves her arms outward and inward. It can be noted that she as a system has no external torque acting upon her.

[4] In the Sun Earth system the angular momentum of the Earth about the pole star is conserved

[5] The three components of angular momentum of a conical pendulum is conserved w.r.t. the origin at the position of the center of mass of the pendulum. SetId=404

[6] A nonzero torque always causes the angular velocity to change, because a change in angular momentum means a change in angular velocity $L = I\omega$

[7] There is no known exception to the law of conservation of momentum in classical mechanics However, an exception to conservation of energy in nuclear physics is observed. In nuclear reactions when two nuclei collide and their mass converts to energy and energy momentum are not conserved.

[8] To apply the conservation laws of momentum, energy and angular momentum, we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *external force* acting on the system, the energy and momentum will be conserved. However, depending on the nature of the system and of the forces, the total angular momentum may not be conserved.

[9] A non conservative force is a force where work done in moving a particle between two points depends on the path through which it is taken.Friction is an example of non conservative force.Mechanical energy is not conserved in case of a non conservative force

SetId=404

[10] A particle moves on a circular path. Then its speed, direction offorce, can remain constant by velocity and acceleration must always change with time.

[11] Displacement is the shortest distance between initial and final points with direction specified.

[12] Assume bullet train, moving with out any jerks, is going on a circular arc of radius R with constant speed. Then an experiment is to be performed entirely within the train without any measurement on objects outside the train. Such an experiment can tell both speed of the train and radius of the track.

[13] when a man walks on the ice slab where friction does not exist between the ice block and the floor but between the feet of the man and the slab the slab moves back as per the law of conservation of momentum

[14] A heavy body is attached from a spring and is held at point A and is such that the spring is not slack nor is it stretched. It is then released. It goes down upto a point B and then it rises upto point C and executes an oscillatory motion between B and C. During the motion from A to C is first positive (from A to B) and then it is negative from B to A and again remains negative from A to C. SetId=404

[15] FORCE is any interaction which tends to change the motion of an object.It has both magnitude and direction,making it a vector quantity.

A psuedo force is an apparent force that acts on all masses whose motion is described with respect to a non-inertial frame of reference like a rotating frame of reference.This force is needed by an observer in an non-inertial frame to make all the Newtons Laws of motion hold true.

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[1] If P and Q are the initial and the final points of a path of a particle,the displacement is the vector $\overrightarrow{PQ}$. SetId=405

[2] Statement of Law of Conservation of Angular Momentum: For a system of many particles The net torque due all the forces, be it external or internal forces. But as the torque due to all the internal forces cancel out, it sufficient to consider the external forces acting on the system.

[3] In case of a skater, who can be considered an isolated system, so no torue will be acting on him/her. When the arms are extended, the moment of inertia is more. When his hands are closely held, the moment of inertia is lesser. Since the angular momentum is same, the angular acceleration changes accordingly.

[4] For the motion of earth around sun, the angular momentum of the sun about the center of mass of the sun + earth system and perpendicular to the orbital plane of earth is conserved.

For the motion of earth around sun, the angular momentum of the sun about and axis passing through the Earth and perpendicular to the orbital plane of motion of earth is conserved.

[5] Only the z component of the angular momentum of a conical pendulum is conserved w.r.t. the origin fixed at the point of suspension. SetId=405

[6] A nonzero torque always implies change in angular momentum and may not give rise to a change in magnitude of angular velocity. A non zero torque may mean change only the direction of the angular momentum and not the angular velocity.

[7] In a system of a canon and a canon ball, total momentum of the system is zero before canon ball is fired. After firing the canon ball, the momentum of the system seems to be conserved as the ball moves forward and the canon moves backward.

[8] In order to apply the law of conservation of momentum we must first identify the system. If there is no *external forces* acting on the system then conservation laws of momentum always holds. And depending on the nature of the system and of the forces, the total kinetic energy and the total angular momentum may not be conserved.

[9] A force:A force is said to be a *non-//**conservative force* if the*/ work done by it in a closed path is/*/ non-zero./For such forces,potential energy cannot be defined. SetId=405

[10] A particle moves on a circular path. Then under suitable conditions its speed may remain constant, but the force, velocity and acceleration must always change with time.

[11] Displacements, being vector quantity can not compared with, a scalar quantity such as distance.

[12] Assume bullet train, moving with out any jerks, is going on a circular arc of radius R with constant speed. Then an experiment is to be performed entirely within the train without any measurement on objects outside the train. Such an experiment can tell only speed of the track.

[13] When a freely falling rigid body collides another body in its path momentum the system of two particles is not conserved in the collision as there is external force mg acting on the system.

[14] The kinetic energy of a body does not change if any one of the following is true
(i)force is always perpendicular to the velocity
(ii) the force is always perpendicular to the acceleration
(iii) the object remains stationary
(iv) the object moves in such a way that the point of application of the force remains fixed. SetId=405

[15] FORCE is any interaction which tends to change the motion of an object.It has both magnitude and direction,making it a vector quantity. A pseudo-force F doesn't arise from any physical interaction between two objects, but rather from the acceleration 'a' of the non-inertial reference frame itself. These forces have no real existence but must be taken into account in an accelerating frame of reference to make all the three Newton's Laws of motion applicable to the system

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[1] If two bodies starting from a point A reach a point B, following different paths, their displacement will be, in general different, but the distances covered will always be the same.

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[2] Depending on the torques acting on a system, the angular momentum can be conserved only in one or two directions, but may not be conserved in all. For instance, if an isolated body has no torque acting on it only in the direction along the Z axis, then the angular momentum is conserved only in that direction.

[3] Example where law of conservation of angular momentum holds:
Let us assume a student seated on a stool that can rotate freely about a vertical axis. The student has been set into rotation at a modest initial angular speed ω . He holds two dumbbells in his outstretched hands. His angular momentum vector L lies along the vertical rotation axis, pointing upwards. Now he pulls in his arms;this action reduces his rotational inertia from its value I_{initial} to a final value I_{final} because he moves the mass closer to the rotational axis. His rate of rotation increases markedly, from ω_{initial} to ω_{final}. The student can then slow down by extending his arms once more,moving the dumbbells outward. No external torque acts on the system consisting of the student, stool and the dumbbells. Thus the angular momentum of the system about the rotational axis remains constant. $I_{\text{initial}} * \omega_{\text{initial}} = I_{\text{final}} * \omega_{\text{final}}$.

[4] For the motion of earth around sun, the sum of angular momenta of the Sun and the Earth about the center of mass of the sun + earth system is conserved.

[5] The z component of angular momentum of a conical pendulum is not conserved w.r.t. the origin fixed at the point of suspension; but the x and y components are conserved.

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[6] In the example of a rotating skew rod the torque due to the external gravitational forces is zero , but the angular momentum is not constant Therefore the law of conservation of angular momentum is violated.

[7] When applying the conservation laws of momentum, energy and angular momentum we must define the system first.Only then check if the laws is applicable or not.

As an example: when a ball is dropped from a height, it gains momentum down if we consider the ball as our system.This is because the force of gravity acts as an external force.

However, if we change our system and consider earth as a part of our system too, then the momentum remains conserved because the earth gains momentum up.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then check if the laws is applicable or not.

So if there is no *net external force* acting on the system all the three conservation laws will hold.

[9] A force that is not conservative is nonconservative force. The work done by a noconservative force cannot be represented by a potential energy function. That is work done by a nonconservative force is dependent on the path through which the system is moved. Some nonconservative forces cause the mechanical energy to be lost or dissipiated. Such forces are called dissipiative forces. There is no way to get back the lost mechanical energy. Nonconservative forces can also increase the mechanical energy. This is arrived from the concept of irreversible process.

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[10] A particle moves on a circular path. Then under suitable conditions its speed and acceleration may remain constant, but the force, and velocity must always change with time.

[11] Distance depends on the path where as the displacement depends on the end point only

[12] A particle is observed from two frames S_1 and S_2. The frame S_2 moves with respect to S_1 with an acceleration a. If F_1 and F_2 be the pseudoforces when seen from S_1 and S_2 respectively it is not possible to have $F_1 = F_2 = 0$

[13] If we take some amount of a substance like construction putty, cement, cake batter, playing dough,etc and drop it on the ground, it does not bounce back, like a rubber ball would bounce, and hence the momentum it had before striking the ground seems to have been lost. Hence it appears that the law of conservation of linear momentum does not hold.

[14] The total work done on a particle is always equal to the change in kinetic energy. SetId=406

[15] FORCE is any interaction which tends to change the motion of an object.It has both magnitude and direction,making it a vector quantity.
A pseudo-force results from acceleration of the frame of reference in which the objects reside. It is taken into account so that Newton's second law isn't invalidated. The pseudo force acting on an object can always be mathematically expressed as the product of the mass of the object and the acceleration of the frame of reference.

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[1] Displacement is equal to the vector difference $\vec{r}_f - \vec{r}_i$ of the position vectors of initial and final points. The distance covered will be $|\vec{r}_f - \vec{r}_i|$

[2] According to Law of Conservation of Angular momentum,if no external torque acts on an object or system of objects,angular momentum of an object or system of objects remains CONSTANT or no change in angular momentum can occur.

Also it states that,only external torque can change angular momentm of the system where as the torque produced by internal forces can not change the angular momentum of the system

[3] A bob is attached to ceiling by a string and moves in a horizontal circular plane is an example. In this case the law of conservation of angular momentum does not hold.

[4] For the motion of the Earth around the sun, the total of angular momenta of the Earth and the Sun, about in a reference frame fixed in the pole star, is conserved.

[5] Only the z component of angular momentum of a conical pendulum is conserved w.r.t. the origin fixed at the point of suspension. SetId=407

[6] In the example of skew rod, the angular momentum changes with time and there is a non zero torque coming from action of forces other than gravitational forces. Hence the law of conservation of angular momentum dos not apply.

[7] Statement: Law of Conservation of energy states that "ENERGY CAN NEITHER BE CREATED NOR DESTROYED",but it can be changed from one form to other.

EXPLANATION: Statement implies that the total amount of energy in an isolated system remains constant although it may change forms. viz, kinetic energy may change to potential;chemical to electrical energies etc.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then check we should if the laws are applicable or not.

So if there is no *external force* acting on the system all the three quantities, total momentum is conserved. The total angular momentum is also because the torque of internal forces will be zero. The conservation of energy depends on the nature of forces. will be conserved.

[9] Nonconservative forces are forces, such that the work done by these forces are path dependent. Work done by these forces around a close path is not necessarily equal to zero. Hence if a particle is acted on by a non-conservative force and that particle returns to its original position, that particle will experience a net loss of energy. Energy will thus not be conserved for particle. Potential Energy can not be defined

SetId=407 for these type of forces.

[10] When the force is kept constant as function of time, it is possible for a particle to move on a circular path in such a way that its speed remains constant, but the velocity and acceleration must always change with time.

[11] Distance equal to zero $\Rightarrow$ displacement=0; but Displacement=0

[12] A particle is observed from two frames S_1 and S_2. The frame S_2 moves with respect to S_1 with an acceleration a. If F_1 and F_2 be the pseudoforces when seen from S_1 and S_2 respectively and if $F_1 = 0$ then we must have $F_2 \neq 0$

[13] When we consider collision between two bodies in a non-inertial frame of reference, the law of conservation of momentum cannot be applied because there will be a pseudo force acting on the frame itself.

[14] A particle is acted upon by a force of constant magnitude which is always perpendicular to the velocity of the particle and the motion of the particle takes place in a plane, Then its kinetic energy, speed, velocity acceleration will not change. SetId=407

[15] Explain Force:FORCE is any interaction which tends to change the motion of an object.It has both magnitude and direction,making it a vector quantity.
In the case of a non inertial frame, we can use the second law of motion by adding a pseudo force to the system which makes it an inertial frame of reference.

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[1] Distance is equal to the length of the path covered. Displacement is the shortest distance between initial and final points.

[2] The law of conservation of angular momentum states that when the net external torque acting on the system is zero, then the angular momentum of the system remains constant.both the initial and final momentum should be taken from a fixed inertial frame of reference provided.

[3] Consider a disc rotating about an axis perpendicular to its plane. On placing a smaller disc with its surface parallel to the surface of the rotating disc, the angular momentum of the system of two discs remains constant as there is no external torque.

[4] For the motion of the Earth around the sun, the total of angular momenta of the Earth and the Sun, is conserved in every inertial frame of reference; but the angular momentum of the Earth (or of the sun)is not conserved in every inertial frame.

[5] The projection of angular momentum of a conical pendulum in the horizontal plane is a constant of motion when the origin is chosen to be at fixed at the point of suspension. SetId=408

[6] In the example of conical pendulum, the z- component of angular momentum does not change. This follows from the angular momentum conservation as there is no external torque.

[7] Oscillating simple pendulum is a very good example where potential energy gets converted to kinetic energy and kinetic to potential energy. Some energy gets dissipated as heat if we consider air resistance. Energy as a whole is conserved if we consider universe as system, the energy has just changed its form.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *net external force* acting on the system, the momentum is conserved. The definition of angular momentum and torque depends on the choice of axes, and therefore it may not be be conserved. The conservation of total energy holds only for conservative forces.

When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *net external force* acting on the system, the energy and momentum will be conserved. However, the total angular momentum may not be conserved because the torque may not be zero.

[9] Non Conservative force is a force with the property that workdone in moving an object from one point to another is dependent on the path taken .

Non Conservative Force can arise in classical physics due to neglected degrees of freedom or time dependent potentials.

Friction may be treated without resorting the use of non conservative forces by considering the motion of individual molecules.

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[10] It is not possible for a particle to move on a circular path in such a way that its speed and force remains constant, and only the velocity and acceleration may (or may not) always change with time.

[11] If P and Q are the initial and the final points of a path of a particle, displacement is a vector whose direction is along PQ and has magnitude is equal to the length of line PQ

[12] If K is an inertial frame, any frame that moves w.r.t. the frame K with uniform velocity is also an inertial frame.

[13] When a system is acted upon by external forces like friction etc, the conservation principle does not hold good,there will be impulse imparted and so we cant conserve momentum. This is case when a collision between two elastic balls take place on a rough horizontal table. The total momentum just after the collision will be different from the total momentum just before the collision. Here momentum is not conserved as there is external force friction is present.

[14] The kinetic energy of a particle is continuously increasing with time, then the angle bewteen the net force and the velocity cannot be greater than or equal to 90° at any time.

SetId=408

[15] For the Newton's Law of Motion to hold true,the physically apparent but nonexistent force needed by an observer in a non-inertial frame is called the pseudo force.
1) Caused by relative acceleration of the origin in a straight line
2) Centrifugal and Centripetal forces
3) Coriolis force
4) Euler force

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[1] Distance is a scalar quantity where as the displacement is a vector quantity.

[2] The law of conservation of angular momentum states that The total angular momentum of a system is constant in both magnitude and direction if the resultant torque, of the external forces acting on the system, is zero.

[3] Consider a man standing on a spinning platform. Initially, the man spreads out his arms and he spins with a certain angular velocity. The next moment, he pulls his arms inwards keeping them close to his body. We will observe that the angular velocity with which he is spinning now increases. This phenomenon can be explained by the Law Of Conservation of Angular momentum. Initially, since his arms were spread wide, his moment of inertia was large. However, when he pulled them close to his body, his moment of inertia decreased.
In this example the angular velocity of the man increases and therefore the angular momentum also increases.The law of conservation of angular momentum does not apply because the torque of muscular forces is not zero.

[4] In the Sun Earth system the angular momentum of the Earth is conserved in every frame of reference

[5] The law of angular momentum of a is not applicable for the conical pendulum conserved w.r.t. the origin fixed at the point of suspension. SetId=409

[6] In the example of conical pendulum, the x and$y$ components of angular momentum change. This follows from the angular momentum conservation as the z components external torque is zero and horizontal components of torque are non zero.

[7] Law of conservation of momentum does not hold whenever an external force or impulse acts on the system. For example,when a body collides with earth then it bounces back to a lesser height as it loses some velocity.

In this example the momentum of a ball is not conserved due to impulsive force by ground in the normal direction.

However, strictly speaking the system that should be considered here is the ball-earth system and the total momentum is conserved.

[8] In order to apply the law of conservation of momentum we must first identify the system. If there is no *net external forces* acting on the system then conservation laws of momentum always holds. The total energy and the total angular momentum may not be conserved.

[9] A non-conservative force is a force with the property that the work done in moving a particle between two points is dependent of the path taken . Mostly the enery of the particle in a non conservative force field dissipates in the form of heat or sound

. Since the lost energy cannot be bought back ,conservation of mechanical energy does not hold true .

SetId=409

[10] For a particle moving on circle the acceleration is always constant in magnitude and directed towards the centre of the circle.

[11] If P and Q are the initial and the final points of a path of a particle,the displacement is the vector $\overrightarrow{PQ}$.

[12] If K is an inertial frame, any frame that moves w.r.t. the frame K with uniform speed is also an inertial frame.

[13] When we are in accelerating frame if we observe any collision between two bodies then the law of conservation of momentum does not hold in that frame of reference. On the other hand the law of conservation of momentum holds in all inertial frames.

[14] A heavy body is attached from a spring and is held at point A and is such that the spring is not slack nor is it stretched. It is then released. It goes down upto a point B and then it rises upto point C and executes an oscillatory motion between B and C. During the motion from A to C is first positive (from A to B) and then it is negative from B to A and again remains negative from A to C. SetId=409

[15] A force is any interaction which tends to change the motion of an object. It is also *defined* as rate of change of momentum.It is a vector quantity.

Pseudo-force is a fictitious force it is taken by an observer from non inertial frame of reference. This force arises from acceleration of reference frame that is a reference frame which is accelerating or rotating.

The equation of motion is then written by balancing all forces. As an example a particle moving in a circle is seen to be at rest by balancing the centripetal and centrifugal forces.

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[1] The speed is rate of change of distance and the velocity is the rate of change of displacement.

[2] If the net external torque acting on a system is zero,the angular momentum L(vector) of the system remains constant,no matter what changes take place within the system.L(vector)=a constant (net external torque acting on system is zero)

[3] In the Sun-Earth system, angular momentum of the earth is not conserved but the total angular momentum of the sun and the earth is constant of motion.

[4] In the motion of earth around sun, the angular momentum of the earth about an axis passing through the sun and perpendicular to the plane of motion of earth is conserved.

[5] The law of angular momentum of a is not applicable for the conical pendulum conserved when the origin is chosen to be at the pendulum bob itself. SetId=410

[6] Example where law of conservation of angular momentum does not hold: A disc rotating on a horizontal rough surface will not have a constant angular momentum because there will be a constant torque by frictional force. Hence, its angular momentum will decrease, and the law of conservation of angular momentum does not apply.

[7] If a bullet hits a wooden board and gets embedded in the board, the total energy and the total momentum of the bullet and the board are conserved.

[8] In order to apply the law of conservation of momentum we must first identify the system. Then even if there is no *net external forces* acting on the system, all the three conservation laws of momentum, angular momentum and energy may not hold due to presence of internal forces.

[9] If the work done by a force depends on the path followed by the particle, it is called a Non conservative force. Work done by a non conservative force is not zero in round trip.

SetId=410

[10] The motion of a bomb dropped from a plane does is not a uniform motion as it follows a parabolic path and not a straight line path.

[11] If two bodies starting from a point A reach a point B, following different paths, their displacement will be, in general different, but the distances covered will always be the same.

[12] A frame rotating w.r.t K with uniform angular velocity is also an inertial frame.

[13] When a freely falling body hits another rigid body in its path then momentum is not conserved as external force mg acts on both the bodies. The total momentum after the collision will be different from the total momentum before the hit.

[14] The kinetic energy of a body does not change if any one of the following is true
(i)force is always perpendicular to the velocity
(ii) the force is always perpendicular to the acceleration
(iii) the object remains stationary
(iv) the object moves in such a way that the point of application of the force remains fixed. SetId=410

[15] A psuedo force is an apparent force that acts on all masses whose motion is described with respect to a non-inertial frame of reference like a rotating frame of reference. This force is needed by an observer in an non-inertial frame to make all the Newtons second laws to write correct equation of motion..

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[1] For any type of translational motion of a body, the displacement cannot be zero, where as the distance travelled can be zero.

[2] The Law of conservation of angular momentum states that when no external torque acts on an object or a closed system of objects undergoing motion about a given axis, the change in angular momentum is zero. Therefore, considering an event where only internal torque or no torque is involved, the total angular momentum of the system before the event is equal to the total angular momentum after the event

[3] Consider a disc and a man system. man is standing on center of the disc rotating with angular velocity.initially man folded his hand.when man stretches his hands then momentum of inertia of system increases.and angular velocity decreases.and total angular momentum remains constant.

[4] For the motion of earth around sun, the angular momentum of the earth about the center of mass of the sun + earth system and perpendicular to the plane of motion of earth is conserved.

[5] The three components of angular momentum of a conical pendulum is conserved w.r.t. the origin at the position of the center of mass of the pendulum. SetId=411

[6] Example where law of conservation of angular momentum does not hold:Consider a vertical stick on the ground falling to a horizontal position. During the fall, the conservation of angular momentum applied at the point of rotation on the ground and perpendicular to the plane of the stick is not applicable as, the gravitational force which acts vertically downwards assumed at the centre of mass produces an external torque about the axis of rotation

[7] If a bullet hits a wooden board and gets embedded in the board, the total energy of the bullet and the board system is conserved but the total momentum is not conserved.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then check we should if the laws are applicable or not.

So if there is no *external force* acting on the system all the three quantities, total momentum, total angular momentum, and total kinetic energy will be conserved independent of the nature of forces.

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[9] The workdone by a non conservative force is dependant on its path. the work varies as the path varies.

[10] A wagon sliding on a roller coaster designed in such a way that the wagon covers equal distances in equal times. As the motion of the wagon is uniform, there will be no net force acting on it.

[11] Distance is equal to the length of the path covered. Displacement is the shortest distance between initial and final points.

[12] The Newton's Laws of motion will hold in all frames which are at rest w.r.t. K but do not remain valid in a frame that move with respect to K.

[13] .The law of conservation of momentum does not hold good when net external forces acting on the system is not zero.when two bodies collide law of conservation of momentum is applicable on system of two bodies but on not individual bodies because external impulse acts on them.

[14] The total work done on a particle is always equal to the change in kinetic energy. SetId=411

[15] One indication that pseudo forces are NON-NEWTONIAN is that they violate Newton's III law and violate the Newton's third law.

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[1] Displacements, being vector quantity can not compared with, a scalar quantity such as distance.

[2] The law of conservation of angular momentum states that when no external torque acts on an object or a closed system of objects, no change of angular momentum can occur. Hence, the angular momentum before an event involving only internal torques or no torques is equal to the angular momentum after the event . Angular momentum can be calculated with the help of the formula $L = I\omega$ where L stands for Angular momentum, I stands for moment of inertia and ω stands for angular velocity

[3] The conservation of angular momentum of a system of bodies requires that the the sum of torque due to all forces be equal to zero. Now consider a situation where the forces are such that the sum of torques of external forces is zero w.r.t. some axes K. Since the value of torque depends of the choices of axes, the sum of torques due to all internal forces will depend on the choice of axes and in general it will be non zero. Therefore, for a system of several bodies, for a given choice of axes K, there will be situations when the total angular momentum may not be conserved.

[4] In the Sun Earth system the angular momentum of the Earth about the pole star is conserved

[5] Only the z component of the angular momentum of a conical pendulum is conserved w.r.t. the origin fixed at the point of suspension.

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[6] We have a conical pendulum .The forces acting on the bob are tension (along the direction of the string) and gravitational force acting in the vertically downward direction.we have an additional force called the drag force which is tangential to the motion of the bob and acts in the direction opposite to the motion of the bob.The axis of rotation passes through the hinge point and is vertical.The torque due to tension is 0 because the force passes through the axis of rotation.The torque due to mg is also zero since it is parallel to the axis of rotation.but the torque due to drag force is not zero.since the net external torque acting on the bob is not zero,therefore the law of conservation of angular momentum does not hold here

[7] If a bullet hits a wooden board and gets embedded in the board, both total energy and the total momentum of the bullet and the board are not conserved.

[8] If we want to apply the conservation laws of momentum, energy and angular momentum, we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *external force* acting on the system, the momentum and angular momentum will be conserved, and depending on the nature of the forces but total energy may or may not be conserved.

SetId=412

[9] A non conservative force is a force with the property that the work done in moving a particle between two points is dependent on the path followed.

[10] A simple pendulum moves along a circular arc and does not have constant speed and therefore its motion is not uniform.

[11] Distance is a scalar quantity where as the displacement is a vector quantity.

[12] Staying inside a bullet train moving with constant velocity (no jerks etc) an experiment can always be performed which will tell us the numerical velocity of the bullet train

[13] A block moving in the air breaks up into two parts and the parts separate, then the total momentum must be the same before and after the break.

[14] A particle is acted upon by a force of constant magnitude which is always perpendicular to the velocity of the particle and the motion of the particle takes place in a plane, Then its kinetic energy, speed, velocity acceleration will not change. SetId=412

[15] The apparent force which seems to act on an object in an accelerating frame of reference if we wish to describe the object's motion is called a pseudo force.Its a non-existent force used only to describe the motion completely using Newton's second law even though the agent causing the force is undefined.

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SetId=413

[1] Distance depends on the path where as the displacement depends on the end point only.

[2] Newton's Second Law of Motion is defined by the expression $F = \frac{dp}{dT}$, where F gives the force vector acting on the system and p gives its momentum vector; in linear motion. A similar expression can be written to describe angular motion, i.e. : $\tau = \frac{dL}{dt}$, where τ is the external torque vector acting on the system, and L is the angular momentum.

If the external torque on the system is zero, then we get the expression as: dL/dt=0. This points out to the fact that, when no external torque is acting on the system, then its angular momentum is constant, no matter what changes occur in the system. This is the Law of Conservation Of Angular Momentum.

[3] Example where law of conservation of angular momentum does not hold:
When there is external force like frictional force acting on a object when it is rotating we cannot use conservation of angular momentum as the friction force acting on the object produces an external torque.

[4] For the motion of earth around sun, the angular momentum of the sun about the center of mass of the sun + earth system and perpendicular to the orbital plane of earth is conserved.

For the motion of earth around sun, the angular momentum of the sun about and axis passing through the Earth and perpendicular to the orbital plane of motion of earth is conserved.

[5] The z component of angular momentum of a conical pendulum is not conserved w.r.t. the origin fixed at the point of suspension; but the x and y components are conserved. SetId=413

[6] When you release a toy gyroscope on its pedestal, it initially has no precessional rotation around that pedestal, i.e, the orientation of rotation is fixed. However, it instantaneously starts precessing around the pedestal. Both Kinetic Energy and Angular Momentum now exist where they did not exist a moment earlier. The Kinetic Energy is easy to explain, as appearing due to the body of the gyroscope dropping a tiny fraction of a millimeter in the Earth's gravitational field, giving up exactly the correct amount of Potential Energy. But the Angular Momentum of the Precession which just appeared, does not come from anywhere. This is therefore a Violation of the Conservation of Angular Momentum.

[7] There are certain situations where it appears that the law of conservation of linear momentum does not hold. For example if we take some amount of a substance like construction putty, cement, cake batter, playing dough,etc and drop it on the

ground, it does not bounce back like a rubber ball would and hence the momentum it had before striking the ground seems to have been lost. Hence it appears that the law of conservation of linear momentum does not hold.

[8] To apply the conservation laws of momentum, energy and angular momentum, we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *external force* acting on the system, the energy and momentum will be conserved. However, depending on the nature of the system and of the forces, the total angular momentum may not be conserved.

[9] A non conservative force is a force with the property that the work done in moving a particle between two points is dependent of the taken path.

Friction, for example, does less work on a book dragged across a table if the book is dragged straight across than if the book is dragged in a curved path.

SetId=413

To write the equation for conservation of energy for non conservative forces we need to include the work done by the non conservative force also.This is because forces like friction liberate heat which are not included in the mechanical energy.

[10] A satellite goes around the earth in a circular orbit of 600km with a time period of $5.8 \times 10^3 s$. Its motion will be uniform as it will cover equal distances in equal times.

[11] Both displacement and distance tell us about the motion of a body but their study does not tell much about the forces on the body

[12] Staying inside a bullet train moving with constant velocity (no jerks etc) an experiment can always be performed which will tell us the numerical value of the acceleration of the bullet train

[13] A ball hits the floor and rebounds after an inelastic collision. In this case the total momentum of the ball before and after the collsion is conserved. Also the total enrgy of the ball and the earth remains the same

[14] The kinetic energy of a particle is continuously increasing with time, then the angle bewteen the net force and the velocity cannot be greater than or equal to 90^o at any time. SetId=413

[15] The physically apparent, but nonexistent, force needed by an observer in a noninertial frame to make Newton's laws of motion hold true is called pseudoforce.

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[1] Distance equal to zero implies displacement=0; and Displacement=0 also implies distance = 0

[2] If the net external torque acting on a system is zero, the angular momentum L of the system remains constant, no matter what changes take place within the system.

$$\sum(T_{\text{ext}}) = \frac{dL}{dt}$$

The law states that when there is no net external torque, $\frac{dL}{dt}$ is zero implying that the total angular momentum of system is constant.

i.e. $L = a$ constant (isolated system)

[3] A bob attached to a ceiling by a string moving in a horizontal circular plane is an example where the total angular momentum of the bob about the point of suspension is not conserved. This is because the the torque due to the weight of the bob about the point of suspension does not vanish and has non zero horizontal component. Only the vertical component of the angular component is conserved.

[4] For the motion of earth around sun, the sum of angular momenta of the Sun and the Earth about the center of mass of the sun + earth system is conserved.

[5] Only the z component of angular momentum of a conical pendulum is conserved w.r.t. the origin fixed at the point of suspension. SetId=414

[6] There is no case where LAW OF CONSERVATION OF ANGULAR MOMENTUM does'nt hold.But there are cases where conservation of angular momentum does not hold.A body in vertical circular motion is an example where angular momentum is not conserved. Here the law of conservation does not apply.

[7] A tennis ball is dropped from height h and after hitting the ground and it bounces back and rises to the same height. In this case the momentum of the ball is conserved because (under ideal conditions) the momentum after it hits the ground will be equal to the momentum it had before hitting the ground.

[8] In order to apply the law of conservation of momentum we must first identify the system. If there is no *external forces* acting on the system then conservation laws of momentum always holds. And depending on the nature of the system and of the forces, the total kinetic energy and the total angular momentum may not be conserved.

[9] A non conservative force is a force with the property that the work done in moving a particle between two points is dependent of the taken path.

Friction, for example, does less work on a book dragged across a table if the book is dragged straight across than if the book is dragged in a curved path.

To write the equation for conservation of energy for nonconservative forces we need toinclude the work done by the non conservative force also.This is because forces like friction liberate heat which are not included in the mechanical energy.

SetId=414

[10] A uniform motion is defined to be the one in which a body covers equal distances in equal time intervals.

[11] Displacement is the shortest distance between initial and final points with direction specified.

[12] Assume bullet train, moving with out any jerks, is going on a circular arc of radius R with constant speed. Then an experiment is to be performed entirely within the train without any measurement on objects outside the train. Such an experiment can tell only radius of the track.

[13] In a head on elastic collision of two identical bodies of equal masses the velocities, the speeds, the momenta and the kinetic energy are all exchanged.

[14] A heavy body is attached from a spring and is held at point A and is such that the spring is not slack nor is it stretched. It is then released. It goes down upto a point B and then it rises upto point C and executes an oscillatory motion between B and C. During the motion from A to C is first positive (from A to B) and then it is negative from B to A and again remains negative from A to C. SetId=414

[15] Pseudo forces come into picture when Newton's laws of motion have to be applied to describe the motion of bodies in non-inertial frames. These forces have no real existence.

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SetId=415

[1] If P and Q are the initial and the final points of a path of a particle, displacement is a vector whose direction is along PQ and has magnitude is equal to the length of line PQ

[2] When the net external torque acting on a body or a system of bodies is zero about a particular axis, then the angular momentum of each body is conserved about that axis.

[3] Law of conservation of angular momentum holds in case of long jump. When a athlete takes off from the ground in a running long jump, the forces on the launching foot give the athlete an angular momentum with a forward rotation around a horizontal axis. Such rotation would not allow the jumper to land properly. In the landing, the legs should be together and extended forward at an angle so that the heels mark the sand at the greatest distance. Once airborne, the angular momentum cannot change (it is conserved) because no external torque acts to change it. However, the jumper can shift most of the angular momentum to the arms by rotating them in windmill fashion. Then the body remains upright in the proper orientation of landing.

[4] For the motion of the Earth around the sun, the total of angular momenta of the Earth and the Sun, about in a reference frame fixed in the pole star, is conserved.

[5] The projection of angular momentum of a conical pendulum in the horizontal plane is a constant of motion when the origin is chosen to be at fixed at the point of suspension.

SetId=415

[6] A sphere rolling on a rough surface.Due to friction there is external torque so the angular momentum changes which results in the slowing of the sphere. The angular momentum keeps changing. Even in case like this one, it is wrong to say that the Law of Angular Momentum Conservation does not hold.

[7] Law of conservation of momentum does not hold when Newton's laws are not valid, e.g. in a non-inertial frame of reference. For example, when we consider collision between two bodies in a non-inertial frame of reference, the law of conservation of momentum cannot be applied because there will be a pseudo force acting on the frame itself.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then check if the laws is applicable or not.

So if there is no *net external force* acting on the system all the three conservation laws will hold.

[9] The non conservative force is a force with a property thet the work done between two points depends on path taken. If a particle moves along a curve path, to know about the work done by a non conservative force we should have the equation of the path along which the particle had move.The work done would be

WORK = INTEGRAL (F.dx)

The equation of conservation of mechanical energy for a non conservative force would be

SetId=415

$KE_{\text{final}} + PE_{final} = KE_{initial} + PE_{initial} + W_{nc}$

[10] A particle moves on a circular path. Then its speed, direction of force, velocity and acceleration must always change with time.

[11] Displacements, being vector quantity can not compared with, a scalar quantity such as distance.

[12] Assume bullet train, moving with out any jerks, is going on a circular arc of radius R with constant speed. Then an experiment is to be performed entirely within the train without any measurement on objects outside the train. Such an experiment can tell both speed of the train and radius of the track.

[13] For a system of several particles the conservation of total linear momentum is equivalent to the statement that their centre of mass moves like a free particle.

[14] The kinetic energy of a body does not change if any one of the following is true
(i)force is always perpendicular to the velocity
(ii) the force is always perpendicular to the acceleration
(iii) the object remains stationary
(iv) the object moves in such a way that the point of application of the force remains fixed. SetId=415

[15] In a non-inertial frame of reference the accelration of the body that we measure, is not the true acceleration, as the frame itself accelerates.Thus,force(F=ma) is also not the true force acting on the body.The extra force added to make it a true value is called pseudo force.Thus pseudo force does not really act on a body but just compensates the change produced by the non inertial frame, in true acceleration.

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[1] If P and Q are the initial and the final points of a path of a particle,the displacement is the vector $\overrightarrow{PQ}$.

SetId=416

[2] The law of conservation of angular momentum states that in absence of an external torque on an object or a closed system of objects the total angular momentum of the system remains constant. Thus if $\vec{\tau} = 0 => \vec{L} =$ constant where τ is the torque and $\vec{L}$ is the angular momentum of the system.

[3] The total angular momentum of a body remains constant of motion when the net torque of the external forces acting on the body is zero.
In general, we have a system of particles such that the net torque of the external forces on the system, w.r.t. some axes K, is zero, the total angular momentum may not remain conserved, because the torque due to the internal forces may not be zero.

[4] For the motion of the Earth around the sun, the total of angular momenta of the Earth and the Sun, is conserved in every inertial frame of reference; but the angular momentum of the Earth (or of the sun)is not conserved in every inertial frame.

[5] The law of angular momentum of a is not applicable for the conical pendulum conserved w.r.t. the origin fixed at the point of suspension. SetId=416

[6] Consider a rod of length l. Let us give an impulse to one end . Now the angular momentum about the oposite end is not zero since the impulse provides some torque . So the angular momentum is not conserved .

$$\text{torque} = \text{impulse} * \ell.$$

$d\ell/dt$ is not equal to zero and the law of conservation of angular momentum does not hold.

[7] If I throw a ball upward, it's speed decreases as it rises upwards. There is an external force (gravity) acting on the ball, so the momentum conservation law does not apply. Momentum of the ball is not conserved, however the momentum of the Earth-ball system is conserved as gravity will become an internal force in this case.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then check we should if the laws are applicable or not.

So if there is no *external force* acting on the system all the three quantities, total momentum is conserved. The total angular momentum is also because the torque of internal forces will be zero. The conservation of energy depends on the nature of forces. will be conserved.

[9] Nonconservative forces arise due to neglected degrees of freedom or from time dependent potentials. The work done by a nonconservative force depends upon the path taken. It causes a change in the mechanical energy of the system. It adds or removes mechanical energy from a system. SetId=416

[10] A particle moves on a circular path. Then its speed, direction offorce, can remain constant by velocity and acceleration must always change with time.

[11] Distance depends on the path where as the displacement depends on the end point only

[12] Assume bullet train, moving with out any jerks, is going on a circular arc of radius R with constant speed. Then an experiment is to be performed entirely within the train without any measurement on objects outside the train. Such an experiment can tell only speed of the track.

[13] The total mechanical energy of a system may not be conserved if there are no external forces and the internal forces are conservative.

[14] The total work done on a particle is always equal to the change in kinetic energy. SetId=416

[15] A force is any interaction which tends to change the motion of an object. It is *equal to* the rate of change of momentum by Newton's second law.

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[1] If two bodies starting from a point A reach a point B, following different paths, their displacement will be, in general different, but the distances covered will always be the same.

[2] If no net external torque acts on a system, the total angular momentum of the system remains constant.

[3] An example where law of conservation of angular momentum holds:
The Law of conservation of angular momentum holds in the case of a ballet dancer performing a pirouette.

When the dancer extends her arms outward, the angular velocity of her rotation decreases whereas when she keeps her arms close to her body, the angular velocity increases. This is because her moment of inertia changes as she moves her arms outward and inward. It can be noted that she as a system has no external torque acting upon her.

[4] In the Sun Earth system the angular momentum of the Earth is conserved in every frame of reference

[5] The law of angular momentum of a is not applicable for the conical pendulum conserved when the origin is chosen to be at the pendulum bob itself. SetId=417

[6] Let us consider a rotating skew rod. In the absence of friction or any other drag force, the rod should continuously spin without stopping. Here the net torque about the axis of rotation is 0 and hence angular momentum is conserved. It therefore follows from law of conservation of angular momentum that a spinning skew rod will keep rotating with constant angular velocity if there is no external torque. So law of conservation of angular momentum does not hold.

[7] A soldier accelerating away, after detonating a bomb, will find that the total momentum of the fragments of the bomb is zero. This is an example where the law of conservation of momentum holds as the forces on the fragments are internal forces only and sum of all such forces is zero.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *net external force* acting on the system, the momentum is conserved. The definition of angular momentum and torque depends on the choice of axes, and therefore it may not be be conserved. The conservation of total energy holds only for conservative forces.

When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *net external force* acting on the system, the energy and momentum will be conserved. However, the total angular momentum may not be conserved because the torque may not be zero.

[9] The work done by a *Nonconservative Force *is not recoverable*.*The work done by a *Non Conservative force* is usually dissipated in the form of Heat and Sound.

SetId=417 Non conservative force *cannot* be expressed in the form of *Potential Energy*.

[10] A particle moves on a circular path. Then under suitable conditions its speed may remain constant, but the force, velocity and acceleration must always change with time.

[11] Distance equal to zero $\Rightarrow$ displacement=0; but Displacement=0

[12] A particle is observed from two frames S_1 and S_2. The frame S_2 moves with respect to S_1 with an acceleration a. If F_1 and F_2 be the pseudoforces when seen from S_1 and S_2 respectively it is not possible to have $F_1 = F_2 = 0$

[13] When a bullet fired on a wooden block, some energy is transferred to the block and the total mechanical energy of the block and the bullet is conserved.

[14] A particle is acted upon by a force of constant magnitude which is always perpendicular to the velocity of the particle and the motion of the particle takes place in a plane, Then its kinetic energy, speed, velocity acceleration will not change. SetId=417

[15] Newton's laws are not valid on non-inertial frame of reference. So to validate Newton's laws of motion pseudo force (fictious or virtual force) is introduced.
Pseudo force acts in non-inertial frame. Its magnitude is always mass of the body multiplied by acceleration of the frame. It is always in direction opposite to the acceleration of the frame of reference. The resultant of pseudo forces and real forces is always zero.

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SetId=418

[1] Displacement is equal to the vector difference $\vec{r}_f - \vec{r}_i$ of the position vectors of initial and final points. The distance covered will be $|\vec{r}_f - \vec{r}_i|$

[2] The law of conservation of angular momentum states that when no external torque is applied on an object or a closed system of objects about an axis, the angular momentum about that axis remains constant.

[3] In case of a skater, who can be considered an isolated system, so no torue will be acting on him/her. When the arms are extended, the moment of inertia is more. When his hands are closely held, the moment of inertia is lesser. Since the angular momentum is same, the angular acceleration changes accordingly.

[4] In the motion of earth around sun, the angular momentum of the earth about an axis passing through the sun and perpendicular to the plane of motion of earth is conserved.

[5] The three components of angular momentum of a conical pendulum is conserved w.r.t. the origin at the position of the center of mass of the pendulum. SetId=418

[6] In the example of skew rod the angular velocity does not change even though the torque applied is nonzero. However there is no contradiction as in this case the law of conservation of momentum is not applicable. conservation is violated.

[7] There is no known exception to the law of conservation of momentum in classical mechanics However, an exception to conservation of energy in nuclear physics is observed. In nuclear reactions when two nuclei collide and their mass converts to energy and energy momentum are not conserved.

[8] In order to apply the law of conservation of momentum we must first identify the system. If there is no *net external forces* acting on the system then conservation laws of momentum always holds. The total energy and the total angular momentum may not be conserved.

[9] * A non conservative force is a force that acts on a particle(or point), such that the work done by this force in moving this particle from one point to another is */dependent of path taken/* that is the work done depends on the path itself. * For example frictional force is non conservative because the work done by friction always acts in the direction of travel and therefore depends on length L of the path taken.

SetId=418

[10] A particle moves on a circular path. Then under suitable conditions its speed and acceleration may remain constant, but the force, and velocity must always change with time.

[11] If P and Q are the initial and the final points of a path of a particle, displacement is a vector whose direction is along PQ and has magnitude is equal to the length of line PQ

[12] A particle is observed from two frames S_1 and S_2. The frame S_2 moves with respect to S_1 with an acceleration a. If F_1 and F_2 be the pseudoforces when seen from S_1 and S_2 respectively and if $F_1 = 0$ then we must have $F_2 \neq 0$

[13] When a moving car hits a parked lorry and causes the parked lorry to move ,energy is transferred from moving the car to the lorry and the total energy of the lorry and the car is conserved.

[14] The kinetic energy of a particle is continuously increasing with time, then the angle bewteen the net force and the velocity cannot be greater than or equal to 90^o at any time. SetId=418

[15] These forces are non-real forces but must be taken into account while applying Newton's Law's of Motion in accelerating frame of reference as compared to an inertial frame of reference.

The centrifugal and centripetal forces are examples of pesudo-forces.

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[1] Distance is equal to the length of the path covered. Displacement is the shortest distance between initial and final points.

[2] The angular momentum of a given system of bodies shall remain conserved unless acted upon by an external unbalanced torque.

[3] Example where law of conservation of angular momentum holds:
Let us assume a student seated on a stool that can rotate freely about a vertical axis. The student has been set into rotation at a modest initial angular speed ω . He holds two dumbbells in his outstretched hands. His angular momentum vector L lies along the vertical rotation axis, pointing upwards. Now he pulls in his arms;this action reduces his rotational inertia from its value I_{initial} to a final value I_{final} because he moves the mass closer to the rotational axis. His rate of rotation increases markedly, from ω_{initial} to ω_{final}. The student can then slow down by extending his arms once more,moving the dumbbells outward. No external torque acts on the system consisting of the student, stool and the dumbbells. Thus the angular momentum of the system about the rotational axis remains constant. $I_{\text{initial}} * \omega_{\text{initial}} = I_{\text{final}} * \omega_{\text{final}}$.

[4] For the motion of earth around sun, the angular momentum of the earth about the center of mass of the sun + earth system and perpendicular to the plane of motion of earth is conserved.

[5] Only the z component of the angular momentum of a conical pendulum is conserved w.r.t. the origin fixed at the point of suspension. SetId=419

[6] Example where law of conservation of angular momentum does not hold:If a particle undergoes conical motion and the only force acting on particle is central force like tension of the string.Then total external torque about fixed point A is zero,yet angular momentum is not conserved,as angular momentum keeps on changing direction.

[7] In a system of a canon and a canon ball, total momentum of the system is zero before canon ball is fired. After firing the canon ball, the momentum of the system seems to be conserved as the ball moves forward and the canon moves backward.

[8] In order to apply the law of conservation of momentum we must first identify the system. Then even if there is no *net external forces* acting on the system, all the three conservation laws of momentum, angular momentum and energy may not hold due to presence of internal forces.

[9] A force with the property that the work done in moving a particle is dependent on the path followed. The work done by a conservative force in moving a body from an initial location to a final location is dependent on the path taken between the two points

SetId=419

[10] When the force is kept constant as function of time, it is possible for a particle to move on a circular path in such a way that its speed remains constant, but the velocity and acceleration must always change with time.

[11] If P and Q are the initial and the final points of a path of a particle,the displacement is the vector $\overrightarrow{PQ}$.

[12] If K is an inertial frame, any frame that moves w.r.t. the frame K with uniform velocity is also an inertial frame.

[13] When a bomb explodes the total mechanical energy is not conserved. But the total chemical energy and the mechanical energy is conserved.

[14] A heavy body is attached from a spring and is held at point A and is such that the spring is not slack nor is it stretched. It is then released. It goes down upto a point B and then it rises upto point C and executes an oscillatory motion between B and C. During the motion from A to C is first positive (from A to B) and then it is negative from B to A and again remains negative from A to C. SetId=419

[15] When observing our system from a reference frame which is accelerating compared to an inertial frame,in order to make it easier to apply newtons laws, we can apply a pseudo force on all objects in the universe proportional to their mass capable of causing an acceleration equal and opposite to that of our reference frame. Hence serving to in a way "stop"(or make inertial) our reference frame, and making it easier for us to investigate the motion.

This application of pseudo force doesn't change the motion of the object because just as we can choose an arbitrary reference frame, we can choose an arbitrary force to cause the same acceleration in every object in the whole universe without changing the relative motions of objects. (as all motion is truly relative, we will still get correct answers for our investigations.

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SetId=420

[1] Distance is a scalar quantity where as the displacement is a vector quantity.

[2] When the net external torque acting on a system about a given axis is zero, the total angular momentum of the system about that axis remains consant.

[3] A bob is attached to ceiling by a string and moves in a horizontal circular plane is an example. In this case the law of conservation of angular momentum does not hold.

[4] In the Sun Earth system the angular momentum of the Earth about the pole star is conserved

[5] The z component of angular momentum of a conical pendulum is not conserved w.r.t. the origin fixed at the point of suspension; but the x and y components are conserved. SetId=420

[6] A nonzero torque always causes the angular velocity to change, because a change in angular momentum means a change in angular velocity $L = I\omega$

[7] When applying the conservation laws of momentum, energy and angular momentum we must define the system first.Only then check if the laws is applicable or not.

As an example: when a ball is dropped from a height, it gains momentum down if we consider the ball as our system.This is because the force of gravity acts as an external force.

However, if we change our system and consider earth as a part of our system too, then the momentum remains conserved because the earth gains momentum up.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then check we should if the laws are applicable or not.

So if there is no *external force* acting on the system all the three quantities, total momentum, total angular momentum, and total kinetic energy will be conserved independent of the nature of forces.

[9] The work done by non conservative force is dependent on the path taken by the particle in reaching final position from initial position. Non conservative force depends on the distance travelled by the particle

SetId=420

[10] It is not possible for a particle to move on a circular path in such a way that its speed and force remains constant, and only the velocity and acceleration may (or may not) always change with time.

[11] If two bodies starting from a point A reach a point B, following different paths, their displacement will be, in general different, but the distances covered will always be the same.

[12] If K is an inertial frame, any frame that moves w.r.t. the frame K with uniform speed is also an inertial frame.

[13] When a ball rolls over a rough surface, it comes to stop after some time. This is because transational and rotational kinetic energy initially present in the ball continuosly gets converted to heat due to friction. When all the kinetic energy changes to heat, the ball stops. The total mechanical energy of the ball is not conserved.

[14] The kinetic energy of a body does not change if any one of the following is true
(i)force is always perpendicular to the velocity
(ii) the force is always perpendicular to the acceleration
(iii) the object remains stationary
(iv) the object moves in such a way that the point of application of the force remains fixed. SetId=420

[15] Various types of forces in nature can be grouped in four categories:
(a)Gravitational; (b)Electromagnetic; (c)Nuclear; (d)Weak
There are also some non-fundamental forces such as:
(i)Normal reaction on bodies in contact with surfaces , (ii) Friction,(iii) Tension,(iv)Elastic force.

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[1] The speed is rate of change of distance and the velocity is the rate of change of displacement.

[2] This law sates that when no net torque of all forces acts on a object or a system of objects then total angular momentum of system is conserved.The angular momentum before an event is equal to angular momentum after that event.mathematically explained by when, net torque=0 ;then, total angular momentum(L)=constant.

[3] Consider a disc rotating about an axis perpendicular to its plane. On placing a smaller disc with its surface parallel to the surface of the rotating disc, the angular momentum of the system of two discs remains constant as there is no external torque.

[4] For the motion of earth around sun, the angular momentum of the sun about the center of mass of the sun + earth system and perpendicular to the orbital plane of earth is conserved.

For the motion of earth around sun, the angular momentum of the sun about and axis passing through the Earth and perpendicular to the orbital plane of motion of earth is conserved.

[5] Only the z component of angular momentum of a conical pendulum is conserved w.r.t. the origin fixed at the point of suspension. SetId=421

[6] A nonzero torque always implies change in angular momentum and may not give rise to a change in magnitude of angular velocity. A non zero torque may mean change only the direction of the angular momentum and not the angular velocity.

[7] Statement: Law of Conservation of energy states that ”ENERGY CAN NEITHER BE CREATED NOR DESTROYED”,but it can be changed from one form to other.

EXPLANATION: Statement implies that the total amount of energy in an isolated system remains constant although it may change forms. viz, kinetic energy may change to potential;chemical to electrical energies etc.

[8] If we want to apply the conservation laws of momentum, energy and angular momentum, we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *external force* acting on the system, the momentum and angular momentum will be conserved, and depending on the nature of the forces but total energy may or may not be conserved.

[9] The work done by non conservative force is dependent on the path taken by the particle in reaching final position from initial position. Non conservative force depends on the distance travelled by the particle

SetId=421

[10] For a particle moving on circle the acceleration is always constant in magnitude and directed towards the centre of the circle.

[11] Distance is equal to the length of the path covered. Displacement is the shortest distance between initial and final points.

[12] A frame rotating w.r.t K with uniform angular velocity is also an inertial frame.

[13] Let us consider that a pendulum is oscillating moving in a vertical plane. Mean while let another bob which is attached to a spring and is executing a simple harmonic motion in horizontal direction comes and hits the pendulum. Here conservation of momentum does not hold good as tension(external force) is acting on the system.(pendulum)

[14] The total work done on a particle is always equal to the change in kinetic energy. SetId=421

[15] A force is agency that which changes or tends to change the state of rest or motion of a body.

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[1] For any type of translational motion of a body, the displacement cannot be zero, where as the distance travelled can be zero.

[2] Statement of Law of Conservation of Angular Momentum:
Differentiating $\vec{L} = \vec{r} \times \vec{p}$ w.r.t, time,

$$
\begin{aligned}
\frac{dL}{dt} &= \frac{d\vec{r} \times \vec{p}}{dt} = \frac{d\vec{r}}{dt} \times \vec{p} + \vec{r} \times \frac{d\vec{p}}{dt} = \vec{v} \times (m\vec{v}) + \vec{r} \times \vec{F} \\
&= \vec{r} \times \vec{F} (\because v \times v = 0) \\
&= \vec{\tau}
\end{aligned}
$$

here $\vec{\tau}$ represents the net torque acting on a rigid body rotating about a fixed axis.This torque must take into account of all the forces, be it external or internal forces

[3] Consider a man standing on a spinning platform. Initially, the man spreads out his arms and he spins with a certain angular velocity. The next moment, he pulls his arms inwards keeping them close to his body. We will observe that the angular velocity with which he is spinning now increases. This phenomenon can be explained by the Law Of Conservation of Angular momentum. Initially, since his arms were spread wide, his moment of inertia was large. However, when he pulled them close to his body, his moment of inertia decreased.
In this example the angular velocity of the man increases and therefore the angular momentum also increases.The law of conservation of angular momentum does not apply because the torque of muscular forces is not zero.

[4] For the motion of earth around sun, the sum of angular momenta of the Sun and the Earth about the center of mass of the sun + earth system is conserved.

[5] The projection of angular momentum of a conical pendulum in the horizontal plane is a constant of motion when the origin is chosen to be at fixed at the point of suspension. SetId=422

[6] In the example of a rotating skew rod the torque due to the external gravitational forces is zero , but the angular momentum is not constant Therefore the law of conservation of angular momentum is violated.

[7] Oscillating simple pendulum is a very good example where potential energy gets converted to kinetic energy and kinetic to potential energy. Some energy gets dissipated as heat if we consider air resistance. Energy as a whole is conserved if we consider universe as system, the energy has just changed its form.

[8] To apply the conservation laws of momentum, energy and angular momentum, we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *external force* acting on the system, the energy and momentum will be conserved. However, depending on the nature of the system and of the forces, the total angular momentum may not be conserved.

[9] Nonconservative forces are those forces in which the work done in moving a particle is dependant on the path taken to cover the distance. Some energy woul be lost to the environment in the form of heat, sound, etc. The energy in the final state is less than that in the initial state.

SetId=422

[10] The motion of a bomb dropped from a plane does is not a uniform motion as it follows a parabolic path and not a straight line path.

[11] Distance is a scalar quantity where as the displacement is a vector quantity.

[12] The Newton's Laws of motion will hold in all frames which are at rest w.r.t. K but do not remain valid in a frame that move with respect to K.

[13] The law of conservation of momentum does not hold in relativistic situations, i.e., where the speeds of the masses involved are close to the speed of light.

[14] A particle is acted upon by a force of constant magnitude which is always perpendicular to the velocity of the particle and the motion of the particle takes place in a plane, Then its kinetic energy, speed, velocity acceleration will not change. SetId=422

[15] The forces may be of the following two types - *Contact forces* (those that act when bodies are in physical contact) eg. friction, normal reaction, bouyancy etc. and*Action-at-a-distance forces* (those that act when bodies are not in contact) eg. Gravity, electostatic forces, magnetic forces etc. There At the root level, forces are of the following fundamental types :- (a) *Gravitational forces* - weakest of all forces, always attractive
(b) *Electromagnetic forces* - stronger than gravitational forces, can be attractive or repulsive,
(c) *Nuclear forces* - exist at atomic level, have very short range,
(d) *Weak nuclear forces* associated with beta particle emission

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[1] Displacements, being vector quantity can not compared with, a scalar quantity such as distance.

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[2] Statement of Law of Conservation of Angular Momentum: For a system of many particles The net torque due all the forces, be it external or internal forces. But as the torque due to all the internal forces cancel out, it sufficient to consider the external forces acting on the system.

[3] In the Sun-Earth system, angular momentum of the earth is not conserved but the total angular momentum of the sun and the earth is constant of motion.

[4] For the motion of the Earth around the sun, the total of angular momenta of the Earth and the Sun, about in a reference frame fixed in the pole star, is conserved.

[5] The law of angular momentum of a is not applicable for the conical pendulum conserved w.r.t. the origin fixed at the point of suspension.

SetId=423

[6] In the example of skew rod, the angular momentum changes with time and there is a non zero torque coming from action of forces other than gravitational forces. Hence the law of conservation of angular momentum dos not apply.

[7] Law of conservation of momentum does not hold whenever an external force or impulse acts on the system. For example,when a body collides with earth then it bounces back to a lesser height as it loses some velocity.

In this example the momentum of a ball is not conserved due to impulsive force by ground in the normal direction.

However, strictly speaking the system that should be considered here is the ball-earth system and the total momentum is conserved.

[8] In order to apply the law of conservation of momentum we must first identify the system. If there is no *external forces* acting on the system then conservation laws of momentum always holds. And depending on the nature of the system and of the forces, the total kinetic energy and the total angular momentum may not be conserved.

[9] The work done by such forces depends on the path taken. The work done cannot be represented as a potential energy function.Work done by such forces is always negative.

SetId=423

[10] A wagon sliding on a roller coaster designed in such a way that the wagon covers equal distances in equal times. As the motion of the wagon is uniform, there will be no net force acting on it.

[11] Both displacement and distance tell us about the motion of a body but their study does not tell much about the forces on the body

[12] Staying inside a bullet train moving with constant velocity (no jerks etc) an experiment can always be performed which will tell us the numerical velocity of the bullet train

[13] when we are in accelerating frame if we observe any collision between two bodies then the law of conservation of momentum does not hold in that frame of reference.

[14] The kinetic energy of a particle is continuously increasing with time, then the angle bewteen the net force and the velocity cannot be greater than or equal to 90^{o} at any time. $\boxed{\text{SetId=423}}$

[15] The main differences between force and pseudo force are -
(1) Forces have a real presence while pseudo forces don't.
(2) Forces can be accounted for by Newton's laws.
(3) Pseudo forces are only taken into account when the reference frame is accelerated.

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[1] Distance depends on the path where as the displacement depends on the end point only.

[2] Depending on the torques acting on a system, the angular momentum can be conserved only in one or two directions, but may not be conserved in all. For instance, if an isolated body has no torque acting on it only in the direction along the Z axis, then the angular momentum is conserved only in that direction.

[3] Consider a disc and a man system. man is standing on center of the disc rotating with angular velocity.initially man folded his hand.when man stretches his hands then momentum of inertia of system increases.and angular velocity decreases.and total angular momentum remains constant.

[4] For the motion of the Earth around the sun, the total of angular momenta of the Earth and the Sun, is conserved in every inertial frame of reference; but the angular momentum of the Earth (or of the sun)is not conserved in every inertial frame.

[5] The law of angular momentum of a is not applicable for the conical pendulum conserved when the origin is chosen to be at the pendulum bob itself. SetId=424

[6] In the example of conical pendulum, the z- component of angular momentum does not change. This follows from the angular momentum conservation as there is no external torque.

[7] If a bullet hits a wooden board and gets embedded in the board, the total energy and the total momentum of the bullet and the board are conserved.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then check if the laws is applicable or not.

So if there is no *net external force* acting on the system all the three conservation laws will hold.

[9] A nonconservative force is a force with the property that the work done in moving a particle depends on the path taken.Also, the net work done in a closed loop is non zero.

SetId=424

[10] A simple pendulum moves along a circular arc and does not have constant speed and therefore its motion is not uniform.

[11] Displacement is the shortest distance between initial and final points with direction specified.

[12] Staying inside a bullet train moving with constant velocity (no jerks etc) an experiment can always be performed which will tell us the numerical value of the acceleration of the bullet train

[13] Give an example where law of conservation of momentum does not hold all cases when seen from non inertial frame of references for example when we see two cars collide from a moving bus there momentum is not conserved

[14] A heavy body is attached from a spring and is held at point A and is such that the spring is not slack nor is it stretched. It is then released. It goes down upto a point B and then it rises upto point C and executes an oscillatory motion between B and C. During the motion from A to C is first positive (from A to B) and then it is negative from B to A and again remains negative from A to C. SetId=424

[15] A force is any interaction which tends to change the motion of an object. It is also *defined* as rate of change of momentum. It is a vector quantity.

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SetId=425

[1] Distance equal to zero implies displacement=0; and Displacement=0 also implies distance = 0

[2] According to Law of Conservation of Angular momentum,if no external torque acts on an object or system of objects,angular momentum of an object or system of objects remains CONSTANT or no change in angular momentum can occur.

Also it states that,only external torque can change angular momentm of the system where as the torque produced by internal forces can not change the angular momentum of the system

[3] The conservation of angular momentum of a system of bodies requires that the the sum of torque due to all forces be equal to zero. Now consider a situation where the forces are such that the sum of torques of external forces is zero w.r.t. some axes K. Since the value of torque depends of the choices of axes, the sum of torques due to all internal forces will depend on the choice of axes and in general it will be non zero. Therefore, for a system of several bodies, for a given choice of axes K, there will be situations when the total angular momentum may not be conserved.

[4] In the Sun Earth system the angular momentum of the Earth is conserved in every frame of reference

[5] The three components of angular momentum of a conical pendulum is conserved w.r.t. the origin at the position of the center of mass of the pendulum. SetId=425

[6] In the example of conical pendulum, the x and$y$ components of angular momentum change. This follows from the angular momentum conservation as the z components external torque is zero and horizontal components of torque are non zero.

[7] If a bullet hits a wooden board and gets embedded in the board, the total energy of the bullet and the board system is conserved but the total momentum is not conserved.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then check we should if the laws are applicable or not.

So if there is no *external force* acting on the system all the three quantities, total momentum is conserved. The total angular momentum is also because the torque of internal forces will be zero. The conservation of energy depends on the nature of forces. will be conserved.

[9] A force whose work done is a path function is called a non-conservative force. All the forces which do not satisfy the definition of conservative forces are non-conservative in nature. The work done by these forces dissipates into heat energy, sound energy,

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light energy, etc. Therefore, law of conservation of mechanical energy cannot be applied to a system on which a non-conservative force is acting. No potential function can be defined for these forces.

[10] A satellite goes around the earth in a circular orbit of 600km with a time period of $5.8 \times 10^3 s$. Its motion will be uniform as it will cover equal distances in equal times.

[11] Displacements, being vector quantity can not compared with, a scalar quantity such as distance.

[12] Assume bullet train, moving with out any jerks, is going on a circular arc of radius R with constant speed. Then an experiment is to be performed entirely within the train without any measurement on objects outside the train. Such an experiment can tell only radius of the track.

[13] When a tennis ball hits the ground at an oblique angle, the angle of reflection is equal to the angle of incidence. This is a simple consequence of conservation of horizontal component of momentum.

[14] The kinetic energy of a body does not change if any one of the following is true
(i)force is always perpendicular to the velocity
(ii) the force is always perpendicular to the acceleration
(iii) the object remains stationary
(iv) the object moves in such a way that the point of application of the force remains fixed.

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[15] Explain Pseudo Force: While applying Newton's laws of motion in non-inertial frame of reference it gives answers which contradict observations. Thus, to account for this,using Newton's Laws, we introduce a "fake" or pseudo force which gives answers that match the observations in a non-inertial frame.

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[1] If P and Q are the initial and the final points of a path of a particle, displacement is a vector whose direction is along PQ and has magnitude is equal to the length of line PQ

[2] The law of conservation of angular momentum states that when the net external torque acting on the system is zero, then the angular momentum of the system remains constant.both the initial and final momentum should be taken from a fixed inertial frame of reference provided.

[3] Example where law of conservation of angular momentum does not hold:
When there is external force like frictional force acting on a object when it is rotating we cannot use conservation of angular momentum as the friction force acting on the object produces an external torque.

[4] In the motion of earth around sun, the angular momentum of the earth about an axis passing through the sun and perpendicular to the plane of motion of earth is conserved.

[5] Only the z component of the angular momentum of a conical pendulum is conserved w.r.t. the origin fixed at the point of suspension.

SetId=426

[6] Example where law of conservation of angular momentum does not hold: A disc rotating on a horizontal rough surface will not have a constant angular momentum because there will be a constant torque by frictional force. Hence, its angular momentum will decrease, and the law of conservation of angular momentum does not apply.

[7] If a bullet hits a wooden board and gets embedded in the board, both total energy and the total momentum of the bullet and the board are not conserved.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *net external force* acting on the system, the momentum is conserved. The definition of angular momentum and torque depends on the choice of axes, and therefore it may not be be conserved. The conservation of total energy holds only for conservative forces.

When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *net external force* acting on the system, the energy and momentum will be conserved. However, the total angular momentum may not be conserved because the torque may not be zero.

[9] *Non conservative forces* are the type of forces in which the work done by the forces is purely dependent on the path taken by the body.Thus the net work done by the forces in cyclic path is never equal to zero.

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[10] A uniform motion is defined to be the one in which a body covers equal distances in equal time intervals.

[11] Distance depends on the path where as the displacement depends on the end point only

[12] Assume bullet train, moving with out any jerks, is going on a circular arc of radius R with constant speed. Then an experiment is to be performed entirely within the train without any measurement on objects outside the train. Such an experiment can tell both speed of the train and radius of the track.

[13] when a ball is dropped from a height, it gains momentum down if we consider the ball as our system.This is because the force of gravity acts as an external force.

However, if we change our system and consider earth as a part of our system too, then the momentum remains conserved because the earth gains momentum up.

[14] The total work done on a particle is always equal to the change in kinetic energy. SetId=426

[15] When a train is at rest and a ball is hung from the ceiling with a string, an observer in the train sees that the string is vertical. But when the train starts moving, the observer sees that the string makes an angle with the vertical and is tilted in forward direction . This means that some force other than gravity and tension must act on the ball. That force is the pseudo force.

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[1] If P and Q are the initial and the final points of a path of a particle,the displacement is the vector $\overrightarrow{PQ}$.

[2] The law of conservation of angular momentum states that The total angular momentum of a system is constant in both magnitude and direction if the resultant torque, of the external forces acting on the system, is zero.

[3] A bob attached to a ceiling by a string moving in a horizontal circular plane is an example where the total angular momentum of the bob about the point of suspension is not conserved. This is because the the torque due to the weight of the bob about the point of suspension does not vanish and has non zero horizontal component. Only the vertical component of the angular component is conserved.

[4] For the motion of earth around sun, the angular momentum of the earth about the center of mass of the sun + earth system and perpendicular to the plane of motion of earth is conserved.

[5] The z component of angular momentum of a conical pendulum is not conserved w.r.t. the origin fixed at the point of suspension; but the x and y components are conserved.

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[6] Example where law of conservation of angular momentum does not hold:Consider a vertical stick on the ground falling to a horizontal position. During the fall, the conservation of angular momentum applied at the point of rotation on the ground and perpendicular to the plane of the stick is not applicable as, the gravitational force which acts vertically downwards assumed at the centre of mass produces an external torque about the axis of rotation

[7] There are certain situations where it appears that the law of conservation of linear momentum does not hold. For example if we take some amount of a substance like construction putty, cement, cake batter, playing dough,etc and drop it on the ground, it does not bounce back like a rubber ball would and hence the momentum it had before striking the ground seems to have been lost. Hence it appears that the law of conservation of linear momentum does not hold.

[8] In order to apply the law of conservation of momentum we must first identify the system. If there is no *net external forces* acting on the system then conservation laws of momentum always holds. The total energy and the total angular momentum may not be conserved.

[9] Non-conservative forces are path-dependent forces, i.e. the work done on a body by these forces depends on the path taken by the body. Mechanical energy of a system is not conserved when a conservative force acts on it but the total energy is

conserved. Therefore, the mechanical energy lost by the system is liberated in some other form such as light energy, heat energy, etc.

For example, when a body is moving along a surface, frictional force acts on the body as well. Due to this frictional force, the body loses its mechanical energy, and this loss is generally released in the form of heat energy to the surroundings. Thus, the mechanical energy will not be conserved and frictional force can be classified as a non-conservative force.

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[10] A particle moves on a circular path. Then its speed, direction of force, velocity and acceleration must always change with time.

[11] Distance equal to zero $\Rightarrow$ displacement=0; but Displacement=0

[12] Assume bullet train, moving with out any jerks, is going on a circular arc of radius R with constant speed. Then an experiment is to be performed entirely within the train without any measurement on objects outside the train. Such an experiment can tell only speed of the track.

[13] There is no known exception to the law of conservation of momentum in classical mechanics however when two bodies collide and their mass converts to energy, an exception in nuclear physics is observed. In real life this is observed in nuclear reactions at atomic level.

[14] A particle is acted upon by a force of constant magnitude which is always perpendicular to the velocity of the particle and the motion of the particle takes place in a plane, Then its kinetic energy, speed, velocity acceleration will not change. SetId=427

[15] Since newton's laws are not valid in non-inertial frames, pseudoforces (which do not exist in reality) are used to help us formualate and use Newton's laws of motion in non-inertial frames.

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SetId=428

[1] If two bodies starting from a point A reach a point B, following different paths, their displacement will be, in general different, but the distances covered will always be the same.

[2] If the net external torque acting on a system is zero,the angular momentum L(vector) of the system remains constant,no matter what changes take place within the system.L(vector)=a constant (net external torque acting on system is zero)

[3] Law of conservation of angular momentum holds in case of long jump. When a athlete takes off from the ground in a running long jump, the forces on the launching foot give the athlete an angular momentum with a forward rotation around a horizontal axis. Such rotation would not allow the jumper to land properly. In the landing, the legs should be together and extended forward at an angle so that the heels mark the sand at the greatest distance. Once airborne, the angular momentum cannot change (it is conserved) because no external torque acts to change it. However, the jumper can shift most of the angular momentum to the arms by rotating them in windmill fashion. Then the body remains upright in the proper orientation of landing.

[4] In the Sun Earth system the angular momentum of the Earth about the pole star is conserved

[5] Only the z component of angular momentum of a conical pendulum is conserved w.r.t. the origin fixed at the point of suspension. SetId=428

[6] We have a conical pendulum .The forces acting on the bob are tension (along the direction of the string) and gravitational force acting in the vertically downward direction.we have an additional force called the drag force which is tangential to the motion of the bob and acts in the direction opposite to the motion of the bob.The axis of rotation passes through the hinge point and is vertical.The torque due to tension is 0 because the force passes through the axis of rotation.The torque due to mg is also zero since it is parallel to the axis of rotation.but the torque due to drag force is not zero.since the net external torque acting on the bob is not zero,therefore the law of conservation of angular momentum does not hold here

[7] A tennis ball is dropped from height h and after hitting the ground and it bounces back and rises to the same height. In this case the momentum of the ball is conserved because (under ideal conditions) the momentum after it hits the ground will be equal to the momentum it had before hitting the ground.

[8] In order to apply the law of conservation of momentum we must first identify the system. Then even if there is no *net external forces* acting on the system, all the three conservation laws of momentum, angular momentum and energy may not hold due to presence of internal forces.

[9] It is a force for which the work done by that force on an object or a particle in moving it between any two points depends on its path travelled.This force doesn't conserves the mechanical energy.The work done by a non-conservative force on an object in moving it in a circular path is not equal to zero.

SetId=428

[10] A particle moves on a circular path. Then its speed, direction offorce, can remain constant by velocity and acceleration must always change with time.

[11] If P and Q are the initial and the final points of a path of a particle, displacement is a vector whose direction is along PQ and has magnitude is equal to the length of line PQ

[12] A particle is observed from two frames S_1 and S_2. The frame S_2 moves with respect to S_1 with an acceleration a. If F_1 and F_2 be the pseudoforces when seen from S_1 and S_2 respectively it is not possible to have $F_1 = F_2 = 0$

[13] When there is no external forces act on a system of many particles, and there are only internal forces acting on the particles. The third law gives that the internal forces are pairwise equal and opposite.Thus the sum of internal forces is zero and the momentum of each particle is conserved.

[14] The kinetic energy of a particle is continuously increasing with time, then the angle bewteen the net force and the velocity cannot be greater than or equal to 90° at any time.

SetId=428

[15] Force is defined as the rate of change of linear momentum. In other words it is the agency which changes or tends to change the (a) State of rest; (b)State of uniform motion (c) Direction of body's motion; (d) Shape of the body

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[1] Displacement is equal to the vector difference $\vec{r}_f - \vec{r}_i$ of the position vectors of initial and final points. The distance covered will be $|\vec{r}_f - \vec{r}_i|$

[2] The Law of conservation of angular momentum states that when no external torque acts on an object or a closed system of objects undergoing motion about a given axis, the change in angular momentum is zero. Therefore, considering an event where only internal torque or no torque is involved, the total angular momentum of the system before the event is equal to the total angular momentum after the event

[3] The total angular momentum of a body remains constant of motion when the net torque of the external forces acting on the body is zero.
In general, we have a system of particles such that the net torque of the external forces on the system, w.r.t. some axes K, is zero, the total angular momentum may not remain conserved, because the torque due to the internal forces may not be zero.

[4] For the motion of earth around sun, the angular momentum of the sun about the center of mass of the sun + earth system and perpendicular to the orbital plane of earth is conserved.

For the motion of earth around sun, the angular momentum of the sun about and axis passing through the Earth and perpendicular to the orbital plane of motion of earth is conserved.

[5] The projection of angular momentum of a conical pendulum in the horizontal plane is a constant of motion when the origin is chosen to be at fixed at the point of suspension. SetId=429

[6] When you release a toy gyroscope on its pedestal, it initially has no precessional rotation around that pedestal, i.e, the orientation of rotation is fixed. However, it instantaneously starts precessing around the pedestal. Both Kinetic Energy and Angular Momentum now exist where they did not exist a moment earlier. The Kinetic Energy is easy to explain, as appearing due to the body of the gyroscope dropping a tiny fraction of a millimeter in the Earth's gravitational field, giving up exactly the correct amount of Potential Energy. But the Angular Momentum of the Precession which just appeared, does not come from anywhere. This is therefore a Violation of the Conservation of Angular Momentum.

[7] Law of conservation of momentum does not hold when Newton's laws are not valid, e.g. in a non-inertial frame of reference. For example, when we consider collision between two bodies in a non-inertial frame of reference, the law of conservation of momentum cannot be applied because there will be a pseudo force acting on the frame itself.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then check we should if the laws are applicable or not.

So if there is no *external force* acting on the system all the three quantities, total momentum, total angular momentum, and total kinetic energy will be conserved independent of the nature of forces.

[9] Explain Nonconservative force: This force is just opposite to that of conservative force. The work done by this force depends on the path taken by the particle on which the force is applied.This force does not conserve mechanical energy.If a particle travels in a closed loop, the net work done by a non consevative force is non zero.

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[10] A particle moves on a circular path. Then under suitable conditions its speed may remain constant, but the force, velocity and acceleration must always change with time.

[11] If P and Q are the initial and the final points of a path of a particle,the displacement is the vector $\overrightarrow{PQ}$.

[12] A particle is observed from two frames S_1 and S_2. The frame S_2 moves with respect to S_1 with an acceleration a. If F_1 and F_2 be the pseudoforces when seen from S_1 and S_2 respectively and if $F_1 = 0$ then we must have $F_2 \neq 0$

[13] During collision of billiard balls momentum is conserved. During explosion of a bomb also momentum is conserved and the total momentum of the fragments of bomb will be zero. This is because all the forces are only internal forces.

[14] A heavy body is attached from a spring and is held at point A and is such that the spring is not slack nor is it stretched. It is then released. It goes down upto a point B and then it rises upto point C and executes an oscillatory motion between B and C. During the motion from A to C is first positive (from A to B) and then it is negative from B to A and again remains negative from A to C. SetId=429

[15] Real forces have their origin in matter such as electricity, gravitation etc., while pseudo forces are caused by inertial motion.

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[1] Distance is equal to the length of the path covered. Displacement is the shortest distance between initial and final points.

[2] The law of conservation of angular momentum states that when no external torque acts on an object or a closed system of objects, no change of angular momentum can occur. Hence, the angular momentum before an event involving only internal torques or no torques is equal to the angular momentum after the event . Angular momentum can be calculated with the help of the formula $L = I\omega$ where L stands for Angular momentum, I stands for moment of inertia and ω stands for angular velocity

[3] An example where law of conservation of angular momentum holds:
The Law of conservation of angular momentum holds in the case of a ballet dancer performing a pirouette.

When the dancer extends her arms outward, the angular velocity of her rotation decreases whereas when she keeps her arms close to her body, the angular velocity increases. This is because her moment of inertia changes as she moves her arms outward and inward. It can be noted that she as a system has no external torque acting upon her.

[4] For the motion of earth around sun, the sum of angular momenta of the Sun and the Earth about the center of mass of the sun + earth system is conserved.

[5] The law of angular momentum of a is not applicable for the conical pendulum conserved w.r.t. the origin fixed at the point of suspension. SetId=430

[6] There is no case where LAW OF CONSERVATION OF ANGULAR MOMENTUM does'nt hold.But there are cases where conservation of angular momentum does not hold.A body in vertical circular motion is an example where angular momentum is not conserved. Here the law of conservation does not apply.

[7] If I throw a ball upward, it's speed decreases as it rises upwards. There is an external force (gravity) acting on the ball, so the momentum conservation law does not apply. Momentum of the ball is not conserved, however the momentum of the Earth-ball system is conserved as gravity will become an internal force in this case.

[8] If we want to apply the conservation laws of momentum, energy and angular momentum, we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *external force* acting on the system, the momentum and angular momentum will be conserved, and depending on the nature of the forces but total energy may or may not be conserved.

[9] Non conservative force is the force in which the work done by a particle in going from one point to another is path dependent.

For non conservative forces mechanical energy is not conserved,mostly lost in the form of heat and light.The work done by a non conservative force is equal to the change in mechanical energy.

SetId=430 For non conservative force $E_{\text{initial}} > E_{\text{final}}$

[10] A particle moves on a circular path. Then under suitable conditions its speed and acceleration may remain constant, but the force, and velocity must always change with time.

[11] If two bodies starting from a point A reach a point B, following different paths, their displacement will be, in general different, but the distances covered will always be the same.

[12] If K is an inertial frame, any frame that moves w.r.t. the frame K with uniform velocity is also an inertial frame.

[13] Give an example where law of conservation of momentum holds: A mass exploding into several pieces in a conservative field like gravitational field(if air resistance is neglected), obeys law of conservation of momentum. If air resistance cannot be neglected then the law of conservation of momentum will not hold.

[14] The kinetic energy of a body does not change if any one of the following is true
(i)force is always perpendicular to the velocity
(ii) the force is always perpendicular to the acceleration
(iii) the object remains stationary
(iv) the object moves in such a way that the point of application of the force remains fixed. SetId=430

[15] 1)When we start rolling a body on a rough ground, it stops rolling after certain period because of frictional force.
2)When we leave a body from a certain height, it falls due to the act of gravitational force.

1)When a body is rotating in a circular path due to the centrifugal force which is the pseudo force. 2) When the lift is accelerating upwards, the upwards force felt by passengers a pseudo force.

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[1] Distance is a scalar quantity where as the displacement is a vector quantity.

[2] Newton's Second Law of Motion is defined by the expression $F = \frac{dp}{dT}$, where F gives the force vector acting on the system and p gives its momentum vector; in linear motion. A similar expression can be written to describe angular motion, i.e. : $\tau = \frac{dL}{dt}$, where τ is the external torque vector acting on the system, and L is the angular momentum.

If the external torque on the system is zero, then we get the expression as: dL/dt=0. This points out to the fact that, when no external torque is acting on the system, then its angular momentum is constant, no matter what changes occur in the system. This is the Law of Conservation Of Angular Momentum.

[3] In case of a skater, who can be considered an isolated system, so no torue will be acting on him/her. When the arms are extended, the moment of inertia is more. When his hands are closely held, the moment of inertia is lesser. Since the angular momentum is same, the angular acceleration changes accordingly.

[4] For the motion of the Earth around the sun, the total of angular momenta of the Earth and the Sun, about in a reference frame fixed in the pole star, is conserved.

[5] The law of angular momentum of a is not applicable for the conical pendulum conserved when the origin is chosen to be at the pendulum bob itself. SetId=431

[6] A sphere rolling on a rough surface.Due to friction there is external torque so the angular momentum changes which results in the slowing of the sphere. The angular momentum keeps changing. Even in case like this one, it is wrong to say that the Law of Angular Momentum Conservation does not hold.

[7] A soldier accelerating away, after detonating a bomb, will find that the total momentum of the fragments of the bomb is zero. This is an example where the law of conservation of momentum holds as the forces on the fragments are internal forces only and sum of all such forces is zero.

[8] To apply the conservation laws of momentum, energy and angular momentum, we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *external force* acting on the system, the energy and momentum will be conserved. However, depending on the nature of the system and of the forces, the total angular momentum may not be conserved.

[9] A force is said to be non-conservative, if the work done by the force is dependent on the path taken. It could also be defined as a force for which the work done during
SetId=431 a cyclic process is non-zero.

[10] When the force is kept constant as function of time, it is possible for a particle to move on a circular path in such a way that its speed remains constant, but the velocity and acceleration must always change with time.

[11] Distance is equal to the length of the path covered. Displacement is the shortest distance between initial and final points.

[12] If K is an inertial frame, any frame that moves w.r.t. the frame K with uniform speed is also an inertial frame.

[13] Also a good example of law of conservation momentum can be seen when a bullet from a rifle is fired.As the bullet is fired and gets out of the rifle, the rifle gives a backward jerk due to the phenomenon of conservation of momentum.

[14] The total work done on a particle is always equal to the change in kinetic energy. SetId=431

[15] Newton's first law defines inertial frame. An inertial frame is a frame in which the first law hold. It also makes it possible to compare and tell two force being equal or not. The second law defines the force.

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[1] The speed is rate of change of distance and the velocity is the rate of change of displacement.

[2] If the net external torque acting on a system is zero, the angular momentum L of the system remains constant, no matter what changes take place within the system.

$$\sum(T_{\text{ext}}) = \frac{dL}{dt}$$

The law states that when there is no net external torque, $\frac{dL}{dt}$ is zero implying that the total angular momentum of system is constant.

i.e. $L = a$ constant (isolated system)

[3] Example where law of conservation of angular momentum holds:
Let us assume a student seated on a stool that can rotate freely about a vertical axis. The student has been set into rotation at a modest initial angular speed ω . He holds two dumbbells in his outstretched hands. His angular momentum vector L lies along the vertical rotation axis, pointing upwards. Now he pulls in his arms;this action reduces his rotational inertia from its value I_{initial} to a final value I_{final} because he moves the mass closer to the rotational axis. His rate of rotation increases markedly, from ω_{initial} to ω_{final}. The student can then slow down by extending his arms once more,moving the dumbbells outward. No external torque acts on the system consisting of the student, stool and the dumbbells. Thus the angular momentum of the system about the rotational axis remains constant. $I_{\text{initial}} * \omega_{\text{initial}} = I_{\text{final}} * \omega_{\text{final}}$.

[4] For the motion of the Earth around the sun, the total of angular momenta of the Earth and the Sun, is conserved in every inertial frame of reference; but the angular momentum of the Earth (or of the sun)is not conserved in every inertial frame.

[5] The three components of angular momentum of a conical pendulum is conserved w.r.t. the origin at the position of the center of mass of the pendulum. SetId=432

[6] Consider a rod of length l. Let us give an impulse to one end . Now the angular momentum about the oposite end is not zero since the impulse provides some torque . So the angular momentum is not conserved .

$$\text{torque} = \text{impulse} * \ell.$$

$d\ell/dt$ is not equal to zero and the law of conservation of angular momentum does not hold.

[7] There is no known exception to the law of conservation of momentum in classical mechanics However, an exception to conservation of energy in nuclear physics is observed. In nuclear reactions when two nuclei collide and their mass converts to energy and energy momentum are not conserved.

[8] In order to apply the law of conservation of momentum we must first identify the system. If there is no *external forces* acting on the system then conservation laws of momentum always holds. And depending on the nature of the system and of the forces, the total kinetic energy and the total angular momentum may not be conserved.

[9] a force is said to be non conservative if work done is dependent on the path of the particle.potential cannot be defined in the case of non conservative forces.work done in closed loop is not equal to zero.

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[10] It is not possible for a particle to move on a circular path in such a way that its speed and force remains constant, and only the velocity and acceleration may (or may not) always change with time.

[11] Distance is a scalar quantity where as the displacement is a vector quantity.

[12] A frame rotating w.r.t K with uniform angular velocity is also an inertial frame.

[13] when a man walks on the ice slab where friction does not exist between the ice block and the floor but between the feet of the man and the slab the slab moves back as per the law of conservation of momentum

[14] A particle is acted upon by a force of constant magnitude which is always perpendicular to the velocity of the particle and the motion of the particle takes place in a plane, Then its kinetic energy, speed, velocity acceleration will not change.

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[15] The magnitude of the pseudo force arising in a non-inertial frame is always equal to the mass of the body under consideration multiplied by the acceleration of the frame of reference and the direction of pseudoforce is always opposite to the direction of acceleration of the frame.

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[1] For any type of translational motion of a body, the displacement cannot be zero, where as the distance travelled can be zero.

[2] When the net external torque acting on a body or a system of bodies is zero about a particular axis, then the angular momentum of each body is conserved about that axis.

[3] A bob is attached to ceiling by a string and moves in a horizontal circular plane is an example. In this case the law of conservation of angular momentum does not hold.

[4] In the Sun Earth system the angular momentum of the Earth is conserved in every frame of reference

[5] Only the z component of the angular momentum of a conical pendulum is conserved w.r.t. the origin fixed at the point of suspension.

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[6] Let us consider a rotating skew rod. In the absence of friction or any other drag force, the rod should continuously spin without stopping. Here the net torque about the axis of rotation is 0 and hence angular momentum is conserved. It therefore follows from law of conservation of angular momentum that a spinning skew rod will keep rotating with constant angular velocity if there is no external torque. So law of conservation of angular momentum does not hold.

[7] In a system of a canon and a canon ball, total momentum of the system is zero before canon ball is fired. After firing the canon ball, the momentum of the system seems to be conserved as the ball moves forward and the canon moves backward.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then check if the laws is applicable or not.

So if there is no *net external force* acting on the system all the three conservation laws will hold.

[9] Explain Nonconservative Forces:

The forces that depend on the path taken by the particle are called non-conservative forces.

Mechanical energy is not conserved during the action of a non conservative force, instead, it is lost as other forms of enery like heat, light, etc.

Potential energy is not defined for a non-conservative force.

The initial and final kinetic energy in a closed loop is not equal.

The work done by a non conservative force in a closed loop is non zero. In practice, the net work is invariably negative.

Work done by a non conservative force cannot be completely recovered.

For a non conservative force,

$/text(KE)//_f//+$(PE)$//_f//=$ (KE)$_i$+(PE)$_i$//+//Work Done)//non-conservative force//

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[10] For a particle moving on circle the acceleration is always constant in magnitude and directed towards the centre of the circle.

[11] Both displacement and distance tell us about the motion of a body but their study does not tell much about the forces on the body

[12] The Newton's Laws of motion will hold in all frames which are at rest w.r.t. K but do not remain valid in a frame that move with respect to K.

[13] When a freely falling rigid body collides another body in its path momentum the system of two particles is not conserved in the collision as there is external force mg acting on the system.

[14] The kinetic energy of a particle is continuously increasing with time, then the angle bewteen the net force and the velocity cannot be greater than or equal to 90^o at any time. SetId=433

[15] A force is any interaction which tends to change the motion of an object. It is also *defined* as rate of change of momentum.It is a vector quantity.
A physically apparent but nonexistent force felt by an observer in a noninertial frame (that is, a frame undergoing acceleration).

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[1] Displacements, being vector quantity can not compared with, a scalar quantity such as distance.

[2] The law of conservation of angular momentum states that in absence of an external torque on an object or a closed system of objects the total angular momentum of the system remains constant. Thus if $\vec{\tau} = 0 => \vec{L} =$ constant where τ is the torque and $\vec{L}$ is the angular momentum of the system.

[3] Consider a disc rotating about an axis perpendicular to its plane. On placing a smaller disc with its surface parallel to the surface of the rotating disc, the angular momentum of the system of two discs remains constant as there is no external torque.

[4] In the motion of earth around sun, the angular momentum of the earth about an axis passing through the sun and perpendicular to the plane of motion of earth is conserved.

[5] The z component of angular momentum of a conical pendulum is not conserved w.r.t. the origin fixed at the point of suspension; but the x and y components are conserved.

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[6] In the example of skew rod the angular velocity does not change even though the torque applied is nonzero. However there is no contradiction as in this case the law of conservation of momentum is not applicable. conservation is violated.

[7] When applying the conservation laws of momentum, energy and angular momentum we must define the system first.Only then check if the laws is applicable or not.

As an example: when a ball is dropped from a height, it gains momentum down if we consider the ball as our system.This is because the force of gravity acts as an external force.

However, if we change our system and consider earth as a part of our system too, then the momentum remains conserved because the earth gains momentum up.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then check we should if the laws are applicable or not.

So if there is no *external force* acting on the system all the three quantities, total momentum is conserved. The total angular momentum is also because the torque of internal forces will be zero. The conservation of energy depends on the nature of forces. will be conserved.

[9] A non conservative force is one where the mechanical energy is not conserved.Here the work done is dependent on the path taken .Different amounts of work need to be done in different paths.Here potential energy would have no meaning as it would keep changing with the path.Here some amount of mechanical energy is lost as sound energy or heat energy and hence is not conserved.

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[10] The motion of a bomb dropped from a plane does is not a uniform motion as it follows a parabolic path and not a straight line path.

[11] Displacement is the shortest distance between initial and final points with direction specified.

[12] Staying inside a bullet train moving with constant velocity (no jerks etc) an experiment can always be performed which will tell us the numerical velocity of the bullet train

[13] If we take some amount of a substance like construction putty, cement, cake batter, playing dough,etc and drop it on the ground, it does not bounce back, like a rubber ball would bounce, and hence the momentum it had before striking the ground seems to have been lost. Hence it appears that the law of conservation of linear momentum does not hold.

[14] A heavy body is attached from a spring and is held at point A and is such that the spring is not slack nor is it stretched. It is then released. It goes down upto a point B and then it rises upto point C and executes an oscillatory motion between B and C. During the motion from A to C is first positive (from A to B) and then it is negative from B to A and again remains negative from A to C. SetId=434

[15] Psuedo Force is defined as an apparent force that acts in only non-inertial frames. Pseudo Forces are also called Fictitious Forces. It is an Imaginary force. It is independent of mass.

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[1] Distance depends on the path where as the displacement depends on the end point only.

[2] If no net external torque acts on a system, the total angular momentum of the system remains constant.

[3] Consider a man standing on a spinning platform. Initially, the man spreads out his arms and he spins with a certain angular velocity. The next moment, he pulls his arms inwards keeping them close to his body. We will observe that the angular velocity with which he is spinning now increases. This phenomenon can be explained by the Law Of Conservation of Angular momentum. Initially, since his arms were spread wide, his moment of inertia was large. However, when he pulled them close to his body, his moment of inertia decreased.
In this example the angular velocity of the man increases and therefore the angular momentum also increases.The law of conservation of angular momentum does not apply because the torque of muscular forces is not zero.

[4] For the motion of earth around sun, the angular momentum of the earth about the center of mass of the sun + earth system and perpendicular to the plane of motion of earth is conserved.

[5] Only the z component of angular momentum of a conical pendulum is conserved w.r.t. the origin fixed at the point of suspension. SetId=435

[6] Example where law of conservation of angular momentum does not hold:If a particle undergoes conical motion and the only force acting on particle is central force like tension of the string.Then total external torque about fixed point A is zero,yet angular momentum is not conserved,as angular momentum keeps on changing direction.

[7] Statement: Law of Conservation of energy states that "ENERGY CAN NEITHER BE CREATED NOR DESTROYED",but it can be changed from one form to other.

EXPLANATION: Statement implies that the total amount of energy in an isolated system remains constant although it may change forms. viz, kinetic energy may change to potential;chemical to electrical energies etc.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *net external force* acting on the system, the momentum is conserved. The definition of angular momentum and torque depends on the choice of axes, and therefore it may not be be conserved. The conservation of total energy holds only for conservative forces.

When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *net external force* acting on the system, the energy and momentum will be conserved. However, the total angular momentum may not be conserved because the torque may not be zero.

[9] The force whose work depends on path taken is called a non conservative force.friction for example does less work on a book dragged across a table if the book is dragged straight across than if the book is dragged in a curved path.

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[10] A wagon sliding on a roller coaster designed in such a way that the wagon covers equal distances in equal times. As the motion of the wagon is uniform, there will be no net force acting on it.

[11] Displacements, being vector quantity can not compared with, a scalar quantity such as distance.

[12] Staying inside a bullet train moving with constant velocity (no jerks etc) an experiment can always be performed which will tell us the numerical value of the acceleration of the bullet train

[13] When we consider collision between two bodies in a non-inertial frame of reference, the law of conservation of momentum cannot be applied because there will be a pseudo force acting on the frame itself.

[14] The kinetic energy of a body does not change if any one of the following is true
(i)force is always perpendicular to the velocity
(ii) the force is always perpendicular to the acceleration
(iii) the object remains stationary
(iv) the object moves in such a way that the point of application of the force remains fixed.

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[15] Psuedo Force is defined as an apparent force that acts in only non-inertial frames. Pseudo Forces are also called Fictious Forces. It is an Imaginary force. It is always proportional to mass. It is sometimes dependent on speed.

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[1] Distance equal to zero implies displacement=0; and Displacement=0 also implies distance = 0

[2] The law of conservation of angular momentum states that when no external torque is applied on an object or a closed system of objects about an axis, the angular momentum about that axis remains constant.

[3] In the Sun-Earth system, angular momentum of the earth is not conserved but the total angular momentum of the sun and the earth is constant of motion.

[4] In the Sun Earth system the angular momentum of the Earth about the pole star is conserved

[5] The projection of angular momentum of a conical pendulum in the horizontal plane is a constant of motion when the origin is chosen to be at fixed at the point of suspension. SetId=436

[6] A nonzero torque always causes the angular velocity to change, because a change in angular momentum means a change in angular velocity $L = I\omega$

[7] Oscillating simple pendulum is a very good example where potential energy gets converted to kinetic energy and kinetic to potential energy. Some energy gets dissipated as heat if we consider air resistance. Energy as a whole is conserved if we consider universe as system, the energy has just changed its form.

[8] In order to apply the law of conservation of momentum we must first identify the system. If there is no *net external forces* acting on the system then conservation laws of momentum always holds. The total energy and the total angular momentum may not be conserved.

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[9] ** Nonconservative force is a force in which the amount of work done by the force is dependent of the path taken to change a state of a system.

[10] A simple pendulum moves along a circular arc and does not have constant speed and therefore its motion is not uniform.

[11] Distance depends on the path where as the displacement depends on the end point only

[12] Assume bullet train, moving with out any jerks, is going on a circular arc of radius R with constant speed. Then an experiment is to be performed entirely within the train without any measurement on objects outside the train. Such an experiment can tell only radius of the track.

[13] When a system is acted upon by external forces like friction etc, the conservation principle does not hold good,there will be impulse imparted and so we cant conserve momentum. This is case when a collision between two elastic balls take place on a rough horizontal table. The total momentum just after the collision will be different from the total momentum just before the collision. Here momentum is not conserved as there is external force friction is present.

[14] The total work done on a particle is always equal to the change in kinetic energy. SetId=436

[15] Since pseudo forces are not real forces, they do not affect the conservation laws and all the three conservation laws hold in noninertial frames.

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[1] If P and Q are the initial and the final points of a path of a particle, displacement is a vector whose direction is along PQ and has magnitude is equal to the length of line PQ

[2] The angular momentum of a given system of bodies shall remain conserved unless acted upon by an external unbalanced torque.

[3] Consider a disc and a man system. man is standing on center of the disc rotating with angular velocity.initially man folded his hand.when man stretches his hands then momentum of inertia of system increases.and angular velocity decreases.and total angular momentum remains constant.

[4] For the motion of earth around sun, the angular momentum of the sun about the center of mass of the sun + earth system and perpendicular to the orbital plane of earth is conserved.

For the motion of earth around sun, the angular momentum of the sun about and axis passing through the Earth and perpendicular to the orbital plane of motion of earth is conserved.

[5] The law of angular momentum of a is not applicable for the conical pendulum conserved w.r.t. the origin fixed at the point of suspension. SetId=437

[6] A nonzero torque always implies change in angular momentum and may not give rise to a change in magnitude of angular velocity. A non zero torque may mean change only the direction of the angular momentum and not the angular velocity.

[7] Law of conservation of momentum does not hold whenever an external force or impulse acts on the system. For example,when a body collides with earth then it bounces back to a lesser height as it loses some velocity.

In this example the momentum of a ball is not conserved due to impulsive force by ground in the normal direction.

However, strictly speaking the system that should be considered here is the ball-earth system and the total momentum is conserved.

[8] In order to apply the law of conservation of momentum we must first identify the system. Then even if there is no *net external forces* acting on the system, all the three conservation laws of momentum, angular momentum and energy may not hold due to presence of internal forces.

[9] Nonconservative force is any force where the work done by the force on the object depends on the path of motion of the object.the work done by the frictional force results in to loss of the energy of the system in the form of heat or other form of energy.

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[10] A satellite goes around the earth in a circular orbit of 600km with a time period of $5.8 \times 10^3 s$. Its motion will be uniform as it will cover equal distances in equal times.

[11] Distance equal to zero $\Rightarrow$ displacement=0; but Displacement=0

[12] Assume bullet train, moving with out any jerks, is going on a circular arc of radius R with constant speed. Then an experiment is to be performed entirely within the train without any measurement on objects outside the train. Such an experiment can tell both speed of the train and radius of the track.

[13] When we are in accelerating frame if we observe any collision between two bodies then the law of conservation of momentum does not hold in that frame of reference. On the other hand the law of conservation of momentum holds in all inertial frames.

[14] A particle is acted upon by a force of constant magnitude which is always perpendicular to the velocity of the particle and the motion of the particle takes place in a plane, Then its kinetic energy, speed, velocity acceleration will not change. SetId=437

[15] A force is any interaction which tends to change the motion of an object. Newtons' second tell us that it is *equal* to the rate of change of momentum.It is a vector quantity. Real forces can be distinguished from pseudo forces because the pseudo forces always proportional to the mass of the body. All real forces, except the gravitational force, do not depend on the mass of the body.

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SetId=438

[1] If P and Q are the initial and the final points of a path of a particle,the displacement is the vector $\overrightarrow{PQ}$.

[2] When the net external torque acting on a system about a given axis is zero, the total angular momentum of the system about that axis remains consant.

[3] The conservation of angular momentum of a system of bodies requires that the the sum of torque due to all forces be equal to zero. Now consider a situation where the forces are such that the sum of torques of external forces is zero w.r.t. some axes K. Since the value of torque depends of the choices of axes, the sum of torques due to all internal forces will depend on the choice of axes and in general it will be non zero. Therefore, for a system of several bodies, for a given choice of axes K, there will be situations when the total angular momentum may not be conserved.

[4] For the motion of earth around sun, the sum of angular momenta of the Sun and the Earth about the center of mass of the sun + earth system is conserved.

[5] The law of angular momentum of a is not applicable for the conical pendulum conserved when the origin is chosen to be at the pendulum bob itself. SetId=438

[6] In the example of a rotating skew rod the torque due to the external gravitational forces is zero , but the angular momentum is not constant Therefore the law of conservation of angular momentum is violated.

[7] If a bullet hits a wooden board and gets embedded in the board, the total energy and the total momentum of the bullet and the board are conserved.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then check we should if the laws are applicable or not.

So if there is no *external force* acting on the system all the three quantities, total momentum, total angular momentum, and total kinetic energy will be conserved independent of the nature of forces.

[9] nonconservative force is any force ,where the work done by the force depends on the path of motion of the body.The work done by such a force is equal to the change in mechanical energy of the system.Energy mostly observed to be lost in form of heat, by the action of non conservative force.

SetId=438

[10] A uniform motion is defined to be the one in which a body covers equal distances in equal time intervals.

[11] If P and Q are the initial and the final points of a path of a particle, displacement is a vector whose direction is along PQ and has magnitude is equal to the length of line PQ

[12] Assume bullet train, moving with out any jerks, is going on a circular arc of radius R with constant speed. Then an experiment is to be performed entirely within the train without any measurement on objects outside the train. Such an experiment can tell only speed of the track.

[13] When a freely falling body hits another rigid body in its path then momentum is not conserved as external force mg acts on both the bodies. The total momentum after the collision will be different from the total momentum before the hit.

[14] The kinetic energy of a particle is continuously increasing with time, then the angle bewteen the net force and the velocity cannot be greater than or equal to 90^o at any time. SetId=438

[15] Examples of pseudoforce are Coriolis Force, Centrifugal Force, and magnetic force on currents.
Psuedo force also called as fictitious force is an apparent force that are needed for masses whose their motion is described using a non inertial frame of reference.

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[1] If two bodies starting from a point A reach a point B, following different paths, their displacement will be, in general different, but the distances covered will always be the same.

SetId=439

[2] This law sates that when no net torque of all forces acts on a object or a system of objects then total angular momentum of system is conserved.The angular momentum before an event is equal to angular momentum after that event.mathematically explained by when, net torque=0 ;then, total angular momentum(L)=constant.

[3] Example where law of conservation of angular momentum does not hold:
When there is external force like frictional force acting on a object when it is rotating we cannot use conservation of angular momentum as the friction force acting on the object produces an external torque.

[4] For the motion of the Earth around the sun, the total of angular momenta of the Earth and the Sun, about in a reference frame fixed in the pole star, is conserved.

[5] The three components of angular momentum of a conical pendulum is conserved w.r.t. the origin at the position of the center of mass of the pendulum. SetId=439

[6] In the example of skew rod, the angular momentum changes with time and there is a non zero torque coming from action of forces other than gravitational forces. Hence the law of conservation of angular momentum dos not apply.

[7] If a bullet hits a wooden board and gets embedded in the board, the total energy of the bullet and the board system is conserved but the total momentum is not conserved.

[8] If we want to apply the conservation laws of momentum, energy and angular momentum, we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *external force* acting on the system, the momentum and angular momentum will be conserved, and depending on the nature of the forces but total energy may or may not be conserved.

[9] The work done by a "non-conservative" force does depend on the path taken. Non-conservative forces cannot be associated with a potential energy. If some of the internal forces of a system are non-conservative, the mechanical energy of the system is not constant.Work-energy theorem is valid even in the presence of some non-conservative forces.

SetId=439

[10] A particle moves on a circular path. Then its speed, direction of force, velocity and acceleration must always change with time.

[11] If P and Q are the initial and the final points of a path of a particle,the displacement is the vector $\overrightarrow{PQ}$.

[12] A particle is observed from two frames S_1 and S_2. The frame S_2 moves with respect to S_1 with an acceleration a. If F_1 and F_2 be the pseudoforces when seen from S_1 and S_2 respectively it is not possible to have $F_1 = F_2 = 0$

[13] .The law of conservation of momentum does not hold good when net external forces acting on the system is not zero.when two bodies collide law of conservation of momentum is applicable on system of two bodies but on not individual bodies because external impulse acts on them.

[14] A heavy body is attached from a spring and is held at point A and is such that the spring is not slack nor is it stretched. It is then released. It goes down upto a point B and then it rises upto point C and executes an oscillatory motion between B and C. During the motion from A to C is first positive (from A to B) and then it is negative from B to A and again remains negative from A to C. SetId=439

[15] Examples of pseudo-force are Coriolis Force, Centrifugal Force, Centripetal force and magnetic force on currents. The pseudo forces do not obey Newton's third law and therefore the total momentum does not appear to be conserved in a non-inertial frame.

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SetId=440

[1] Displacement is equal to the vector difference $\vec{r}_f - \vec{r}_i$ of the position vectors of initial and final points. The distance covered will be $|\vec{r}_f - \vec{r}_i|$

[2] Statement of Law of Conservation of Angular Momentum:
Differentiating $\vec{L} = \vec{r} \times \vec{p}$ w.r.t, time,

$$\begin{aligned}\frac{dL}{dt} &= \frac{d\vec{r} \times \vec{p}}{dt} = \frac{d\vec{r}}{dt} \times \vec{p} + \vec{r} \times \frac{d\vec{p}}{dt} = \vec{v} \times (m\vec{v}) + \vec{r} \times \vec{F} \\ &= \vec{r} \times \vec{F} (\because v \times v = 0) \\ &= \vec{\tau}\end{aligned}$$

here $\vec{\tau}$ represents the net torque acting on a rigid body rotating about a fixed axis.This torque must take into account of all the forces, be it external or internal forces

[3] A bob attached to a ceiling by a string moving in a horizontal circular plane is an example where the total angular momentum of the bob about the point of suspension is not conserved. This is because the the torque due to the weight of the bob about the point of suspension does not vanish and has non zero horizontal component. Only the vertical component of the angular component is conserved.

[4] For the motion of the Earth around the sun, the total of angular momenta of the Earth and the Sun, is conserved in every inertial frame of reference; but the angular momentum of the Earth (or of the sun)is not conserved in every inertial frame.

[5] Only the z component of the angular momentum of a conical pendulum is conserved w.r.t. the origin fixed at the point of suspension.

SetId=440

[6] In the example of conical pendulum, the z- component of angular momentum does not change. This follows from the angular momentum conservation as there is no external torque.

[7] If a bullet hits a wooden board and gets embedded in the board, both total energy and the total momentum of the bullet and the board are not conserved.

[8] To apply the conservation laws of momentum, energy and angular momentum, we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *external force* acting on the system, the energy and momentum will be conserved. However, depending on the nature of the system and of the forces, the total angular momentum may not be conserved.

[9] Non conservative forces are forces with the property that the work done by the force in moving a particle between two points is dependent on the path taken.Also the work done over a closed loop is not zero.Defining of scalar potential is not possible in case of non conservative forces because the change in potential energy between two points will depend on path taken.

SetId=440

[10] A particle moves on a circular path. Then its speed, direction offorce, can remain constant by velocity and acceleration must always change with time.

[11] If two bodies starting from a point A reach a point B, following different paths, their displacement will be, in general different, but the distances covered will always be the same.

[12] A particle is observed from two frames S_1 and S_2. The frame S_2 moves with respect to S_1 with an acceleration a. If F_1 and F_2 be the pseudoforces when seen from S_1 and S_2 respectively and if $F_1 = 0$ then we must have $F_2 \neq 0$

[13] A block moving in the air breaks up into two parts and the parts separate, then the total momentum must be the same before and after the break.

[14] The kinetic energy of a body does not change if any one of the following is true
(i)force is always perpendicular to the velocity
(ii) the force is always perpendicular to the acceleration
(iii) the object remains stationary
(iv) the object moves in such a way that the point of application of the force remains fixed.

SetId=440

[15] FORCE is any interaction which tends to change the motion of an object.It has both magnitude and direction,making it a vector quantity.

A psuedo force is an apparent force that acts on all masses whose motion is described with respect to a non-inertial frame of reference like a rotating frame of reference.This force is needed by an observer in an non-inertial frame to make all the Newtons Laws of motion hold true.

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SetId=441

[1] Distance is equal to the length of the path covered. Displacement is the shortest distance between initial and final points.

[2] Statement of Law of Conservation of Angular Momentum: For a system of many particles The net torque due all the forces, be it external or internal forces. But as the torque due to all the internal forces cancel out, it sufficient to consider the external forces acting on the system.

[3] Law of conservation of angular momentum holds in case of long jump. When a athlete takes off from the ground in a running long jump, the forces on the launching foot give the athlete an angular momentum with a forward rotation around a horizontal axis. Such rotation would not allow the jumper to land properly. In the landing, the legs should be together and extended forward at an angle so that the heels mark the sand at the greatest distance. Once airborne, the angular momentum cannot change (it is conserved) because no external torque acts to change it. However, the jumper can shift most of the angular momentum to the arms by rotating them in windmill fashion. Then the body remains upright in the proper orientation of landing.

[4] In the Sun Earth system the angular momentum of the Earth is conserved in every frame of reference

[5] The z component of angular momentum of a conical pendulum is not conserved w.r.t. the origin fixed at the point of suspension; but the x and y components are conserved. SetId=441

[6] In the example of conical pendulum, the x and$y$ components of angular momentum change. This follows from the angular momentum conservation as the z components external torque is zero and horizontal components of torque are non zero.

[7] There are certain situations where it appears that the law of conservation of linear momentum does not hold. For example if we take some amount of a substance like construction putty, cement, cake batter, playing dough,etc and drop it on the ground, it does not bounce back like a rubber ball would and hence the momentum it had before striking the ground seems to have been lost. Hence it appears that the law of conservation of linear momentum does not hold.

[8] In order to apply the law of conservation of momentum we must first identify the system. If there is no *external forces* acting on the system then conservation laws of momentum always holds. And depending on the nature of the system and of the forces, the total kinetic energy and the total angular momentum may not be conserved.

[9] A non conservative force is the force with the property that the work done in moving a particle between two points is dependent of the path taken.If a particle travels in a closed path, the net work done(the some of the forces acting along the path multiplied by the distance travelled) by a non conservative force is non zero. When an object moves from one location to another, the force changes the potential energy of the object by an amount that depends on the path taken.Non conservative force depends only on the path followed by the object.

SetId=441

[10] A particle moves on a circular path. Then under suitable conditions its speed may remain constant, but the force, velocity and acceleration must always change with time.

[11] Distance is equal to the length of the path covered. Displacement is the shortest distance between initial and final points.

[12] If K is an inertial frame, any frame that moves w.r.t. the frame K with uniform velocity is also an inertial frame.

[13] A ball hits the floor and rebounds after an inelastic collision. In this case the total momentum of the ball before and after the collsion is conserved. Also the total enrgy of the ball and the earth remains the same

[14] The total work done on a particle is always equal to the change in kinetic energy. SetId=441

[15] FORCE is any interaction which tends to change the motion of an object.It has both magnitude and direction,making it a vector quantity. A pseudo-force F doesn't arise from any physical interaction between two objects, but rather from the acceleration 'a' of the non-inertial reference frame itself. These forces have no real existence but must be taken into account in an accelerating frame of reference to make all the three Newton's Laws of motion applicable to the system

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[1] Distance is a scalar quantity where as the displacement is a vector quantity.

[2] Depending on the torques acting on a system, the angular momentum can be conserved only in one or two directions, but may not be conserved in all. For instance, if an isolated body has no torque acting on it only in the direction along the Z axis, then the angular momentum is conserved only in that direction.

[3] The total angular momentum of a body remains constant of motion when the net torque of the external forces acting on the body is zero.
In general, we have a system of particles such that the net torque of the external forces on the system, w.r.t. some axes K, is zero, the total angular momentum may not remain conserved, because the torque due to the internal forces may not be zero.

[4] In the motion of earth around sun, the angular momentum of the earth about an axis passing through the sun and perpendicular to the plane of motion of earth is conserved.

[5] Only the z component of angular momentum of a conical pendulum is conserved w.r.t. the origin fixed at the point of suspension. SetId=442

[6] Example where law of conservation of angular momentum does not hold: A disc rotating on a horizontal rough surface will not have a constant angular momentum because there will be a constant torque by frictional force. Hence, its angular momentum will decrease, and the law of conservation of angular momentum does not apply.

[7] A tennis ball is dropped from height h and after hitting the ground and it bounces back and rises to the same height. In this case the momentum of the ball is conserved because (under ideal conditions) the momentum after it hits the ground will be equal to the momentum it had before hitting the ground.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then check if the laws is applicable or not.

So if there is no *net external force* acting on the system all the three conservation laws will hold.

[9] In this type of force the work done depends on the path taken by the body.Mechanical energy is not conserved in the system if non conservative force acts on it.

SetId=442

[10] A particle moves on a circular path. Then under suitable conditions its speed and acceleration may remain constant, but the force, and velocity must always change with time.

[11] Distance is a scalar quantity where as the displacement is a vector quantity.

[12] If K is an inertial frame, any frame that moves w.r.t. the frame K with uniform speed is also an inertial frame.

[13] In a head on elastic collision of two identical bodies of equal masses the velocities, the speeds, the momenta and the kinetic energy are all exchanged.

[14] A particle is acted upon by a force of constant magnitude which is always perpendicular to the velocity of the particle and the motion of the particle takes place in a plane, Then its kinetic energy, speed, velocity acceleration will not change. SetId=442

[15] FORCE is any interaction which tends to change the motion of an object.It has both magnitude and direction,making it a vector quantity.
A pseudo-force results from acceleration of the frame of reference in which the objects reside. It is taken into account so that Newton's second law isn't invalidated. The pseudo force acting on an object can always be mathematically expressed as the product of the mass of the object and the acceleration of the frame of reference.

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[1] The speed is rate of change of distance and the velocity is the rate of change of displacement.

[2] According to Law of Conservation of Angular momentum,if no external torque acts on an object or system of objects,angular momentum of an object or system of objects remains CONSTANT or no change in angular momentum can occur.

Also it states that,only external torque can change angular momentm of the system where as the torque produced by internal forces can not change the angular momentum of the system

[3] An example where law of conservation of angular momentum holds:
The Law of conservation of angular momentum holds in the case of a ballet dancer performing a pirouette.

When the dancer extends her arms outward, the angular velocity of her rotation decreases whereas when she keeps her arms close to her body, the angular velocity increases. This is because her moment of inertia changes as she moves her arms outward and inward. It can be noted that she as a system has no external torque acting upon her.

[4] For the motion of earth around sun, the angular momentum of the earth about the center of mass of the sun + earth system and perpendicular to the plane of motion of earth is conserved.

[5] The projection of angular momentum of a conical pendulum in the horizontal plane is a constant of motion when the origin is chosen to be at fixed at the point of suspension. SetId=443

[6] Example where law of conservation of angular momentum does not hold:Consider a vertical stick on the ground falling to a horizontal position. During the fall, the conservation of angular momentum applied at the point of rotation on the ground and perpendicular to the plane of the stick is not applicable as, the gravitational force which acts vertically downwards assumed at the centre of mass produces an external torque about the axis of rotation

[7] Law of conservation of momentum does not hold when Newton's laws are not valid, e.g. in a non-inertial frame of reference. For example, when we consider collision between two bodies in a non-inertial frame of reference, the law of conservation of momentum cannot be applied because there will be a pseudo force acting on the frame itself.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then check we should if the laws are applicable or not.

So if there is no *external force* acting on the system all the three quantities, total momentum is conserved. The total angular momentum is also because the torque of internal forces will be zero. The conservation of energy depends on the nature of forces. will be conserved.

[9] A force is said to be a non-conservative force if the work done by the force in a closed path is non-zero;(i.e) the cyclic integral of the work done is non-zero.

Work done by a non-conservative force is equal to change in total energy of the system.Work-Energy theorem is not applicable in the case of a non-conservative force.Work done by conservative force depends on the path.It differs with the paths taken by the partical even if the initial and final points are same.In case of non-conservative forces,the total mechanical energy is not constant as the energy is dissipated in various forms such as heat energy,sound energy,etc and cannot be recovered.

SetId=443

[10] When the force is kept constant as function of time, it is possible for a particle to move on a circular path in such a way that its speed remains constant, but the velocity and acceleration must always change with time.

[11] Both displacement and distance tell us about the motion of a body but their study does not tell much about the forces on the body

[12] A frame rotating w.r.t K with uniform angular velocity is also an inertial frame.

[13] For a system of several particles the conservation of total linear momentum is equivalent to the statement that their centre of mass moves like a free particle.

[14] The kinetic energy of a particle is continuously increasing with time, then the angle bewteen the net force and the velocity cannot be greater than or equal to 90° at any time.

SetId=443

[15] Explain Force:FORCE is any interaction which tends to change the motion of an object.It has both magnitude and direction,making it a vector quantity.
In the case of a non inertial frame, we can use the second law of motion by adding a pseudo force to the system which makes it an inertial frame of reference.

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[1] For any type of translational motion of a body, the displacement cannot be zero, where as the distance travelled can be zero.

[2] The law of conservation of angular momentum states that when the net external torque acting on the system is zero, then the angular momentum of the system remains constant.both the initial and final momentum should be taken from a fixed inertial frame of reference provided.

[3] In case of a skater, who can be considered an isolated system, so no torue will be acting on him/her. When the arms are extended, the moment of inertia is more. When his hands are closely held, the moment of inertia is lesser. Since the angular momentum is same, the angular acceleration changes accordingly.

[4] In the Sun Earth system the angular momentum of the Earth about the pole star is conserved

[5] The law of angular momentum of a is not applicable for the conical pendulum conserved w.r.t. the origin fixed at the point of suspension. SetId=444

[6] We have a conical pendulum .The forces acting on the bob are tension (along the direction of the string) and gravitational force acting in the vertically downward direction.we have an additional force called the drag force which is tangential to the motion of the bob and acts in the direction opposite to the motion of the bob.The axis of rotation passes through the hinge point and is vertical.The torque due to tension is 0 because the force passes through the axis of rotation.The torque due to mg is also zero since it is parallel to the axis of rotation.but the torque due to drag force is not zero.since the net external torque acting on the bob is not zero,therefore the law of conservation of angular momentum does not hold here

[7] If I throw a ball upward, it's speed decreases as it rises upwards. There is an external force (gravity) acting on the ball, so the momentum conservation law does not apply. Momentum of the ball is not conserved, however the momentum of the Earth-ball system is conserved as gravity will become an internal force in this case.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *net external force* acting on the system, the momentum is conserved. The definition of angular momentum and torque depends on the choice of axes, and therefore it may not be be conserved. The conservation of total energy holds only for conservative forces.

When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *net external force* acting on the system, the energy and momentum will be conserved. However, the total angular momentum may not be conserved because the torque may not be zero.

[9] A non conservative force is a force where work done in moving a particle between two points depends on the path through which it is taken.Friction is an example of non conservative force.Mechanical energy is not conserved in case of a non conservative force

SetId=444

[10] It is not possible for a particle to move on a circular path in such a way that its speed and force remains constant, and only the velocity and acceleration may (or may not) always change with time.

[11] Displacement is the shortest distance between initial and final points with direction specified.

[12] The Newton's Laws of motion will hold in all frames which are at rest w.r.t. K but do not remain valid in a frame that move with respect to K.

[13] The total mechanical energy of a system may not be conserved if there are no external forces and the internal forces are conservative.

[14] A heavy body is attached from a spring and is held at point A and is such that the spring is not slack nor is it stretched. It is then released. It goes down upto a point B and then it rises upto point C and executes an oscillatory motion between B and C. During the motion from A to C is first positive (from A to B) and then it is negative from B to A and again remains negative from A to C.

SetId=444

[15] For the Newton's Law of Motion to hold true,the physically apparent but nonexistent force needed by an observer in a non-inertial frame is called the pseudo force.
1) Caused by relative acceleration of the origin in a straight line
2) Centrifugal and Centripetal forces
3) Coriolis force
4) Euler force

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[1] Displacements, being vector quantity can not compared with, a scalar quantity such as distance.

[2] The law of conservation of angular momentum states that The total angular momentum of a system is constant in both magnitude and direction if the resultant torque, of the external forces acting on the system, is zero.

[3] Example where law of conservation of angular momentum holds:
Let us assume a student seated on a stool that can rotate freely about a vertical axis. The student has been set into rotation at a modest initial angular speed ω . He holds two dumbbells in his outstretched hands. His angular momentum vector L lies along the vertical rotation axis, pointing upwards. Now he pulls in his arms;this action reduces his rotational inertia from its value I_{initial} to a final value I_{final} because he moves the mass closer to the rotational axis. His rate of rotation increases markedly, from ω_{initial} to ω_{final}. The student can then slow down by extending his arms once more,moving the dumbbells outward. No external torque acts on the system consisting of the student, stool and the dumbbells. Thus the angular momentum of the system about the rotational axis remains constant. $I_{\text{initial}} * \omega_{\text{initial}} = I_{\text{final}} * \omega_{\text{final}}$.

[4] For the motion of earth around sun, the angular momentum of the sun about the center of mass of the sun + earth system and perpendicular to the orbital plane of earth is conserved.

For the motion of earth around sun, the angular momentum of the sun about and axis passing through the Earth and perpendicular to the orbital plane of motion of earth is conserved.

[5] The law of angular momentum of a is not applicable for the conical pendulum conserved when the origin is chosen to be at the pendulum bob itself. SetId=445

[6] When you release a toy gyroscope on its pedestal, it initially has no precessional rotation around that pedestal, i.e, the orientation of rotation is fixed. However, it instantaneously starts precessing around the pedestal. Both Kinetic Energy and Angular Momentum now exist where they did not exist a moment earlier. The Kinetic Energy is easy to explain, as appearing due to the body of the gyroscope dropping a tiny fraction of a millimeter in the Earth's gravitational field, giving up exactly the correct amount of Potential Energy. But the Angular Momentum of the Precession which just appeared, does not come from anywhere. This is therefore a Violation of the Conservation of Angular Momentum.

[7] A soldier accelerating away, after detonating a bomb, will find that the total momentum of the fragments of the bomb is zero. This is an example where the law of

conservation of momentum holds as the forces on the fragments are internal forces only and sum of all such forces is zero.

[8] In order to apply the law of conservation of momentum we must first identify the system. If there is no *net external forces* acting on the system then conservation laws of momentum always holds. The total energy and the total angular momentum may not be conserved.

[9] A force:A force is said to be a *non-//**conservative force* if the*/ work done by it in a closed path is/*/ non-zero./For such forces,potential energy cannot be defined.

SetId=445

[10] For a particle moving on circle the acceleration is always constant in magnitude and directed towards the centre of the circle.

[11] Displacements, being vector quantity can not compared with, a scalar quantity such as distance.

[12] Staying inside a bullet train moving with constant velocity (no jerks etc) an experiment can always be performed which will tell us the numerical velocity of the bullet train

[13] When a bullet fired on a wooden block, some energy is transferred to the block and the total mechanical energy of the block and the bullet is conserved.

[14] The kinetic energy of a body does not change if any one of the following is true
(i)force is always perpendicular to the velocity
(ii) the force is always perpendicular to the acceleration
(iii) the object remains stationary
(iv) the object moves in such a way that the point of application of the force remains fixed.

SetId=445

[15] A force is any interaction which tends to change the motion of an object. It is also *defined* as rate of change of momentum.It is a vector quantity.

Pseudo-force is a fictitious force it is taken by an observer from non inertial frame of reference. This force arises from acceleration of reference frame that is a reference frame which is accelerating or rotating.

The equation of motion is then written by balancing all forces. As an example a particle moving in a circle is seen to be at rest by balancing the centripetal and centrifugal forces.

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SetId=446

[1] Distance depends on the path where as the displacement depends on the end point only.

[2] If the net external torque acting on a system is zero,the angular momentum L(vector) of the system remains constant,no matter what changes take place within the system.L(vector)=a constant (net external torque acting on system is zero)

[3] A bob is attached to ceiling by a string and moves in a horizontal circular plane is an example. In this case the law of conservation of angular momentum does not hold.

[4] For the motion of earth around sun, the sum of angular momenta of the Sun and the Earth about the center of mass of the sun + earth system is conserved.

[5] The three components of angular momentum of a conical pendulum is conserved w.r.t. the origin at the position of the center of mass of the pendulum. SetId=446

[6] There is no case where LAW OF CONSERVATION OF ANGULAR MOMENTUM does'nt hold.But there are cases where conservation of angular momentum does not hold.A body in vertical circular motion is an example where angular momentum is not conserved. Here the law of conservation does not apply.

[7] There is no known exception to the law of conservation of momentum in classical mechanics However, an exception to conservation of energy in nuclear physics is observed. In nuclear reactions when two nuclei collide and their mass converts to energy and energy momentum are not conserved.

[8] In order to apply the law of conservation of momentum we must first identify the system. Then even if there is no *net external forces* acting on the system, all the three conservation laws of momentum, angular momentum and energy may not hold due to presence of internal forces.

[9] A force that is not conservative is nonconservative force. The work done by a noconservative force cannot be represented by a potential energy function. That is work done by a nonconservative force is dependent on the path through which the system is moved. Some nonconservative forces cause the mechanical energy to be lost or dissipiated. Such forces are called dissipiative forces. There is no way to get back the lost mechanical energy. Nonconservative forces can also increase the mechanical energy. This is arrived from the concept of irreversible process.

SetId=446

[10] The motion of a bomb dropped from a plane does is not a uniform motion as it follows a parabolic path and not a straight line path.

[11] Distance depends on the path where as the displacement depends on the end point only

[12] Staying inside a bullet train moving with constant velocity (no jerks etc) an experiment can always be performed which will tell us the numerical value of the acceleration of the bullet train

[13] When a moving car hits a parked lorry and causes the parked lorry to move ,energy is transferred from moving the car to the lorry and the total energy of the lorry and the car is conserved.

[14] The total work done on a particle is always equal to the change in kinetic energy. SetId=446

[15] A psuedo force is an apparent force that acts on all masses whose motion is described with respect to a non-inertial frame of reference like a rotating frame of reference. This force is needed by an observer in an non-inertial frame to make all the Newtons second laws to write correct equation of motion..

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SetId=447

[1] Distance equal to zero implies displacement=0; and Displacement=0 also implies distance = 0

[2] The Law of conservation of angular momentum states that when no external torque acts on an object or a closed system of objects undergoing motion about a given axis, the change in angular momentum is zero. Therefore, considering an event where only internal torque or no torque is involved, the total angular momentum of the system before the event is equal to the total angular momentum after the event

[3] Consider a disc rotating about an axis perpendicular to its plane. On placing a smaller disc with its surface parallel to the surface of the rotating disc, the angular momentum of the system of two discs remains constant as there is no external torque.

[4] For the motion of the Earth around the sun, the total of angular momenta of the Earth and the Sun, about in a reference frame fixed in the pole star, is conserved.

[5] Only the z component of the angular momentum of a conical pendulum is conserved w.r.t. the origin fixed at the point of suspension. SetId=447

[6] A sphere rolling on a rough surface.Due to friction there is external torque so the angular momentum changes which results in the slowing of the sphere. The angular momentum keeps changing. Even in case like this one, it is wrong to say that the Law of Angular Momentum Conservation does not hold.

[7] In a system of a canon and a canon ball, total momentum of the system is zero before canon ball is fired. After firing the canon ball, the momentum of the system seems to be conserved as the ball moves forward and the canon moves backward.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then check we should if the laws are applicable or not.

So if there is no *external force* acting on the system all the three quantities, total momentum, total angular momentum, and total kinetic energy will be conserved independent of the nature of forces.

[9] Nonconservative forces are forces, such that the work done by these forces are path dependent. Work done by these forces around a close path is not necessarily equal to zero. Hence if a particle is acted on by a non-conservative force and that particle returns to its original position, that particle will experience a net loss of energy. Energy will thus not be conserved for particle. Potential Energy can not be defined

SetId=447 for these type of forces.

[10] A wagon sliding on a roller coaster designed in such a way that the wagon covers equal distances in equal times. As the motion of the wagon is uniform, there will be no net force acting on it.

[11] Distance equal to zero $\Rightarrow$ displacement=0; but Displacement=0

[12] Assume bullet train, moving with out any jerks, is going on a circular arc of radius R with constant speed. Then an experiment is to be performed entirely within the train without any measurement on objects outside the train. Such an experiment can tell only radius of the track.

[13] When a bomb explodes the total mechanical energy is not conserved. But the total chemical energy and the mechanical energy is conserved.

[14] A particle is acted upon by a force of constant magnitude which is always perpendicular to the velocity of the particle and the motion of the particle takes place in a plane, Then its kinetic energy, speed, velocity acceleration will not change. $\boxed{\text{SetId=447}}$

[15] One indication that pseudo forces are NON-NEWTONIAN is that they violate Newton's III law and violate the Newton's third law.

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[1] If P and Q are the initial and the final points of a path of a particle, displacement is a vector whose direction is along PQ and has magnitude is equal to the length of line PQ

SetId=448

[2] The law of conservation of angular momentum states that when no external torque acts on an object or a closed system of objects, no change of angular momentum can occur. Hence, the angular momentum before an event involving only internal torques or no torques is equal to the angular momentum after the event . Angular momentum can be calculated with the help of the formula $L = I\omega$ where L stands for Angular momentum, I stands for moment of inertia and ω stands for angular velocity

[3] Consider a man standing on a spinning platform. Initially, the man spreads out his arms and he spins with a certain angular velocity. The next moment, he pulls his arms inwards keeping them close to his body. We will observe that the angular velocity with which he is spinning now increases. This phenomenon can be explained by the Law Of Conservation of Angular momentum. Initially, since his arms were spread wide, his moment of inertia was large. However, when he pulled them close to his body, his moment of inertia decreased.
In this example the angular velocity of the man increases and therefore the angular momentum also increases.The law of conservation of angular momentum does not apply because the torque of muscular forces is not zero.

[4] For the motion of the Earth around the sun, the total of angular momenta of the Earth and the Sun, is conserved in every inertial frame of reference; but the angular momentum of the Earth (or of the sun)is not conserved in every inertial frame.

[5] The z component of angular momentum of a conical pendulum is not conserved w.r.t. the origin fixed at the point of suspension; but the x and y components are conserved.

SetId=448

[6] Consider a rod of length l. Let us give an impulse to one end . Now the angular momentum about the oposite end is not zero since the impulse provides some torque . So the angular momentum is not conserved .

$$\text{torque} = \text{impulse} * \ell.$$

$d\ell/dt$ is not equal to zero and the law of conservation of angular momentum does not hold.

[7] When applying the conservation laws of momentum, energy and angular momentum we must define the system first.Only then check if the laws is applicable or not.

As an example: when a ball is dropped from a height, it gains momentum down if we consider the ball as our system.This is because the force of gravity acts as an external force.

However, if we change our system and consider earth as a part of our system too, then the momentum remains conserved because the earth gains momentum up.

[8] If we want to apply the conservation laws of momentum, energy and angular momentum, we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *external force* acting on the system, the momentum and angular momentum will be conserved, and depending on the nature of the forces but total energy may or may not be conserved.

[9] Non Conservative force is a force with the property that workdone in moving an object from one point to another is dependent on the path taken .

Non Conservative Force can arise in classical physics due to neglected degrees of freedom or time dependent potentials.

Friction may be treated without resorting the use of non conservative forces by considering the motion of individual molecules.

SetId=448

[10] A simple pendulum moves along a circular arc and does not have constant speed and therefore its motion is not uniform.

[11] If P and Q are the initial and the final points of a path of a particle, displacement is a vector whose direction is along PQ and has magnitude is equal to the length of line PQ

[12] Assume bullet train, moving with out any jerks, is going on a circular arc of radius R with constant speed. Then an experiment is to be performed entirely within the train without any measurement on objects outside the train. Such an experiment can tell both speed of the train and radius of the track.

[13] When a ball rolls over a rough surface, it comes to stop after some time. This is because transational and rotational kinetic energy initially present in the ball continuosly gets converted to heat due to friction. When all the kinetic energy changes to heat, the ball stops. The total mechanical energy of the ball is not conserved.

[14] The kinetic energy of a particle is continuously increasing with time, then the angle bewteen the net force and the velocity cannot be greater than or equal to 90^o at any time.

SetId=448

[15] The apparent force which seems to act on an object in an accelerating frame of reference if we wish to describe the object's motion is called a pseudo force.Its a non-existent force used only to describe the motion completely using Newton's second law even though the agent causing the force is undefined.

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[1] If P and Q are the initial and the final points of a path of a particle,the displacement is the vector $\overrightarrow{PQ}$.

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[2] Newton's Second Law of Motion is defined by the expression $F = \frac{dp}{dT}$, where F gives the force vector acting on the system and p gives its momentum vector; in linear motion. A similar expression can be written to describe angular motion, i.e. : $\tau = \frac{dL}{dt}$, where τ is the external torque vector acting on the system, and L is the angular momentum.

If the external torque on the system is zero, then we get the expression as: dL/dt=0. This points out to the fact that, when no external torque is acting on the system, then its angular momentum is constant, no matter what changes occur in the system. This is the Law of Conservation Of Angular Momentum.

[3] In the Sun-Earth system, angular momentum of the earth is not conserved but the total angular momentum of the sun and the earth is constant of motion.

[4] In the Sun Earth system the angular momentum of the Earth is conserved in every frame of reference

[5] Only the z component of angular momentum of a conical pendulum is conserved w.r.t. the origin fixed at the point of suspension.

SetId=449

[6] Let us consider a rotating skew rod. In the absence of friction or any other drag force, the rod should continuously spin without stopping. Here the net torque about the axis of rotation is 0 and hence angular momentum is conserved. It therefore follows from law of conservation of angular momentum that a spinning skew rod will keep rotating with constant angular velocity if there is no external torque. So law of conservation of angular momentum does not hold.

[7] Statement: Law of Conservation of energy states that "ENERGY CAN NEITHER BE CREATED NOR DESTROYED",but it can be changed from one form to other.

EXPLANATION: Statement implies that the total amount of energy in an isolated system remains constant although it may change forms. viz, kinetic energy may change to potential;chemical to electrical energies etc.

[8] To apply the conservation laws of momentum, energy and angular momentum, we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *external force* acting on the system, the energy and momentum will be conserved. However, depending on the nature of the system and of the forces, the total angular momentum may not be conserved.

[9] A non-conservative force is a force with the property that the work done in moving a particle between two points is dependent of the path taken . Mostly the enery of the particle in a non conservative force field dissipates in the form of heat or sound . Since the lost energy cannot be bought back ,conservation of mechanical energy does not hold true .

SetId=449

[10] A satellite goes around the earth in a circular orbit of 600km with a time period of $5.8 \times 10^3 s$. Its motion will be uniform as it will cover equal distances in equal times.

[11] If P and Q are the initial and the final points of a path of a particle,the displacement is the vector $\overrightarrow{PQ}$.

[12] Assume bullet train, moving with out any jerks, is going on a circular arc of radius R with constant speed. Then an experiment is to be performed entirely within the train without any measurement on objects outside the train. Such an experiment can tell only speed of the track.

[13] Let us consider that a pendulum is oscillating moving in a vertical plane. Mean while let another bob which is attached to a spring and is executing a simple harmonic motion in horizontal direction comes and hits the pendulum. Here conservation of momentum does not hold good as tension(external force) is acting on the system.(pendulum)

[14] A heavy body is attached from a spring and is held at point A and is such that the spring is not slack nor is it stretched. It is then released. It goes down upto a point B and then it rises upto point C and executes an oscillatory motion between B and C. During the motion from A to C is first positive (from A to B) and then it is negative from B to A and again remains negative from A to C. SetId=449

[15] The physically apparent, but nonexistent, force needed by an observer in a noninertial frame to make Newton's laws of motion hold true is called pseudoforce.

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SetId=450

[1] If two bodies starting from a point A reach a point B, following different paths, their displacement will be, in general different, but the distances covered will always be the same.

[2] If the net external torque acting on a system is zero, the angular momentum L of the system remains constant, no matter what changes take place within the system.

$$\sum(T_{\text{ext}}) = \frac{dL}{dt}$$

The law states that when there is no net external torque, $\frac{dL}{dt}$ is zero implying that the total angular momentum of system is constant.

i.e. $L = a$ constant (isolated system)

[3] Consider a disc and a man system. man is standing on center of the disc rotating with angular velocity.initially man folded his hand.when man stretches his hands then momentum of inertia of system increases.and angular velocity decreases.and total angular momentum remains constant.

[4] In the motion of earth around sun, the angular momentum of the earth about an axis passing through the sun and perpendicular to the plane of motion of earth is conserved.

[5] The projection of angular momentum of a conical pendulum in the horizontal plane is a constant of motion when the origin is chosen to be at fixed at the point of suspension. SetId=450

[6] In the example of skew rod the angular velocity does not change even though the torque applied is nonzero. However there is no contradiction as in this case the law of conservation of momentum is not applicable. conservation is violated.

[7] Oscillating simple pendulum is a very good example where potential energy gets converted to kinetic energy and kinetic to potential energy. Some energy gets dissipated as heat if we consider air resistance. Energy as a whole is conserved if we consider universe as system, the energy has just changed its form.

[8] In order to apply the law of conservation of momentum we must first identify the system. If there is no *external forces* acting on the system then conservation laws of momentum always holds. And depending on the nature of the system and of the forces, the total kinetic energy and the total angular momentum may not be conserved.

SetId=450

[9] If the work done by a force depends on the path followed by the particle, it is called a Non conservative force. Work done by a non conservative force is not zero in round trip.

[10] A uniform motion is defined to be the one in which a body covers equal distances in equal time intervals.

[11] If two bodies starting from a point A reach a point B, following different paths, their displacement will be, in general different, but the distances covered will always be the same.

[12] A particle is observed from two frames S_1 and S_2. The frame S_2 moves with respect to S_1 with an acceleration a. If F_1 and F_2 be the pseudoforces when seen from S_1 and S_2 respectively it is not possible to have $F_1 = F_2 = 0$

[13] The law of conservation of momentum does not hold in relativistic situations, i.e., where the speeds of the masses involved are close to the speed of light.

[14] The kinetic energy of a body does not change if any one of the following is true
(i)force is always perpendicular to the velocity
(ii) the force is always perpendicular to the acceleration
(iii) the object remains stationary
(iv) the object moves in such a way that the point of application of the force remains fixed.

SetId=450

[15] Pseudo forces come into picture when Newton's laws of motion have to be applied to describe the motion of bodies in non-inertial frames. These forces have no real existence.

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[1] Displacement is equal to the vector difference $\vec{r}_f - \vec{r}_i$ of the position vectors of initial and final points. The distance covered will be $|\vec{r}_f - \vec{r}_i|$

[2] When the net external torque acting on a body or a system of bodies is zero about a particular axis, then the angular momentum of each body is conserved about that axis.

[3] The conservation of angular momentum of a system of bodies requires that the the sum of torque due to all forces be equal to zero. Now consider a situation where the forces are such that the sum of torques of external forces is zero w.r.t. some axes K. Since the value of torque depends of the choices of axes, the sum of torques due to all internal forces will depend on the choice of axes and in general it will be non zero. Therefore, for a system of several bodies, for a given choice of axes K, there will be situations when the total angular momentum may not be conserved.

[4] For the motion of earth around sun, the angular momentum of the earth about the center of mass of the sun + earth system and perpendicular to the plane of motion of earth is conserved.

[5] The law of angular momentum of a is not applicable for the conical pendulum conserved w.r.t. the origin fixed at the point of suspension. SetId=451

[6] Example where law of conservation of angular momentum does not hold:If a particle undergoes conical motion and the only force acting on particle is central force like tension of the string.Then total external torque about fixed point A is zero,yet angular momentum is not conserved,as angular momentum keeps on changing direction.

[7] Law of conservation of momentum does not hold whenever an external force or impulse acts on the system. For example,when a body collides with earth then it bounces back to a lesser height as it loses some velocity.

In this example the momentum of a ball is not conserved due to impulsive force by ground in the normal direction.

However, strictly speaking the system that should be considered here is the ball-earth system and the total momentum is conserved.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then check if the laws is applicable or not.

So if there is no *net external force* acting on the system all the three conservation laws will hold.

SetId=451

[9] The workdone by a non conservative force is dependant on its path. the work varies as the path varies.

[10] A particle moves on a circular path. Then its speed, direction of force, velocity and acceleration must always change with time.

[11] Distance is equal to the length of the path covered. Displacement is the shortest distance between initial and final points.

[12] A particle is observed from two frames S_1 and S_2. The frame S_2 moves with respect to S_1 with an acceleration a. If F_1 and F_2 be the pseudoforces when seen from S_1 and S_2 respectively and if $F_1 = 0$ then we must have $F_2 \neq 0$

[13] when we are in accelerating frame if we observe any collision between two bodies then the law of conservation of momentum does not hold in that frame of reference.

[14] The total work done on a particle is always equal to the change in kinetic energy. SetId=451

[15] In a non-inertial frame of reference the accelration of the body that we measure, is not the true acceleration, as the frame itself accelerates.Thus,force(F=ma) is also not the true force acting on the body.The extra force added to make it a true value is called pseudo force.Thus pseudo force does not really act on a body but just compensates the change produced by the non inertial frame, in true acceleration.

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SetId=452

[1] Distance is equal to the length of the path covered. Displacement is the shortest distance between initial and final points.

[2] The law of conservation of angular momentum states that in absence of an external torque on an object or a closed system of objects the total angular momentum of the system remains constant. Thus if $\vec{\tau} = 0 => \vec{L} =$ constant where τ is the torque and $\vec{L}$ is the angular momentum of the system.

[3] Example where law of conservation of angular momentum does not hold:
When there is external force like frictional force acting on a object when it is rotating we cannot use conservation of angular momentum as the friction force acting on the object produces an external torque.

[4] In the Sun Earth system the angular momentum of the Earth about the pole star is conserved

[5] The law of angular momentum of a is not applicable for the conical pendulum conserved when the origin is chosen to be at the pendulum bob itself. SetId=452

[6] A nonzero torque always causes the angular velocity to change, because a change in angular momentum means a change in angular velocity $L = I\omega$

[7] If a bullet hits a wooden board and gets embedded in the board, the total energy and the total momentum of the bullet and the board are conserved.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then check we should if the laws are applicable or not.

So if there is no *external force* acting on the system all the three quantities, total momentum is conserved. The total angular momentum is also because the torque of internal forces will be zero. The conservation of energy depends on the nature of forces. will be conserved.

SetId=452

[9] A non conservative force is a force with the property that the work done in moving a particle between two points is dependent on the path followed.

[10] A particle moves on a circular path. Then its speed, direction offorce, can remain constant by velocity and acceleration must always change with time.

[11] Distance is a scalar quantity where as the displacement is a vector quantity.

[12] If K is an inertial frame, any frame that moves w.r.t. the frame K with uniform velocity is also an inertial frame.

[13] Give an example where law of conservation of momentum does not hold all cases when seen from non inertial frame of references for example when we see two cars collide from a moving bus there momentum is not conserved

[14] A particle is acted upon by a force of constant magnitude which is always perpendicular to the velocity of the particle and the motion of the particle takes place in a plane, Then its kinetic energy, speed, velocity acceleration will not change. SetId=452

[15] A force is any interaction which tends to change the motion of an object. It is *equal to* the rate of change of momentum by Newton's second law.

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SetId=453

[1] Distance is a scalar quantity where as the displacement is a vector quantity.

[2] If no net external torque acts on a system, the total angular momentum of the system remains constant.

[3] A bob attached to a ceiling by a string moving in a horizontal circular plane is an example where the total angular momentum of the bob about the point of suspension is not conserved. This is because the the torque due to the weight of the bob about the point of suspension does not vanish and has non zero horizontal component. Only the vertical component of the angular component is conserved.

[4] For the motion of earth around sun, the angular momentum of the sun about the center of mass of the sun + earth system and perpendicular to the orbital plane of earth is conserved.

For the motion of earth around sun, the angular momentum of the sun about and axis passing through the Earth and perpendicular to the orbital plane of motion of earth is conserved.

[5] The three components of angular momentum of a conical pendulum is conserved w.r.t. the origin at the position of the center of mass of the pendulum.

SetId=453

[6] A nonzero torque always implies change in angular momentum and may not give rise to a change in magnitude of angular velocity. A non zero torque may mean change only the direction of the angular momentum and not the angular velocity.

[7] If a bullet hits a wooden board and gets embedded in the board, the total energy of the bullet and the board system is conserved but the total momentum is not conserved.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *net external force* acting on the system, the momentum is conserved. The definition of angular momentum and torque depends on the choice of axes, and therefore it may not be be conserved. The conservation of total energy holds only for conservative forces.

When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *net external force* acting on the system, the energy and momentum will be conserved. However, the total angular momentum may not be conserved because the torque may not be zero.

[9] A non conservative force is a force with the property that the work done in moving a particle between two points is dependent of the taken path.

Friction, for example, does less work on a book dragged across a table if the book is dragged straight across than if the book is dragged in a curved path.

To write the equation for conservation of energy for non conservative forces we need to include the work done by the non conservative force also.This is because forces like friction liberate heat which are not included in the mechanical energy.

SetId=453

[10] A particle moves on a circular path. Then under suitable conditions its speed may remain constant, but the force, velocity and acceleration must always change with time.

[11] Both displacement and distance tell us about the motion of a body but their study does not tell much about the forces on the body

[12] If K is an inertial frame, any frame that moves w.r.t. the frame K with uniform speed is also an inertial frame.

[13] When a tennis ball hits the ground at an oblique angle, the angle of reflection is equal to the angle of incidence. This is a simple consequence of conservation of horizontal component of momentum.

[14] The kinetic energy of a particle is continuously increasing with time, then the angle bewteen the net force and the velocity cannot be greater than or equal to 90^o at any time.

SetId=453

[15] Newton's laws are not valid on non-inertial frame of reference. So to validate Newton's laws of motion pseudo force (fictious or virtual force) is introduced.
Pseudo force acts in non-inertial frame. Its magnitude is always mass of the body multiplied by acceleration of the frame. It is always in direction opposite to the acceleration of the frame of reference. The resultant of pseudo forces and real forces is always zero.

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SetId=454

[1] The speed is rate of change of distance and the velocity is the rate of change of displacement.

[2] The law of conservation of angular momentum states that when no external torque is applied on an object or a closed system of objects about an axis, the angular momentum about that axis remains constant.

[3] Law of conservation of angular momentum holds in case of long jump. When a athlete takes off from the ground in a running long jump, the forces on the launching foot give the athlete an angular momentum with a forward rotation around a horizontal axis. Such rotation would not allow the jumper to land properly. In the landing, the legs should be together and extended forward at an angle so that the heels mark the sand at the greatest distance. Once airborne, the angular momentum cannot change (it is conserved) because no external torque acts to change it. However, the jumper can shift most of the angular momentum to the arms by rotating them in windmill fashion. Then the body remains upright in the proper orientation of landing.

[4] For the motion of earth around sun, the sum of angular momenta of the Sun and the Earth about the center of mass of the sun + earth system is conserved.

[5] Only the z component of the angular momentum of a conical pendulum is conserved w.r.t. the origin fixed at the point of suspension. SetId=454

[6] In the example of a rotating skew rod the torque due to the external gravitational forces is zero , but the angular momentum is not constant Therefore the law of conservation of angular momentum is violated.

[7] If a bullet hits a wooden board and gets embedded in the board, both total energy and the total momentum of the bullet and the board are not conserved.

[8] In order to apply the law of conservation of momentum we must first identify the system. If there is no *net external forces* acting on the system then conservation laws of momentum always holds. The total energy and the total angular momentum may not be conserved.

[9] A non conservative force is a force with the property that the work done in moving a particle between two points is dependent of the taken path.

Friction, for example, does less work on a book dragged across a table if the book is dragged straight across than if the book is dragged in a curved path.

To write the equation for conservation of energy for nonconservative forces we need toinclude the work done by the non conservative force also.This is because forces like friction liberate heat which are not included in the mechanical energy.

SetId=454

[10] A particle moves on a circular path. Then under suitable conditions its speed and acceleration may remain constant, but the force, and velocity must always change with time.

[11] Displacement is the shortest distance between initial and final points with direction specified.

[12] A frame rotating w.r.t K with uniform angular velocity is also an inertial frame.

[13] when a ball is dropped from a height, it gains momentum down if we consider the ball as our system.This is because the force of gravity acts as an external force.

However, if we change our system and consider earth as a part of our system too, then the momentum remains conserved because the earth gains momentum up.

[14] A heavy body is attached from a spring and is held at point A and is such that the spring is not slack nor is it stretched. It is then released. It goes down upto a point B and then it rises upto point C and executes an oscillatory motion between B and C. During the motion from A to C is first positive (from A to B) and then it is negative from B to A and again remains negative from A to C. SetId=454

[15] These forces are non-real forces but must be taken into account while applying Newton's Law's of Motion in accelerating frame of reference as compared to an inertial frame of reference.

The centrifugal and centripetal forces are examples of pesudo-forces.

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SetId=455

[1] For any type of translational motion of a body, the displacement cannot be zero, where as the distance travelled can be zero.

[2] The angular momentum of a given system of bodies shall remain conserved unless acted upon by an external unbalanced torque.

[3] The total angular momentum of a body remains constant of motion when the net torque of the external forces acting on the body is zero.
In general, we have a system of particles such that the net torque of the external forces on the system, w.r.t. some axes K, is zero, the total angular momentum may not remain conserved, because the torque due to the internal forces may not be zero.

[4] For the motion of the Earth around the sun, the total of angular momenta of the Earth and the Sun, about in a reference frame fixed in the pole star, is conserved.

[5] The z component of angular momentum of a conical pendulum is not conserved w.r.t. the origin fixed at the point of suspension; but the x and y components are conserved. SetId=455

[6] In the example of skew rod, the angular momentum changes with time and there is a non zero torque coming from action of forces other than gravitational forces. Hence the law of conservation of angular momentum dos not apply.

[7] There are certain situations where it appears that the law of conservation of linear momentum does not hold. For example if we take some amount of a substance like construction putty, cement, cake batter, playing dough,etc and drop it on the ground, it does not bounce back like a rubber ball would and hence the momentum it had before striking the ground seems to have been lost. Hence it appears that the law of conservation of linear momentum does not hold.

[8] In order to apply the law of conservation of momentum we must first identify the system. Then even if there is no *net external forces* acting on the system, all the three conservation laws of momentum, angular momentum and energy may not hold due to presence of internal forces.

[9] The non conservative force is a force with a property thet the work done between two points depends on path taken. If a particle moves along a curve path, to know about the work done by a non conservative force we should have the equation of the path along which the particle had move.The work done would be

WORK = INTEGRAL (F.dx)

The equation of conservation of mechanical energy for a non conservative force would be

SetId=455

$KE_{\text{final}} + PE_{final} = KE_{initial} + PE_{initial} + W_{nc}$

[10] When the force is kept constant as function of time, it is possible for a particle to move on a circular path in such a way that its speed remains constant, but the velocity and acceleration must always change with time.

[11] Displacements, being vector quantity can not compared with, a scalar quantity such as distance.

[12] The Newton's Laws of motion will hold in all frames which are at rest w.r.t. K but do not remain valid in a frame that move with respect to K.

[13] There is no known exception to the law of conservation of momentum in classical mechanics however when two bodies collide and their mass converts to energy, an exception in nuclear physics is observed. In real life this is observed in nuclear reactions at atomic level.

[14] The kinetic energy of a body does not change if any one of the following is true
(i)force is always perpendicular to the velocity
(ii) the force is always perpendicular to the acceleration
(iii) the object remains stationary
(iv) the object moves in such a way that the point of application of the force remains fixed. SetId=455

[15] When observing our system from a reference frame which is accelerating compared to an inertial frame,in order to make it easier to apply newtons laws, we can apply a pseudo force on all objects in the universe proportional to their mass capable of causing an acceleration equal and opposite to that of our reference frame. Hence serving to in a way "stop"(or make inertial) our reference frame, and making it easier for us to investigate the motion.

This application of pseudo force doesn't change the motion of the object because just as we can choose an arbitrary reference frame, we can choose an arbitrary force to cause the same acceleration in every object in the whole universe without changing the relative motions of objects. (as all motion is truly relative, we will still get correct answers for our investigations.

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[1] Displacements, being vector quantity can not compared with, a scalar quantity such as distance.

[2] When the net external torque acting on a system about a given axis is zero, the total angular momentum of the system about that axis remains consant.

[3] An example where law of conservation of angular momentum holds:
The Law of conservation of angular momentum holds in the case of a ballet dancer performing a pirouette.

When the dancer extends her arms outward, the angular velocity of her rotation decreases whereas when she keeps her arms close to her body, the angular velocity increases. This is because her moment of inertia changes as she moves her arms outward and inward. It can be noted that she as a system has no external torque acting upon her.

[4] For the motion of the Earth around the sun, the total of angular momenta of the Earth and the Sun, is conserved in every inertial frame of reference; but the angular momentum of the Earth (or of the sun)is not conserved in every inertial frame.

[5] Only the z component of angular momentum of a conical pendulum is conserved w.r.t. the origin fixed at the point of suspension. SetId=456

[6] In the example of conical pendulum, the z- component of angular momentum does not change. This follows from the angular momentum conservation as there is no external torque.

[7] A tennis ball is dropped from height h and after hitting the ground and it bounces back and rises to the same height. In this case the momentum of the ball is conserved because (under ideal conditions) the momentum after it hits the ground will be equal to the momentum it had before hitting the ground.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then check we should if the laws are applicable or not.

So if there is no *external force* acting on the system all the three quantities, total momentum, total angular momentum, and total kinetic energy will be conserved independent of the nature of forces.

[9] Nonconservative forces arise due to neglected degrees of freedom or from time dependent potentials. The work done by a nonconservative force depends upon the path taken. It causes a change in the mechanical energy of the system. It adds or removes mechanical energy from a system.

SetId=456

[10] It is not possible for a particle to move on a circular path in such a way that its speed and force remains constant, and only the velocity and acceleration may (or may not) always change with time.

[11] Distance depends on the path where as the displacement depends on the end point only

[12] Staying inside a bullet train moving with constant velocity (no jerks etc) an experiment can always be performed which will tell us the numerical velocity of the bullet train

[13] When there is no external forces act on a system of many particles, and there are only internal forces acting on the particles. The third law gives that the internal forces are pairwise equal and opposite.Thus the sum of internal forces is zero and the momentum of each particle is conserved.

[14] The total work done on a particle is always equal to the change in kinetic energy. SetId=456

[15] Various types of forces in nature can be grouped in four categories:
(a)Gravitational; (b)Electromagnetic; (c)Nuclear; (d)Weak
There are also some non-fundamental forces such as:
(i)Normal reaction on bodies in contact with surfaces , (ii) Friction,(iii) Tension,(iv)Elastic force.

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[1] Distance depends on the path where as the displacement depends on the end point only.

[2] This law sates that when no net torque of all forces acts on a object or a system of objects then total angular momentum of system is conserved.The angular momentum before an event is equal to angular momentum after that event.mathematically explained by when, net torque=0 ;then, total angular momentum(L)=constant.

[3] In case of a skater, who can be considered an isolated system, so no torue will be acting on him/her. When the arms are extended, the moment of inertia is more. When his hands are closely held, the moment of inertia is lesser. Since the angular momentum is same, the angular acceleration changes accordingly.

[4] In the Sun Earth system the angular momentum of the Earth is conserved in every frame of reference

[5] The projection of angular momentum of a conical pendulum in the horizontal plane is a constant of motion when the origin is chosen to be at fixed at the point of suspension.

SetId=457

[6] In the example of conical pendulum, the x and$y$ components of angular momentum change. This follows from the angular momentum conservation as the z components external torque is zero and horizontal components of torque are non zero.

[7] Law of conservation of momentum does not hold when Newton's laws are not valid, e.g. in a non-inertial frame of reference. For example, when we consider collision between two bodies in a non-inertial frame of reference, the law of conservation of momentum cannot be applied because there will be a pseudo force acting on the frame itself.

[8] If we want to apply the conservation laws of momentum, energy and angular momentum, we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *external force* acting on the system, the momentum and angular momentum will be conserved, and depending on the nature of the forces but total energy may or may not be conserved.

[9] The work done by a *Nonconservative Force *is not recoverable*.*The work done by a *Non Conservative force* is usually dissipated in the form of Heat and Sound.

SetId=457

Non conservative force *cannot* be expressed in the form of *Potential Energy*.

[10] For a particle moving on circle the acceleration is always constant in magnitude and directed towards the centre of the circle.

[11] Distance equal to zero $\Rightarrow$ displacement=0; but Displacement=0

[12] Staying inside a bullet train moving with constant velocity (no jerks etc) an experiment can always be performed which will tell us the numerical value of the acceleration of the bullet train

[13] During collision of billiard balls momentum is conserved. During explosion of a bomb also momentum is conserved and the total momentum of the fragments of bomb will be zero. This is because all the forces are only internal forces.

[14] A particle is acted upon by a force of constant magnitude which is always perpendicular to the velocity of the particle and the motion of the particle takes place in a plane, Then its kinetic energy, speed, velocity acceleration will not change. SetId=457

[15] A force is agency that which changes or tends to change the state of rest or motion of a body.

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SetId=458

[1] Distance equal to zero implies displacement=0; and Displacement=0 also implies distance = 0

[2] Statement of Law of Conservation of Angular Momentum:
Differentiating $\vec{L} = \vec{r} \times \vec{p}$ w.r.t, time,

$$\begin{aligned}\frac{dL}{dt} &= \frac{d\vec{r} \times \vec{p}}{dt} = \frac{d\vec{r}}{dt} \times \vec{p} + \vec{r} \times \frac{d\vec{p}}{dt} = \vec{v} \times (m\vec{v}) + \vec{r} \times \vec{F} \\ &= \vec{r} \times \vec{F} (\because v \times v = 0) \\ &= \vec{\tau}\end{aligned}$$

here $\vec{\tau}$ represents the net torque acting on a rigid body rotating about a fixed axis.This torque must take into account of all the forces, be it external or internal forces

[3] Example where law of conservation of angular momentum holds:
Let us assume a student seated on a stool that can rotate freely about a vertical axis. The student has been set into rotation at a modest initial angular speed ω . He holds two dumbbells in his outstretched hands. His angular momentum vector L lies along the vertical rotation axis, pointing upwards. Now he pulls in his arms;this action reduces his rotational inertia from its value I_{initial} to a final value I_{final} because he moves the mass closer to the rotational axis. His rate of rotation increases markedly, from ω_{initial} to ω_{final}. The student can then slow down by extending his arms once more,moving the dumbbells outward. No external torque acts on the system consisting of the student, stool and the dumbbells. Thus the angular momentum of the system about the rotational axis remains constant. $I_{\text{initial}} * \omega_{\text{initial}} = I_{\text{final}} * \omega_{\text{final}}$.

[4] In the motion of earth around sun, the angular momentum of the earth about an axis passing through the sun and perpendicular to the plane of motion of earth is conserved.

[5] The law of angular momentum of a is not applicable for the conical pendulum conserved w.r.t. the origin fixed at the point of suspension.

SetId=458

[6] Example where law of conservation of angular momentum does not hold: A disc rotating on a horizontal rough surface will not have a constant angular momentum because there will be a constant torque by frictional force. Hence, its angular momentum will decrease, and the law of conservation of angular momentum does not apply.

[7] If I throw a ball upward, it's speed decreases as it rises upwards. There is an external force (gravity) acting on the ball, so the momentum conservation law does not apply.

Momentum of the ball is not conserved, however the momentum of the Earth-ball system is conserved as gravity will become an internal force in this case.

[8] To apply the conservation laws of momentum, energy and angular momentum, we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *external force* acting on the system, the energy and momentum will be conserved. However, depending on the nature of the system and of the forces, the total angular momentum may not be conserved.

[9] * A non conservative force is a force that acts on a particle(or point), such that the work done by this force in moving this particle from one point to another is */dependent of path taken/* that is the work done depends on the path itself. * For example frictional force is non conservative because the work done by friction always acts in the direction of travel and therefore depends on length L of the path taken.

SetId=458

[10] The motion of a bomb dropped from a plane does is not a uniform motion as it follows a parabolic path and not a straight line path.

[11] If P and Q are the initial and the final points of a path of a particle, displacement is a vector whose direction is along PQ and has magnitude is equal to the length of line PQ

[12] Assume bullet train, moving with out any jerks, is going on a circular arc of radius R with constant speed. Then an experiment is to be performed entirely within the train without any measurement on objects outside the train. Such an experiment can tell only radius of the track.

[13] Give an example where law of conservation of momentum holds: A mass exploding into several pieces in a conservative field like gravitational field(if air resistance is neglected), obeys law of conservation of momentum. If air resistance cannot be neglected then the law of conservation of momentum will not hold.

[14] The kinetic energy of a particle is continuously increasing with time, then the angle bewteen the net force and the velocity cannot be greater than or equal to 90° at any time.

SetId=458

[15] The forces may be of the following two types - *Contact forces* (those that act when bodies are in physical contact) eg. friction, normal reaction, bouyancy etc. and*Action-at-a-distance forces* (those that act when bodies are not in contact) eg. Gravity, electostatic forces, magnetic forces etc. There At the root level, forces are of the following fundamental types :- (a) *Gravitational forces* - weakest of all forces, always attractive
(b) *Electromagnetic forces* - stronger than gravitational forces, can be attractive or repulsive,
(c) *Nuclear forces* - exist at atomic level, have very short range,
(d) *Weak nuclear forces* associated with beta particle emission

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[1] If P and Q are the initial and the final points of a path of a particle, displacement is a vector whose direction is along PQ and has magnitude is equal to the length of line PQ

SetId=459

[2] Statement of Law of Conservation of Angular Momentum: For a system of many particles The net torque due all the forces, be it external or internal forces. But as the torque due to all the internal forces cancel out, it sufficient to consider the external forces acting on the system.

[3] A bob is attached to ceiling by a string and moves in a horizontal circular plane is an example. In this case the law of conservation of angular momentum does not hold.

[4] For the motion of earth around sun, the angular momentum of the earth about the center of mass of the sun + earth system and perpendicular to the plane of motion of earth is conserved.

[5] The law of angular momentum of a is not applicable for the conical pendulum conserved when the origin is chosen to be at the pendulum bob itself. SetId=459

[6] Example where law of conservation of angular momentum does not hold:Consider a vertical stick on the ground falling to a horizontal position. During the fall, the conservation of angular momentum applied at the point of rotation on the ground and perpendicular to the plane of the stick is not applicable as, the gravitational force which acts vertically downwards assumed at the centre of mass produces an external torque about the axis of rotation

[7] A soldier accelerating away, after detonating a bomb, will find that the total momentum of the fragments of the bomb is zero. This is an example where the law of conservation of momentum holds as the forces on the fragments are internal forces only and sum of all such forces is zero.

[8] In order to apply the law of conservation of momentum we must first identify the system. If there is no *external forces* acting on the system then conservation laws of momentum always holds. And depending on the nature of the system and of the forces, the total kinetic energy and the total angular momentum may not be conserved.

[9] A force with the property that the work done in moving a particle is dependent on the path followed. The work done by a conservative force in moving a body from an initial location to a final location is dependent on the path taken between the two points

SetId=459

[10] A wagon sliding on a roller coaster designed in such a way that the wagon covers equal distances in equal times. As the motion of the wagon is uniform, there will be no net force acting on it.

[11] If P and Q are the initial and the final points of a path of a particle,the displacement is the vector $\overrightarrow{PQ}$.

[12] Assume bullet train, moving with out any jerks, is going on a circular arc of radius R with constant speed. Then an experiment is to be performed entirely within the train without any measurement on objects outside the train. Such an experiment can tell both speed of the train and radius of the track.

[13] Also a good example of law of conservation momentum can be seen when a bullet from a rifle is fired.As the bullet is fired and gets out of the rifle, the rifle gives a backward jerk due to the phenomenon of conservation of momentum.

[14] A heavy body is attached from a spring and is held at point A and is such that the spring is not slack nor is it stretched. It is then released. It goes down upto a point B and then it rises upto point C and executes an oscillatory motion between B and C. During the motion from A to C is first positive (from A to B) and then it is negative from B to A and again remains negative from A to C. SetId=459

[15] The main differences between force and pseudo force are -
(1) Forces have a real presence while pseudo forces don't.
(2) Forces can be accounted for by Newton's laws.
(3) Pseudo forces are only taken into account when the reference frame is accelerated.

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SetId=460

[1] If P and Q are the initial and the final points of a path of a particle,the displacement is the vector $\overrightarrow{PQ}$.

[2] Depending on the torques acting on a system, the angular momentum can be conserved only in one or two directions, but may not be conserved in all. For instance, if an isolated body has no torque acting on it only in the direction along the Z axis, then the angular momentum is conserved only in that direction.

[3] Consider a disc rotating about an axis perpendicular to its plane. On placing a smaller disc with its surface parallel to the surface of the rotating disc, the angular momentum of the system of two discs remains constant as there is no external torque.

[4] In the Sun Earth system the angular momentum of the Earth about the pole star is conserved

[5] The three components of angular momentum of a conical pendulum is conserved w.r.t. the origin at the position of the center of mass of the pendulum. SetId=460

[6] We have a conical pendulum .The forces acting on the bob are tension (along the direction of the string) and gravitational force acting in the vertically downward direction.we have an additional force called the drag force which is tangential to the motion of the bob and acts in the direction opposite to the motion of the bob.The axis of rotation passes through the hinge point and is vertical.The torque due to tension is 0 because the force passes through the axis of rotation.The torque due to mg is also zero since it is parallel to the axis of rotation.but the torque due to drag force is not zero.since the net external torque acting on the bob is not zero,therefore the law of conservation of angular momentum does not hold here

[7] There is no known exception to the law of conservation of momentum in classical mechanics However, an exception to conservation of energy in nuclear physics is observed. In nuclear reactions when two nuclei collide and their mass converts to energy and energy momentum are not conserved.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then check if the laws is applicable or not.

So if there is no *net external force* acting on the system all the three conservation laws will hold.

[9] The work done by non conservative force is dependent on the path taken by the particle in reaching final position from initial position. Non conservative force depends on the distance travelled by the particle

SetId=460

[10] A simple pendulum moves along a circular arc and does not have constant speed and therefore its motion is not uniform.

[11] If two bodies starting from a point A reach a point B, following different paths, their displacement will be, in general different, but the distances covered will always be the same.

[12] Assume bullet train, moving with out any jerks, is going on a circular arc of radius R with constant speed. Then an experiment is to be performed entirely within the train without any measurement on objects outside the train. Such an experiment can tell only speed of the track.

[13] when a man walks on the ice slab where friction does not exist between the ice block and the floor but between the feet of the man and the slab the slab moves back as per the law of conservation of momentum

[14] The kinetic energy of a body does not change if any one of the following is true
(i)force is always perpendicular to the velocity
(ii) the force is always perpendicular to the acceleration
(iii) the object remains stationary
(iv) the object moves in such a way that the point of application of the force remains fixed. SetId=460

[15] A force is any interaction which tends to change the motion of an object. It is also *defined* as rate of change of momentum. It is a vector quantity.

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SetId=461

[1] If two bodies starting from a point A reach a point B, following different paths, their displacement will be, in general different, but the distances covered will always be the same.

[2] According to Law of Conservation of Angular momentum,if no external torque acts on an object or system of objects,angular momentum of an object or system of objects remains CONSTANT or no change in angular momentum can occur.

Also it states that,only external torque can change angular momentm of the system where as the torque produced by internal forces can not change the angular momentum of the system

[3] Consider a man standing on a spinning platform. Initially, the man spreads out his arms and he spins with a certain angular velocity. The next moment, he pulls his arms inwards keeping them close to his body. We will observe that the angular velocity with which he is spinning now increases. This phenomenon can be explained by the Law Of Conservation of Angular momentum. Initially, since his arms were spread wide, his moment of inertia was large. However, when he pulled them close to his body, his moment of inertia decreased.
In this example the angular velocity of the man increases and therefore the angular momentum also increases.The law of conservation of angular momentum does not apply because the torque of muscular forces is not zero.

[4] For the motion of earth around sun, the angular momentum of the sun about the center of mass of the sun + earth system and perpendicular to the orbital plane of earth is conserved.

For the motion of earth around sun, the angular momentum of the sun about and axis passing through the Earth and perpendicular to the orbital plane of motion of earth is conserved.

[5] Only the z component of the angular momentum of a conical pendulum is conserved w.r.t. the origin fixed at the point of suspension. SetId=461

[6] When you release a toy gyroscope on its pedestal, it initially has no precessional rotation around that pedestal, i.e, the orientation of rotation is fixed. However, it instantaneously starts precessing around the pedestal. Both Kinetic Energy and Angular Momentum now exist where they did not exist a moment earlier. The Kinetic Energy is easy to explain, as appearing due to the body of the gyroscope dropping a tiny fraction of a millimeter in the Earth's gravitational field, giving up exactly the correct amount of Potential Energy. But the Angular Momentum of the Precession which just appeared, does not come from anywhere. This is therefore a Violation of the Conservation of Angular Momentum.

[7] In a system of a canon and a canon ball, total momentum of the system is zero before canon ball is fired. After firing the canon ball, the momentum of the system seems to be conserved as the ball moves forward and the canon moves backward.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then check we should if the laws are applicable or not.

So if there is no *external force* acting on the system all the three quantities, total momentum is conserved. The total angular momentum is also because the torque of internal forces will be zero. The conservation of energy depends on the nature of forces. will be conserved.

[9] The work done by non conservative force is dependent on the path taken by the particle in reaching final position from initial position. Non conservative force depends on the distance travelled by the particle

SetId=461

[10] A satellite goes around the earth in a circular orbit of 600km with a time period of $5.8 \times 10^3 s$. Its motion will be uniform as it will cover equal distances in equal times.

[11] Distance is equal to the length of the path covered. Displacement is the shortest distance between initial and final points.

[12] A particle is observed from two frames S_1 and S_2. The frame S_2 moves with respect to S_1 with an acceleration a. If F_1 and F_2 be the pseudoforces when seen from S_1 and S_2 respectively it is not possible to have $F_1 = F_2 = 0$

[13] When a freely falling rigid body collides another body in its path momentum the system of two particles is not conserved in the collision as there is external force mg acting on the system.

[14] The total work done on a particle is always equal to the change in kinetic energy. SetId=461

[15] Explain Pseudo Force: While applying Newton's laws of motion in non-inertial frame of reference it gives answers which contradict observations. Thus, to account for this,using Newton's Laws, we introduce a "fake" or pseudo force which gives answers that match the observations in a non-inertial frame.

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[1] Displacement is equal to the vector difference $\vec{r}_f - \vec{r}_i$ of the position vectors of initial and final points. The distance covered will be $|\vec{r}_f - \vec{r}_i|$

[2] The law of conservation of angular momentum states that when the net external torque acting on the system is zero, then the angular momentum of the system remains constant.both the initial and final momentum should be taken from a fixed inertial frame of reference provided.

[3] In the Sun-Earth system, angular momentum of the earth is not conserved but the total angular momentum of the sun and the earth is constant of motion.

[4] For the motion of earth around sun, the sum of angular momenta of the Sun and the Earth about the center of mass of the sun + earth system is conserved.

[5] The z component of angular momentum of a conical pendulum is not conserved w.r.t. the origin fixed at the point of suspension; but the x and y components are conserved. SetId=462

[6] There is no case where LAW OF CONSERVATION OF ANGULAR MOMENTUM does'nt hold.But there are cases where conservation of angular momentum does not hold.A body in vertical circular motion is an example where angular momentum is not conserved. Here the law of conservation does not apply.

[7] When applying the conservation laws of momentum, energy and angular momentum we must define the system first.Only then check if the laws is applicable or not.

As an example: when a ball is dropped from a height, it gains momentum down if we consider the ball as our system.This is because the force of gravity acts as an external force.

However, if we change our system and consider earth as a part of our system too, then the momentum remains conserved because the earth gains momentum up.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *net external force* acting on the system, the momentum is conserved. The definition of angular momentum and torque depends on the choice of axes, and therefore it may not be be conserved. The conservation of total energy holds only for conservative forces.

When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *net external force* acting on the system, the energy and momentum will be conserved. However, the total angular momentum may not be conserved because the torque may not be zero.

[9] Nonconservative forces are those forces in which the work done in moving a particle is dependant on the path taken to cover the distance. Some energy woul be lost to the environment in the form of heat, sound, etc. The energy in the final state is less than that in the initial state.

SetId=462

[10] A uniform motion is defined to be the one in which a body covers equal distances in equal time intervals.

[11] Distance is a scalar quantity where as the displacement is a vector quantity.

[12] A particle is observed from two frames S_1 and S_2. The frame S_2 moves with respect to S_1 with an acceleration a. If F_1 and F_2 be the pseudoforces when seen from S_1 and S_2 respectively and if $F_1 = 0$ then we must have $F_2 \neq 0$

[13] If we take some amount of a substance like construction putty, cement, cake batter, playing dough,etc and drop it on the ground, it does not bounce back, like a rubber ball would bounce, and hence the momentum it had before striking the ground seems to have been lost. Hence it appears that the law of conservation of linear momentum does not hold.

[14] A particle is acted upon by a force of constant magnitude which is always perpendicular to the velocity of the particle and the motion of the particle takes place in a plane, Then its kinetic energy, speed, velocity acceleration will not change.

SetId=462

[15] When a train is at rest and a ball is hung from the ceiling with a string, an observer in the train sees that the string is vertical. But when the train starts moving, the observer sees that the string makes an angle with the vertical and is tilted in forward direction . This means that some force other than gravity and tension must act on the ball. That force is the pseudo force.

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[1] Distance is equal to the length of the path covered. Displacement is the shortest distance between initial and final points.

[2] The law of conservation of angular momentum states that The total angular momentum of a system is constant in both magnitude and direction if the resultant torque, of the external forces acting on the system, is zero.

[3] Consider a disc and a man system. man is standing on center of the disc rotating with angular velocity.initially man folded his hand.when man stretches his hands then momentum of inertia of system increases.and angular velocity decreases.and total angular momentum remains constant.

[4] For the motion of the Earth around the sun, the total of angular momenta of the Earth and the Sun, about in a reference frame fixed in the pole star, is conserved.

[5] Only the z component of angular momentum of a conical pendulum is conserved w.r.t. the origin fixed at the point of suspension. SetId=463

[6] A sphere rolling on a rough surface.Due to friction there is external torque so the angular momentum changes which results in the slowing of the sphere. The angular momentum keeps changing. Even in case like this one, it is wrong to say that the Law of Angular Momentum Conservation does not hold.

[7] Statement: Law of Conservation of energy states that ”ENERGY CAN NEITHER BE CREATED NOR DESTROYED”,but it can be changed from one form to other.

EXPLANATION: Statement implies that the total amount of energy in an isolated system remains constant although it may change forms. viz, kinetic energy may change to potential;chemical to electrical energies etc.

[8] In order to apply the law of conservation of momentum we must first identify the system. If there is no *net external forces* acting on the system then conservation laws of momentum always holds. The total energy and the total angular momentum may not be conserved.

[9] The work done by such forces depends on the path taken. The work done cannot be represented as a potential energy function.Work done by such forces is always negative.

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[10] A particle moves on a circular path. Then its speed, direction of force, velocity and acceleration must always change with time.

[11] Both displacement and distance tell us about the motion of a body but their study does not tell much about the forces on the body

[12] If K is an inertial frame, any frame that moves w.r.t. the frame K with uniform velocity is also an inertial frame.

[13] When we consider collision between two bodies in a non-inertial frame of reference, the law of conservation of momentum cannot be applied because there will be a pseudo force acting on the frame itself.

[14] The kinetic energy of a particle is continuously increasing with time, then the angle bewteen the net force and the velocity cannot be greater than or equal to 90^{o} at any time. SetId=463

[15] Since newton's laws are not valid in non-inertial frames, pseudoforces (which do not exist in reality) are used to help us formualate and use Newton's laws of motion in non-inertial frames.

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[1] Distance is a scalar quantity where as the displacement is a vector quantity.

[2] If the net external torque acting on a system is zero,the angular momentum L(vector) of the system remains constant,no matter what changes take place within the system.L(vector)=a constant (net external torque acting on system is zero)

[3] The conservation of angular momentum of a system of bodies requires that the the sum of torque due to all forces be equal to zero. Now consider a situation where the forces are such that the sum of torques of external forces is zero w.r.t. some axes K. Since the value of torque depends of the choices of axes, the sum of torques due to all internal forces will depend on the choice of axes and in general it will be non zero. Therefore, for a system of several bodies, for a given choice of axes K, there will be situations when the total angular momentum may not be conserved.

[4] For the motion of the Earth around the sun, the total of angular momenta of the Earth and the Sun, is conserved in every inertial frame of reference; but the angular momentum of the Earth (or of the sun)is not conserved in every inertial frame.

[5] The projection of angular momentum of a conical pendulum in the horizontal plane is a constant of motion when the origin is chosen to be at fixed at the point of suspension. SetId=464

[6] Consider a rod of length l. Let us give an impulse to one end . Now the angular momentum about the oposite end is not zero since the impulse provides some torque . So the angular momentum is not conserved .

$$\text{torque} = \text{impulse} * \ell.$$

$d\ell/dt$ is not equal to zero and the law of conservation of angular momentum does not hold.

[7] Oscillating simple pendulum is a very good example where potential energy gets converted to kinetic energy and kinetic to potential energy. Some energy gets dissipated as heat if we consider air resistance. Energy as a whole is conserved if we consider universe as system, the energy has just changed its form.

[8] In order to apply the law of conservation of momentum we must first identify the system. Then even if there is no *net external forces* acting on the system, all the three conservation laws of momentum, angular momentum and energy may not hold due to presence of internal forces.

[9] A nonconservative force is a force with the property that the work done in moving a particle depends on the path taken.Also, the net work done in a closed loop is non zero.

SetId=464

[10] A particle moves on a circular path. Then its speed, direction offorce, can remain constant by velocity and acceleration must always change with time.

[11] Displacement is the shortest distance between initial and final points with direction specified.

[12] If K is an inertial frame, any frame that moves w.r.t. the frame K with uniform speed is also an inertial frame.

[13] When a system is acted upon by external forces like friction etc, the conservation principle does not hold good,there will be impulse imparted and so we cant conserve momentum. This is case when a collision between two elastic balls take place on a rough horizontal table. The total momentum just after the collision will be different from the total momentum just before the collision. Here momentum is not conserved as there is external force friction is present.

[14] A heavy body is attached from a spring and is held at point A and is such that the spring is not slack nor is it stretched. It is then released. It goes down upto a point B and then it rises upto point C and executes an oscillatory motion between B and C. During the motion from A to C is first positive (from A to B) and then it is negative from B to A and again remains negative from A to C. SetId=464

[15] Force is defined as the rate of change of linear momentum. In other words it is the agency which changes or tends to change the (a) State of rest; (b)State of uniform motion (c) Direction of body's motion; (d) Shape of the body

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[1] The speed is rate of change of distance and the velocity is the rate of change of displacement.

[2] The Law of conservation of angular momentum states that when no external torque acts on an object or a closed system of objects undergoing motion about a given axis, the change in angular momentum is zero. Therefore, considering an event where only internal torque or no torque is involved, the total angular momentum of the system before the event is equal to the total angular momentum after the event

[3] Example where law of conservation of angular momentum does not hold:
When there is external force like frictional force acting on a object when it is rotating we cannot use conservation of angular momentum as the friction force acting on the object produces an external torque.

[4] In the Sun Earth system the angular momentum of the Earth is conserved in every frame of reference

[5] The law of angular momentum of a is not applicable for the conical pendulum conserved w.r.t. the origin fixed at the point of suspension. SetId=465

[6] Let us consider a rotating skew rod. In the absence of friction or any other drag force, the rod should continuously spin without stopping. Here the net torque about the axis of rotation is 0 and hence angular momentum is conserved. It therefore follows from law of conservation of angular momentum that a spinning skew rod will keep rotating with constant angular velocity if there is no external torque. So law of conservation of angular momentum does not hold.

[7] Law of conservation of momentum does not hold whenever an external force or impulse acts on the system. For example,when a body collides with earth then it bounces back to a lesser height as it loses some velocity.

In this example the momentum of a ball is not conserved due to impulsive force by ground in the normal direction.

However, strictly speaking the system that should be considered here is the ball-earth system and the total momentum is conserved.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then check we should if the laws are applicable or not.

So if there is no *external force* acting on the system all the three quantities, total momentum, total angular momentum, and total kinetic energy will be conserved independent of the nature of forces.

[9] A force whose work done is a path function is called a non-conservative force. All the forces which do not satisfy the definition of conservative forces are non-conservative in nature. The work done by these forces dissipates into heat energy, sound energy, light energy, etc. Therefore, law of conservation of mechanical energy cannot be applied to a system on which a non-conservative force is acting. No potential function can be defined for these forces.

SetId=465

[10] A particle moves on a circular path. Then under suitable conditions its speed may remain constant, but the force, velocity and acceleration must always change with time.

[11] Displacements, being vector quantity can not compared with, a scalar quantity such as distance.

[12] A frame rotating w.r.t K with uniform angular velocity is also an inertial frame.

[13] When we are in accelerating frame if we observe any collision between two bodies then the law of conservation of momentum does not hold in that frame of reference. On the other hand the law of conservation of momentum holds in all inertial frames.

[14] The kinetic energy of a body does not change if any one of the following is true
(i)force is always perpendicular to the velocity
(ii) the force is always perpendicular to the acceleration
(iii) the object remains stationary
(iv) the object moves in such a way that the point of application of the force remains fixed.

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[15] Real forces have their origin in matter such as electricity, gravitation etc., while pseudo forces are caused by inertial motion.

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[1] For any type of translational motion of a body, the displacement cannot be zero, where as the distance travelled can be zero.

[2] The law of conservation of angular momentum states that when no external torque acts on an object or a closed system of objects, no change of angular momentum can occur. Hence, the angular momentum before an event involving only internal torques or no torques is equal to the angular momentum after the event . Angular momentum can be calculated with the help of the formula $L = I\omega$ where L stands for Angular momentum, I stands for moment of inertia and ω stands for angular velocity

[3] A bob attached to a ceiling by a string moving in a horizontal circular plane is an example where the total angular momentum of the bob about the point of suspension is not conserved. This is because the the torque due to the weight of the bob about the point of suspension does not vanish and has non zero horizontal component. Only the vertical component of the angular component is conserved.

[4] In the motion of earth around sun, the angular momentum of the earth about an axis passing through the sun and perpendicular to the plane of motion of earth is conserved.

[5] The law of angular momentum of a is not applicable for the conical pendulum conserved when the origin is chosen to be at the pendulum bob itself. SetId=466

[6] In the example of skew rod the angular velocity does not change even though the torque applied is nonzero. However there is no contradiction as in this case the law of conservation of momentum is not applicable. conservation is violated.

[7] If a bullet hits a wooden board and gets embedded in the board, the total energy and the total momentum of the bullet and the board are conserved.

[8] If we want to apply the conservation laws of momentum, energy and angular momentum, we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *external force* acting on the system, the momentum and angular momentum will be conserved, and depending on the nature of the forces but total energy may or may not be conserved.

[9] *Non conservative forces* are the type of forces in which the work done by the forces is purely dependent on the path taken by the body.Thus the net work done by the forces in cyclic path is never equal to zero.

SetId=466

[10] A particle moves on a circular path. Then under suitable conditions its speed and acceleration may remain constant, but the force, and velocity must always change with time.

[11] Distance depends on the path where as the displacement depends on the end point only

[12] The Newton's Laws of motion will hold in all frames which are at rest w.r.t. K but do not remain valid in a frame that move with respect to K.

[13] When a freely falling body hits another rigid body in its path then momentum is not conserved as external force mg acts on both the bodies. The total momentum after the collision will be different from the total momentum before the hit.

[14] The total work done on a particle is always equal to the change in kinetic energy. SetId=466

[15] 1)When we start rolling a body on a rough ground, it stops rolling after certain period because of frictional force.
2)When we leave a body from a certain height, it falls due to the act of gravitational force.

1)When a body is rotating in a circular path due to the centrifugal force which is the pseudo force. 2) When the lift is accelerating upwards, the upwards force felt by passengers a pseudo force.

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[1] Displacements, being vector quantity can not compared with, a scalar quantity such as distance.

[2] Newton's Second Law of Motion is defined by the expression $F = \frac{dp}{dT}$, where F gives the force vector acting on the system and p gives its momentum vector; in linear motion. A similar expression can be written to describe angular motion, i.e. : $\tau = \frac{dL}{dt}$, where τ is the external torque vector acting on the system, and L is the angular momentum.

If the external torque on the system is zero, then we get the expression as: dL/dt=0. This points out to the fact that, when no external torque is acting on the system, then its angular momentum is constant, no matter what changes occur in the system. This is the Law of Conservation Of Angular Momentum.

[3] Law of conservation of angular momentum holds in case of long jump. When a athlete takes off from the ground in a running long jump, the forces on the launching foot give the athlete an angular momentum with a forward rotation around a horizontal axis. Such rotation would not allow the jumper to land properly. In the landing, the legs should be together and extended forward at an angle so that the heels mark the sand at the greatest distance. Once airborne, the angular momentum cannot change (it is conserved) because no external torque acts to change it. However, the jumper can shift most of the angular momentum to the arms by rotating them in windmill fashion. Then the body remains upright in the proper orientation of landing.

[4] For the motion of earth around sun, the angular momentum of the earth about the center of mass of the sun + earth system and perpendicular to the plane of motion of earth is conserved.

[5] The three components of angular momentum of a conical pendulum is conserved w.r.t. the origin at the position of the center of mass of the pendulum. SetId=467

[6] Example where law of conservation of angular momentum does not hold:If a particle undergoes conical motion and the only force acting on particle is central force like tension of the string.Then total external torque about fixed point A is zero,yet angular momentum is not conserved,as angular momentum keeps on changing direction.

[7] If a bullet hits a wooden board and gets embedded in the board, the total energy of the bullet and the board system is conserved but the total momentum is not conserved.

[8] To apply the conservation laws of momentum, energy and angular momentum, we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *external force* acting on the system, the energy and momentum will be conserved. However, depending on the nature of the system and of the forces, the total angular momentum may not be conserved.

[9] Non-conservative forces are path-dependent forces, i.e. the work done on a body by these forces depends on the path taken by the body. Mechanical energy of a system is not conserved when a conservative force acts on it but the total energy is conserved. Therefore, the mechanical energy lost by the system is liberated in some other form such as light energy, heat energy, etc.

For example, when a body is moving along a surface, frictional force acts on the body as well. Due to this frictional force, the body loses its mechanical energy, and this loss is generally released in the form of heat energy to the surroundings. Thus, the mechanical energy will not be conserved and frictional force can be classified as a non-conservative force. SetId=467

[10] When the force is kept constant as function of time, it is possible for a particle to move on a circular path in such a way that its speed remains constant, but the velocity and acceleration must always change with time.

[11] Distance equal to zero $\Rightarrow$ displacement=0; but Displacement=0

[12] Staying inside a bullet train moving with constant velocity (no jerks etc) an experiment can always be performed which will tell us the numerical velocity of the bullet train

[13] .The law of conservation of momentum does not hold good when net external forces acting on the system is not zero.when two bodies collide law of conservation of momentum is applicable on system of two bodies but on not individual bodies because external impulse acts on them.

[14] A particle is acted upon by a force of constant magnitude which is always perpendicular to the velocity of the particle and the motion of the particle takes place in a plane, Then its kinetic energy, speed, velocity acceleration will not change. SetId=467

[15] Newton's first law defines inertial frame. An inertial frame is a frame in which the first law hold. It also makes it possible to compare and tell two force being equal or not. The second law defines the force.

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[1] Distance depends on the path where as the displacement depends on the end point only.

[2] If the net external torque acting on a system is zero, the angular momentum L of the system remains constant, no matter what changes take place within the system.

$$\sum(T_{\text{ext}}) = \frac{dL}{dt}$$

The law states that when there is no net external torque, $\frac{dL}{dt}$ is zero implying that the total angular momentum of system is constant.

i.e. $L = a$ constant (isolated system)

[3] The total angular momentum of a body remains constant of motion when the net torque of the external forces acting on the body is zero.
In general, we have a system of particles such that the net torque of the external forces on the system, w.r.t. some axes K, is zero, the total angular momentum may not remain conserved, because the torque due to the internal forces may not be zero.

[4] In the Sun Earth system the angular momentum of the Earth about the pole star is conserved

[5] Only the z component of the angular momentum of a conical pendulum is conserved w.r.t. the origin fixed at the point of suspension. SetId=468

[6] A nonzero torque always causes the angular velocity to change, because a change in angular momentum means a change in angular velocity $L = I\omega$

[7] If a bullet hits a wooden board and gets embedded in the board, both total energy and the total momentum of the bullet and the board are not conserved.

[8] In order to apply the law of conservation of momentum we must first identify the system. If there is no *external forces* acting on the system then conservation laws of momentum always holds. And depending on the nature of the system and of the forces, the total kinetic energy and the total angular momentum may not be conserved.

[9] It is a force for which the work done by that force on an object or a particle in moving it between any two points depends on its path travelled.This force doesn't conserves the mechanical energy.The work done by a non-conservative force on an object in moving it in a circular path is not equal to zero.

SetId=468

[10] It is not possible for a particle to move on a circular path in such a way that its speed and force remains constant, and only the velocity and acceleration may (or may not) always change with time.

[11] If P and Q are the initial and the final points of a path of a particle, displacement is a vector whose direction is along PQ and has magnitude is equal to the length of line PQ

[12] Staying inside a bullet train moving with constant velocity (no jerks etc) an experiment can always be performed which will tell us the numerical value of the acceleration of the bullet train

[13] A block moving in the air breaks up into two parts and the parts separate, then the total momentum must be the same before and after the break.

[14] The kinetic energy of a particle is continuously increasing with time, then the angle bewteen the net force and the velocity cannot be greater than or equal to 90^{o} at any time. SetId=468

[15] The magnitude of the pseudo force arising in a non-inertial frame is always equal to the mass of the body under consideration multiplied by the acceleration of the frame of reference and the direction of pseudoforce is always opposite to the direction of acceleration of the frame.

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[1] Distance equal to zero implies displacement=0; and Displacement=0 also implies distance = 0

[2] When the net external torque acting on a body or a system of bodies is zero about a particular axis, then the angular momentum of each body is conserved about that axis.

[3] An example where law of conservation of angular momentum holds:
The Law of conservation of angular momentum holds in the case of a ballet dancer performing a pirouette.

When the dancer extends her arms outward, the angular velocity of her rotation decreases whereas when she keeps her arms close to her body, the angular velocity increases. This is because her moment of inertia changes as she moves her arms outward and inward. It can be noted that she as a system has no external torque acting upon her.

[4] For the motion of earth around sun, the angular momentum of the sun about the center of mass of the sun + earth system and perpendicular to the orbital plane of earth is conserved.

For the motion of earth around sun, the angular momentum of the sun about and axis passing through the Earth and perpendicular to the orbital plane of motion of earth is conserved.

[5] The z component of angular momentum of a conical pendulum is not conserved w.r.t. the origin fixed at the point of suspension; but the x and y components are conserved.

SetId=469

[6] A nonzero torque always implies change in angular momentum and may not give rise to a change in magnitude of angular velocity. A non zero torque may mean change only the direction of the angular momentum and not the angular velocity.

[7] There are certain situations where it appears that the law of conservation of linear momentum does not hold. For example if we take some amount of a substance like construction putty, cement, cake batter, playing dough,etc and drop it on the ground, it does not bounce back like a rubber ball would and hence the momentum it had before striking the ground seems to have been lost. Hence it appears that the law of conservation of linear momentum does not hold.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then check if the laws is applicable or not.

So if there is no *net external force* acting on the system all the three conservation laws will hold.

[9] Explain Nonconservative force: This force is just opposite to that of conservative force. The work done by this force depends on the path taken by the particle on which the force is applied.This force does not conserve mechanical energy.If a particle travels in a closed loop, the net work done by a non consevative force is non zero.

SetId=469

[10] For a particle moving on circle the acceleration is always constant in magnitude and directed towards the centre of the circle.

[11] If P and Q are the initial and the final points of a path of a particle,the displacement is the vector $\overrightarrow{PQ}$.

[12] Assume bullet train, moving with out any jerks, is going on a circular arc of radius R with constant speed. Then an experiment is to be performed entirely within the train without any measurement on objects outside the train. Such an experiment can tell only radius of the track.

[13] A ball hits the floor and rebounds after an inelastic collision. In this case the total momentum of the ball before and after the collsion is conserved. Also the total enrgy of the ball and the earth remains the same

[14] A heavy body is attached from a spring and is held at point A and is such that the spring is not slack nor is it stretched. It is then released. It goes down upto a point B and then it rises upto point C and executes an oscillatory motion between B and C. During the motion from A to C is first positive (from A to B) and then it is negative from B to A and again remains negative from A to C.

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[15] A force is any interaction which tends to change the motion of an object. It is also *defined* as rate of change of momentum.It is a vector quantity.
A physically apparent but nonexistent force felt by an observer in a noninertial frame (that is, a frame undergoing acceleration).

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[1] If P and Q are the initial and the final points of a path of a particle, displacement is a vector whose direction is along PQ and has magnitude is equal to the length of line PQ

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[2] The law of conservation of angular momentum states that in absence of an external torque on an object or a closed system of objects the total angular momentum of the system remains constant. Thus if $\vec{\tau} = 0 => \vec{L} =$ constant where τ is the torque and $\vec{L}$ is the angular momentum of the system.

[3] In case of a skater, who can be considered an isolated system, so no torue will be acting on him/her. When the arms are extended, the moment of inertia is more. When his hands are closely held, the moment of inertia is lesser. Since the angular momentum is same, the angular acceleration changes accordingly.

[4] For the motion of earth around sun, the sum of angular momenta of the Sun and the Earth about the center of mass of the sun + earth system is conserved.

[5] Only the z component of angular momentum of a conical pendulum is conserved w.r.t. the origin fixed at the point of suspension. SetId=470

[6] In the example of a rotating skew rod the torque due to the external gravitational forces is zero , but the angular momentum is not constant Therefore the law of conservation of angular momentum is violated.

[7] A tennis ball is dropped from height h and after hitting the ground and it bounces back and rises to the same height. In this case the momentum of the ball is conserved because (under ideal conditions) the momentum after it hits the ground will be equal to the momentum it had before hitting the ground.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then check we should if the laws are applicable or not.

So if there is no *external force* acting on the system all the three quantities, total momentum is conserved. The total angular momentum is also because the torque of internal forces will be zero. The conservation of energy depends on the nature of forces. will be conserved.

[9] Non conservative force is the force in which the work done by a particle in going from one point to another is path dependent.

For non conservative forces mechanical energy is not conserved,mostly lost in the form of heat and light.The work done by a non conservative force is equal to the change in mechanical energy.

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For non conservative force $E_{\text{initial}} > E_{\text{final}}$

[10] The motion of a bomb dropped from a plane does is not a uniform motion as it follows a parabolic path and not a straight line path.

[11] If two bodies starting from a point A reach a point B, following different paths, their displacement will be, in general different, but the distances covered will always be the same.

[12] Assume bullet train, moving with out any jerks, is going on a circular arc of radius R with constant speed. Then an experiment is to be performed entirely within the train without any measurement on objects outside the train. Such an experiment can tell both speed of the train and radius of the track.

[13] In a head on elastic collision of two identical bodies of equal masses the velocities, the speeds, the momenta and the kinetic energy are all exchanged.

[14] The kinetic energy of a body does not change if any one of the following is true
(i)force is always perpendicular to the velocity
(ii) the force is always perpendicular to the acceleration
(iii) the object remains stationary
(iv) the object moves in such a way that the point of application of the force remains fixed. SetId=470

[15] Psuedo Force is defined as an apparent force that acts in only non-inertial frames. Pseudo Forces are also called Fictitious Forces. It is an Imaginary force. It is independent of mass.

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[1] If P and Q are the initial and the final points of a path of a particle,the displacement is the vector $\overrightarrow{PQ}$.

[2] If no net external torque acts on a system, the total angular momentum of the system remains constant.

[3] Example where law of conservation of angular momentum holds:
Let us assume a student seated on a stool that can rotate freely about a vertical axis. The student has been set into rotation at a modest initial angular speed ω . He holds two dumbbells in his outstretched hands. His angular momentum vector L lies along the vertical rotation axis, pointing upwards. Now he pulls in his arms;this action reduces his rotational inertia from its value I_{initial} to a final value I_{final} because he moves the mass closer to the rotational axis. His rate of rotation increases markedly, from ω_{initial} to ω_{final}. The student can then slow down by extending his arms once more,moving the dumbbells outward. No external torque acts on the system consisting of the student, stool and the dumbbells. Thus the angular momentum of the system about the rotational axis remains constant. $I_{\text{initial}} * \omega_{\text{initial}} = I_{\text{final}} * \omega_{\text{final}}$.

[4] For the motion of the Earth around the sun, the total of angular momenta of the Earth and the Sun, about in a reference frame fixed in the pole star, is conserved.

[5] The projection of angular momentum of a conical pendulum in the horizontal plane is a constant of motion when the origin is chosen to be at fixed at the point of suspension. SetId=471

[6] In the example of skew rod, the angular momentum changes with time and there is a non zero torque coming from action of forces other than gravitational forces. Hence the law of conservation of angular momentum dos not apply.

[7] Law of conservation of momentum does not hold when Newton's laws are not valid, e.g. in a non-inertial frame of reference. For example, when we consider collision between two bodies in a non-inertial frame of reference, the law of conservation of momentum cannot be applied because there will be a pseudo force acting on the frame itself.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *net external force* acting on the system, the momentum is conserved. The definition of angular momentum and torque depends on the choice of axes, and therefore it may not be be conserved. The conservation of total energy holds only for conservative forces.

When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *net external force* acting on the system, the energy and momentum will be conserved. However, the total angular momentum may not be conserved because the torque may not be zero.

[9] A force is said to be non-conservative, if the work done by the force is dependent on the path taken. It could also be defined as a force for which the work done during a cyclic process is non-zero. SetId=471

[10] A wagon sliding on a roller coaster designed in such a way that the wagon covers equal distances in equal times. As the motion of the wagon is uniform, there will be no net force acting on it.

[11] Distance is equal to the length of the path covered. Displacement is the shortest distance between initial and final points.

[12] Assume bullet train, moving with out any jerks, is going on a circular arc of radius R with constant speed. Then an experiment is to be performed entirely within the train without any measurement on objects outside the train. Such an experiment can tell only speed of the track.

[13] For a system of several particles the conservation of total linear momentum is equivalent to the statement that their centre of mass moves like a free particle.

[14] The total work done on a particle is always equal to the change in kinetic energy. SetId=471

[15] Psuedo Force is defined as an apparent force that acts in only non-inertial frames. Pseudo Forces are also called Fictious Forces. It is an Imaginary force. It is always proportional to mass. It is sometimes dependent on speed.

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[1] If two bodies starting from a point A reach a point B, following different paths, their displacement will be, in general different, but the distances covered will always be the same.

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[2] The law of conservation of angular momentum states that when no external torque is applied on an object or a closed system of objects about an axis, the angular momentum about that axis remains constant.

[3] A bob is attached to ceiling by a string and moves in a horizontal circular plane is an example. In this case the law of conservation of angular momentum does not hold.

[4] For the motion of the Earth around the sun, the total of angular momenta of the Earth and the Sun, is conserved in every inertial frame of reference; but the angular momentum of the Earth (or of the sun)is not conserved in every inertial frame.

[5] The law of angular momentum of a is not applicable for the conical pendulum conserved w.r.t. the origin fixed at the point of suspension.

SetId=472

[6] In the example of conical pendulum, the z- component of angular momentum does not change. This follows from the angular momentum conservation as there is no external torque.

[7] If I throw a ball upward, it's speed decreases as it rises upwards. There is an external force (gravity) acting on the ball, so the momentum conservation law does not apply. Momentum of the ball is not conserved, however the momentum of the Earth-ball system is conserved as gravity will become an internal force in this case.

[8] In order to apply the law of conservation of momentum we must first identify the system. If there is no *net external forces* acting on the system then conservation laws of momentum always holds. The total energy and the total angular momentum may not be conserved.

[9] a force is said to be non conservative if work done is dependent on the path of the particle.potential cannot be defined in the case of non conservative forces.work done in closed loop is not equal to zero.

SetId=472

[10] A simple pendulum moves along a circular arc and does not have constant speed and therefore its motion is not uniform.

[11] Distance is a scalar quantity where as the displacement is a vector quantity.

[12] A particle is observed from two frames S_1 and S_2. The frame S_2 moves with respect to S_1 with an acceleration a. If F_1 and F_2 be the pseudoforces when seen from S_1 and S_2 respectively it is not possible to have $F_1 = F_2 = 0$

[13] The total mechanical energy of a system may not be conserved if there are no external forces and the internal forces are conservative.

[14] A particle is acted upon by a force of constant magnitude which is always perpendicular to the velocity of the particle and the motion of the particle takes place in a plane, Then its kinetic energy, speed, velocity acceleration will not change. SetId=472

[15] Since pseudo forces are not real forces, they do not affect the conservation laws and all the three conservation laws hold in noninertial frames.

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[1] Displacement is equal to the vector difference $\vec{r}_f - \vec{r}_i$ of the position vectors of initial and final points. The distance covered will be $|\vec{r}_f - \vec{r}_i|$

[2] The angular momentum of a given system of bodies shall remain conserved unless acted upon by an external unbalanced torque.

[3] Consider a disc rotating about an axis perpendicular to its plane. On placing a smaller disc with its surface parallel to the surface of the rotating disc, the angular momentum of the system of two discs remains constant as there is no external torque.

[4] In the Sun Earth system the angular momentum of the Earth is conserved in every frame of reference

[5] The law of angular momentum of a is not applicable for the conical pendulum conserved when the origin is chosen to be at the pendulum bob itself. SetId=473

[6] In the example of conical pendulum, the x and$y$ components of angular momentum change. This follows from the angular momentum conservation as the z components external torque is zero and horizontal components of torque are non zero.

[7] A soldier accelerating away, after detonating a bomb, will find that the total momentum of the fragments of the bomb is zero. This is an example where the law of conservation of momentum holds as the forces on the fragments are internal forces only and sum of all such forces is zero.

[8] In order to apply the law of conservation of momentum we must first identify the system. Then even if there is no *net external forces* acting on the system, all the three conservation laws of momentum, angular momentum and energy may not hold due to presence of internal forces.

[9] Explain Nonconservative Forces:

The forces that depend on the path taken by the particle are called non-conservative forces.

Mechanical energy is not conserved during the action of a non conservative force, instead, it is lost as other forms of enery like heat, light, etc.

Potential energy is not defined for a non-conservative force.

The initial and final kinetic energy in a closed loop is not equal.

The work done by a non conservative force in a closed loop is non zero. In practice, the net work is invariably negative.

Work done by a non conservative force cannot be completely recovered.

For a non conservative force,

$/text(KE)//_f//+$(PE)$//_f//=$ (KE)$_i$+(PE)$_i$//+//Work Done)//non-conservative force//

SetId=473

[10] A satellite goes around the earth in a circular orbit of 600km with a time period of $5.8 \times 10^3 s$. Its motion will be uniform as it will cover equal distances in equal times.

[11] Both displacement and distance tell us about the motion of a body but their study does not tell much about the forces on the body

[12] A particle is observed from two frames S_1 and S_2. The frame S_2 moves with respect to S_1 with an acceleration a. If F_1 and F_2 be the pseudoforces when seen from S_1 and S_2 respectively and if $F_1 = 0$ then we must have $F_2 \neq 0$

[13] When a bullet fired on a wooden block, some energy is transferred to the block and the total mechanical energy of the block and the bullet is conserved.

[14] The kinetic energy of a particle is continuously increasing with time, then the angle bewteen the net force and the velocity cannot be greater than or equal to 90^o at any time. SetId=473

[15] A force is any interaction which tends to change the motion of an object. Newtons' second tell us that it is *equal* to the rate of change of momentum.It is a vector quantity. Real forces can be distinguished from pseudo forces because the pseudo forces always proportional to the mass of the body. All real forces, except the gravitational force, do not depend on the mass of the body.

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[1] Distance is equal to the length of the path covered. Displacement is the shortest distance between initial and final points.

[2] When the net external torque acting on a system about a given axis is zero, the total angular momentum of the system about that axis remains consant.

[3] Consider a man standing on a spinning platform. Initially, the man spreads out his arms and he spins with a certain angular velocity. The next moment, he pulls his arms inwards keeping them close to his body. We will observe that the angular velocity with which he is spinning now increases. This phenomenon can be explained by the Law Of Conservation of Angular momentum. Initially, since his arms were spread wide, his moment of inertia was large. However, when he pulled them close to his body, his moment of inertia decreased.
In this example the angular velocity of the man increases and therefore the angular momentum also increases.The law of conservation of angular momentum does not apply because the torque of muscular forces is not zero.

[4] In the motion of earth around sun, the angular momentum of the earth about an axis passing through the sun and perpendicular to the plane of motion of earth is conserved.

[5] The three components of angular momentum of a conical pendulum is conserved w.r.t. the origin at the position of the center of mass of the pendulum.

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[6] Example where law of conservation of angular momentum does not hold: A disc rotating on a horizontal rough surface will not have a constant angular momentum because there will be a constant torque by frictional force. Hence, its angular momentum will decrease, and the law of conservation of angular momentum does not apply.

[7] There is no known exception to the law of conservation of momentum in classical mechanics However, an exception to conservation of energy in nuclear physics is observed. In nuclear reactions when two nuclei collide and their mass converts to energy and energy momentum are not conserved.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then check we should if the laws are applicable or not.

So if there is no *external force* acting on the system all the three quantities, total momentum, total angular momentum, and total kinetic energy will be conserved independent of the nature of forces.

[9] A non conservative force is one where the mechanical energy is not conserved.Here the work done is dependent on the path taken .Different amounts of work need to be done in different paths.Here potential energy would have no meaning as it would keep changing with the path.Here some amount of mechanical energy is lost as sound energy or heat energy and hence is not conserved.

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[10] A uniform motion is defined to be the one in which a body covers equal distances in equal time intervals.

[11] Displacement is the shortest distance between initial and final points with direction specified.

[12] If K is an inertial frame, any frame that moves w.r.t. the frame K with uniform velocity is also an inertial frame.

[13] When a moving car hits a parked lorry and causes the parked lorry to move ,energy is transferred from moving the car to the lorry and the total energy of the lorry and the car is conserved.

[14] A heavy body is attached from a spring and is held at point A and is such that the spring is not slack nor is it stretched. It is then released. It goes down upto a point B and then it rises upto point C and executes an oscillatory motion between B and C. During the motion from A to C is first positive (from A to B) and then it is negative from B to A and again remains negative from A to C.

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[15] Examples of pseudoforce are Coriolis Force, Centrifugal Force, and magnetic force on currents.
Psuedo force also called as fictitious force is an apparent force that are needed for masses whose their motion is described using a non inertial frame of reference.

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[1] Distance is a scalar quantity where as the displacement is a vector quantity.

[2] This law sates that when no net torque of all forces acts on a object or a system of objects then total angular momentum of system is conserved.The angular momentum before an event is equal to angular momentum after that event.mathematically explained by when, net torque=0 ;then, total angular momentum(L)=constant.

[3] In the Sun-Earth system, angular momentum of the earth is not conserved but the total angular momentum of the sun and the earth is constant of motion.

[4] For the motion of earth around sun, the angular momentum of the earth about the center of mass of the sun + earth system and perpendicular to the plane of motion of earth is conserved.

[5] Only the z component of the angular momentum of a conical pendulum is conserved w.r.t. the origin fixed at the point of suspension. SetId=475

[6] Example where law of conservation of angular momentum does not hold:Consider a vertical stick on the ground falling to a horizontal position. During the fall, the conservation of angular momentum applied at the point of rotation on the ground and perpendicular to the plane of the stick is not applicable as, the gravitational force which acts vertically downwards assumed at the centre of mass produces an external torque about the axis of rotation

[7] In a system of a canon and a canon ball, total momentum of the system is zero before canon ball is fired. After firing the canon ball, the momentum of the system seems to be conserved as the ball moves forward and the canon moves backward.

[8] If we want to apply the conservation laws of momentum, energy and angular momentum, we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *external force* acting on the system, the momentum and angular momentum will be conserved, and depending on the nature of the forces but total energy may or may not be conserved.

[9] The force whose work depends on path taken is called a non conservative force.friction for example does less work on a book dragged across a table if the book is dragged
SetId=475 straight across than if the book is dragged in a curved path.

[10] A particle moves on a circular path. Then its speed, direction of force, velocity and acceleration must always change with time.

[11] Displacements, being vector quantity can not compared with, a scalar quantity such as distance.

[12] If K is an inertial frame, any frame that moves w.r.t. the frame K with uniform speed is also an inertial frame.

[13] When a bomb explodes the total mechanical energy is not conserved. But the total chemical energy and the mechanical energy is conserved.

[14] The kinetic energy of a body does not change if any one of the following is true
(i)force is always perpendicular to the velocity
(ii) the force is always perpendicular to the acceleration
(iii) the object remains stationary
(iv) the object moves in such a way that the point of application of the force remains fixed. SetId=475

[15] Examples of pseudo-force are Coriolis Force, Centrifugal Force, Centripetal force and magnetic force on currents. The pseudo forces do not obey Newton's third law and therefore the total momentum does not appear to be conserved in a non-inertial frame.

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[1] The speed is rate of change of distance and the velocity is the rate of change of displacement.

[2] Statement of Law of Conservation of Angular Momentum:
Differentiating $\vec{L} = \vec{r} \times \vec{p}$ w.r.t, time,

$$\begin{aligned} \frac{dL}{dt} &= \frac{d\vec{r} \times \vec{p}}{dt} = \frac{d\vec{r}}{dt} \times \vec{p} + \vec{r} \times \frac{d\vec{p}}{dt} = \vec{v} \times (m\vec{v}) + \vec{r} \times \vec{F} \\ &= \vec{r} \times \vec{F}(\because v \times v = 0) \\ &= \vec{\tau} \end{aligned}$$

here $\vec{\tau}$ represents the net torque acting on a rigid body rotating about a fixed axis.This torque must take into account of all the forces, be it external or internal forces

[3] Consider a disc and a man system. man is standing on center of the disc rotating with angular velocity.initially man folded his hand.when man stretches his hands then momentum of inertia of system increases.and angular velocity decreases.and total angular momentum remains constant.

[4] In the Sun Earth system the angular momentum of the Earth about the pole star is conserved

[5] The z component of angular momentum of a conical pendulum is not conserved w.r.t. the origin fixed at the point of suspension; but the x and y components are conserved. SetId=476

[6] We have a conical pendulum .The forces acting on the bob are tension (along the direction of the string) and gravitational force acting in the vertically downward direction.we have an additional force called the drag force which is tangential to the motion of the bob and acts in the direction opposite to the motion of the bob.The axis of rotation passes through the hinge point and is vertical.The torque due to tension is 0 because the force passes through the axis of rotation.The torque due to mg is also zero since it is parallel to the axis of rotation.but the torque due to drag force is not zero.since the net external torque acting on the bob is not zero,therefore the law of conservation of angular momentum does not hold here

[7] When applying the conservation laws of momentum, energy and angular momentum we must define the system first.Only then check if the laws is applicable or not.

As an example: when a ball is dropped from a height, it gains momentum down if we consider the ball as our system.This is because the force of gravity acts as an external force.

However, if we change our system and consider earth as a part of our system too, then the momentum remains conserved because the earth gains momentum up.

[8] To apply the conservation laws of momentum, energy and angular momentum, we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *external force* acting on the system, the energy and momentum will be conserved. However, depending on the nature of the system and of the forces, the total angular momentum may not be conserved.

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[9] ** Nonconservative force is a force in which the amount of work done by the force is dependent of the path taken to change a state of a system.

[10] A particle moves on a circular path. Then its speed, direction offorce, can remain constant by velocity and acceleration must always change with time.

[11] Distance depends on the path where as the displacement depends on the end point only

[12] A frame rotating w.r.t K with uniform angular velocity is also an inertial frame.

[13] When a ball rolls over a rough surface, it comes to stop after some time. This is because transational and rotational kinetic energy initially present in the ball continuosly gets converted to heat due to friction. When all the kinetic energy changes to heat, the ball stops. The total mechanical energy of the ball is not conserved.

[14] The total work done on a particle is always equal to the change in kinetic energy. SetId=476

[15] FORCE is any interaction which tends to change the motion of an object.It has both magnitude and direction,making it a vector quantity.

A psuedo force is an apparent force that acts on all masses whose motion is described with respect to a non-inertial frame of reference like a rotating frame of reference.This force is needed by an observer in an non-inertial frame to make all the Newtons Laws of motion hold true.

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[1] For any type of translational motion of a body, the displacement cannot be zero, where as the distance travelled can be zero.

[2] Statement of Law of Conservation of Angular Momentum: For a system of many particles The net torque due all the forces, be it external or internal forces. But as the torque due to all the internal forces cancel out, it sufficient to consider the external forces acting on the system.

[3] The conservation of angular momentum of a system of bodies requires that the the sum of torque due to all forces be equal to zero. Now consider a situation where the forces are such that the sum of torques of external forces is zero w.r.t. some axes K. Since the value of torque depends of the choices of axes, the sum of torques due to all internal forces will depend on the choice of axes and in general it will be non zero. Therefore, for a system of several bodies, for a given choice of axes K, there will be situations when the total angular momentum may not be conserved.

[4] For the motion of earth around sun, the angular momentum of the sun about the center of mass of the sun + earth system and perpendicular to the orbital plane of earth is conserved.

For the motion of earth around sun, the angular momentum of the sun about and axis passing through the Earth and perpendicular to the orbital plane of motion of earth is conserved.

[5] Only the z component of angular momentum of a conical pendulum is conserved w.r.t. the origin fixed at the point of suspension. SetId=477

[6] When you release a toy gyroscope on its pedestal, it initially has no precessional rotation around that pedestal, i.e, the orientation of rotation is fixed. However, it instantaneously starts precessing around the pedestal. Both Kinetic Energy and Angular Momentum now exist where they did not exist a moment earlier. The Kinetic Energy is easy to explain, as appearing due to the body of the gyroscope dropping a tiny fraction of a millimeter in the Earth's gravitational field, giving up exactly the correct amount of Potential Energy. But the Angular Momentum of the Precession which just appeared, does not come from anywhere. This is therefore a Violation of the Conservation of Angular Momentum.

[7] Statement: Law of Conservation of energy states that "ENERGY CAN NEITHER BE CREATED NOR DESTROYED",but it can be changed from one form to other.

EXPLANATION: Statement implies that the total amount of energy in an isolated system remains constant although it may change forms. viz, kinetic energy may change to potential;chemical to electrical energies etc.

[8] In order to apply the law of conservation of momentum we must first identify the system. If there is no *external forces* acting on the system then conservation laws of momentum always holds. And depending on the nature of the system and of the forces, the total kinetic energy and the total angular momentum may not be conserved.

[9] Nonconservative force is any force where the work done by the force on the object depends on the path of motion of the object.the work done by the frictional force results in to loss of the energy of the system in the form of heat or other form of energy.

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[10] A particle moves on a circular path. Then under suitable conditions its speed may remain constant, but the force, velocity and acceleration must always change with time.

[11] Distance equal to zero $\Rightarrow$ displacement=0; but Displacement=0

[12] The Newton's Laws of motion will hold in all frames which are at rest w.r.t. K but do not remain valid in a frame that move with respect to K.

[13] Let us consider that a pendulum is oscillating moving in a vertical plane. Mean while let another bob which is attached to a spring and is executing a simple harmonic motion in horizontal direction comes and hits the pendulum. Here conservation of momentum does not hold good as tension(external force) is acting on the system.(pendulum)

[14] A particle is acted upon by a force of constant magnitude which is always perpendicular to the velocity of the particle and the motion of the particle takes place in a plane, Then its kinetic energy, speed, velocity acceleration will not change.

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[15] FORCE is any interaction which tends to change the motion of an object.It has both magnitude and direction,making it a vector quantity. A pseudo-force F doesn't arise from any physical interaction between two objects, but rather from the acceleration 'a' of the non-inertial reference frame itself. These forces have no real existence but must be taken into account in an accelerating frame of reference to make all the three Newton's Laws of motion applicable to the system

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[1] Displacements, being vector quantity can not compared with, a scalar quantity such as distance.

[2] Depending on the torques acting on a system, the angular momentum can be conserved only in one or two directions, but may not be conserved in all. For instance, if an isolated body has no torque acting on it only in the direction along the Z axis, then the angular momentum is conserved only in that direction.

[3] Example where law of conservation of angular momentum does not hold:
When there is external force like frictional force acting on a object when it is rotating we cannot use conservation of angular momentum as the friction force acting on the object produces an external torque.

[4] For the motion of earth around sun, the sum of angular momenta of the Sun and the Earth about the center of mass of the sun + earth system is conserved.

[5] The projection of angular momentum of a conical pendulum in the horizontal plane is a constant of motion when the origin is chosen to be at fixed at the point of suspension.

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[6] There is no case where LAW OF CONSERVATION OF ANGULAR MOMENTUM does'nt hold.But there are cases where conservation of angular momentum does not hold.A body in vertical circular motion is an example where angular momentum is not conserved. Here the law of conservation does not apply.

[7] Oscillating simple pendulum is a very good example where potential energy gets converted to kinetic energy and kinetic to potential energy. Some energy gets dissipated as heat if we consider air resistance. Energy as a whole is conserved if we consider universe as system, the energy has just changed its form.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then check if the laws is applicable or not.

So if there is no *net external force* acting on the system all the three conservation laws will hold.

[9] nonconservative force is any force ,where the work done by the force depends on the path of motion of the body.The work done by such a force is equal to the change in mechanical energy of the system.Energy mostly observed to be lost in form of heat, by the action of non conservative force.

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[10] A particle moves on a circular path. Then under suitable conditions its speed and acceleration may remain constant, but the force, and velocity must always change with time.

[11] If P and Q are the initial and the final points of a path of a particle, displacement is a vector whose direction is along PQ and has magnitude is equal to the length of line PQ

[12] Staying inside a bullet train moving with constant velocity (no jerks etc) an experiment can always be performed which will tell us the numerical velocity of the bullet train

[13] The law of conservation of momentum does not hold in relativistic situations, i.e., where the speeds of the masses involved are close to the speed of light.

[14] The kinetic energy of a particle is continuously increasing with time, then the angle bewteen the net force and the velocity cannot be greater than or equal to 90^o at any time. SetId=478

[15] FORCE is any interaction which tends to change the motion of an object.It has both magnitude and direction,making it a vector quantity.
A pseudo-force results from acceleration of the frame of reference in which the objects reside. It is taken into account so that Newton's second law isn't invalidated. The pseudo force acting on an object can always be mathematically expressed as the product of the mass of the object and the acceleration of the frame of reference.

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[1] Distance depends on the path where as the displacement depends on the end point only.

[2] According to Law of Conservation of Angular momentum,if no external torque acts on an object or system of objects,angular momentum of an object or system of objects remains CONSTANT or no change in angular momentum can occur.

Also it states that,only external torque can change angular momentm of the system where as the torque produced by internal forces can not change the angular momentum of the system

[3] A bob attached to a ceiling by a string moving in a horizontal circular plane is an example where the total angular momentum of the bob about the point of suspension is not conserved. This is because the the torque due to the weight of the bob about the point of suspension does not vanish and has non zero horizontal component. Only the vertical component of the angular component is conserved.

[4] For the motion of the Earth around the sun, the total of angular momenta of the Earth and the Sun, about in a reference frame fixed in the pole star, is conserved.

[5] The law of angular momentum of a is not applicable for the conical pendulum conserved w.r.t. the origin fixed at the point of suspension. SetId=479

[6] A sphere rolling on a rough surface.Due to friction there is external torque so the angular momentum changes which results in the slowing of the sphere. The angular momentum keeps changing. Even in case like this one, it is wrong to say that the Law of Angular Momentum Conservation does not hold.

[7] Law of conservation of momentum does not hold whenever an external force or impulse acts on the system. For example,when a body collides with earth then it bounces back to a lesser height as it loses some velocity.

In this example the momentum of a ball is not conserved due to impulsive force by ground in the normal direction.

However, strictly speaking the system that should be considered here is the ball-earth system and the total momentum is conserved.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then check we should if the laws are applicable or not.

So if there is no *external force* acting on the system all the three quantities, total momentum is conserved. The total angular momentum is also because the torque of internal forces will be zero. The conservation of energy depends on the nature of forces. will be conserved.

[9] The work done by a "non-conservative" force does depend on the path taken. Non-conservative forces cannot be associated with a potential energy. If some of the internal forces of a system are non-conservative, the mechanical energy of the system is not constant.Work-energy theorem is valid even in the presence of some non-conservative forces.

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[10] When the force is kept constant as function of time, it is possible for a particle to move on a circular path in such a way that its speed remains constant, but the velocity and acceleration must always change with time.

[11] If P and Q are the initial and the final points of a path of a particle,the displacement is the vector $\overrightarrow{PQ}$.

[12] Staying inside a bullet train moving with constant velocity (no jerks etc) an experiment can always be performed which will tell us the numerical value of the acceleration of the bullet train

[13] when we are in accelerating frame if we observe any collision between two bodies then the law of conservation of momentum does not hold in that frame of reference.

[14] A heavy body is attached from a spring and is held at point A and is such that the spring is not slack nor is it stretched. It is then released. It goes down upto a point B and then it rises upto point C and executes an oscillatory motion between B and C. During the motion from A to C is first positive (from A to B) and then it is negative from B to A and again remains negative from A to C.

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[15] Explain Force:FORCE is any interaction which tends to change the motion of an object.It has both magnitude and direction,making it a vector quantity.
In the case of a non inertial frame, we can use the second law of motion by adding a pseudo force to the system which makes it an inertial frame of reference.

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SetId=480

[1] Distance equal to zero implies displacement=0; and Displacement=0 also implies distance = 0

[2] The law of conservation of angular momentum states that when the net external torque acting on the system is zero, then the angular momentum of the system remains constant.both the initial and final momentum should be taken from a fixed inertial frame of reference provided.

[3] Law of conservation of angular momentum holds in case of long jump. When a athlete takes off from the ground in a running long jump, the forces on the launching foot give the athlete an angular momentum with a forward rotation around a horizontal axis. Such rotation would not allow the jumper to land properly. In the landing, the legs should be together and extended forward at an angle so that the heels mark the sand at the greatest distance. Once airborne, the angular momentum cannot change (it is conserved) because no external torque acts to change it. However, the jumper can shift most of the angular momentum to the arms by rotating them in windmill fashion. Then the body remains upright in the proper orientation of landing.

[4] For the motion of the Earth around the sun, the total of angular momenta of the Earth and the Sun, is conserved in every inertial frame of reference; but the angular momentum of the Earth (or of the sun)is not conserved in every inertial frame.

[5] The law of angular momentum of a is not applicable for the conical pendulum conserved when the origin is chosen to be at the pendulum bob itself. SetId=480

[6] Consider a rod of length l. Let us give an impulse to one end . Now the angular momentum about the oposite end is not zero since the impulse provides some torque . So the angular momentum is not conserved .

$$\text{torque} = \text{impulse} * \ell.$$

$d\ell/dt$ is not equal to zero and the law of conservation of angular momentum does not hold.

[7] If a bullet hits a wooden board and gets embedded in the board, the total energy and the total momentum of the bullet and the board are conserved.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *net external force* acting on the system, the momentum is conserved. The definition of angular momentum and torque depends on the choice of axes, and

therefore it may not be be conserved. The conservation of total energy holds only for conservative forces.

When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *net external force* acting on the system, the energy and momentum will be conserved. However, the total angular momentum may not be conserved because the torque may not be zero.

[9] Non conservative forces are forces with the property that the work done by the force in moving a particle between two points is dependent on the path taken.Also the work done over a closed loop is not zero.Defining of scalar potential is not possible in case of non conservative forces because the change in potential energy between two points will depend on path taken.

SetId=480

[10] It is not possible for a particle to move on a circular path in such a way that its speed and force remains constant, and only the velocity and acceleration may (or may not) always change with time.

[11] If two bodies starting from a point A reach a point B, following different paths, their displacement will be, in general different, but the distances covered will always be the same.

[12] Assume bullet train, moving with out any jerks, is going on a circular arc of radius R with constant speed. Then an experiment is to be performed entirely within the train without any measurement on objects outside the train. Such an experiment can tell only radius of the track.

[13] Give an example where law of conservation of momentum does not hold all cases when seen from non inertial frame of references for example when we see two cars collide from a moving bus there momentum is not conserved

[14] The kinetic energy of a body does not change if any one of the following is true
(i)force is always perpendicular to the velocity
(ii) the force is always perpendicular to the acceleration
(iii) the object remains stationary
(iv) the object moves in such a way that the point of application of the force remains fixed.

SetId=480

[15] For the Newton's Law of Motion to hold true,the physically apparent but nonexistent force needed by an observer in a non-inertial frame is called the pseudo force.
1) Caused by relative acceleration of the origin in a straight line
2) Centrifugal and Centripetal forces
3) Coriolis force
4) Euler force

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SetId=481

[1] If P and Q are the initial and the final points of a path of a particle, displacement is a vector whose direction is along PQ and has magnitude is equal to the length of line PQ

[2] The law of conservation of angular momentum states that The total angular momentum of a system is constant in both magnitude and direction if the resultant torque, of the external forces acting on the system, is zero.

[3] The total angular momentum of a body remains constant of motion when the net torque of the external forces acting on the body is zero.
In general, we have a system of particles such that the net torque of the external forces on the system, w.r.t. some axes K, is zero, the total angular momentum may not remain conserved, because the torque due to the internal forces may not be zero.

[4] In the Sun Earth system the angular momentum of the Earth is conserved in every frame of reference

[5] The three components of angular momentum of a conical pendulum is conserved w.r.t. the origin at the position of the center of mass of the pendulum. SetId=481

[6] Let us consider a rotating skew rod. In the absence of friction or any other drag force, the rod should continuously spin without stopping. Here the net torque about the axis of rotation is 0 and hence angular momentum is conserved. It therefore follows from law of conservation of angular momentum that a spinning skew rod will keep rotating with constant angular velocity if there is no external torque. So law of conservation of angular momentum does not hold.

[7] If a bullet hits a wooden board and gets embedded in the board, the total energy of the bullet and the board system is conserved but the total momentum is not conserved.

[8] In order to apply the law of conservation of momentum we must first identify the system. If there is no *net external forces* acting on the system then conservation laws of momentum always holds. The total energy and the total angular momentum may not be conserved.

[9] A non conservative force is the force with the property that the work done in moving a particle between two points is dependent of the path taken.If a particle travels in a closed path, the net work done(the some of the forces acting along the path multiplied by the distance travelled) by a non conservative force is non zero. When an object moves from one location to another, the force changes the potential energy of the object by an amount that depends on the path taken.Non conservative force depends only on the path followed by the object.

SetId=481

[10] For a particle moving on circle the acceleration is always constant in magnitude and directed towards the centre of the circle.

[11] Distance is equal to the length of the path covered. Displacement is the shortest distance between initial and final points.

[12] Assume bullet train, moving with out any jerks, is going on a circular arc of radius R with constant speed. Then an experiment is to be performed entirely within the train without any measurement on objects outside the train. Such an experiment can tell both speed of the train and radius of the track.

[13] When a tennis ball hits the ground at an oblique angle, the angle of reflection is equal to the angle of incidence. This is a simple consequence of conservation of horizontal component of momentum.

[14] The total work done on a particle is always equal to the change in kinetic energy. $\boxed{\text{SetId=481}}$

[15] A force is any interaction which tends to change the motion of an object. It is also *defined* as rate of change of momentum.It is a vector quantity.

Pseudo-force is a fictitious force it is taken by an observer from non inertial frame of reference. This force arises from acceleration of reference frame that is a reference frame which is accelerating or rotating.

The equation of motion is then written by balancing all forces. As an example a particle moving in a circle is seen to be at rest by balancing the centripetal and centrifugal forces.

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SetId=482

[1] If P and Q are the initial and the final points of a path of a particle,the displacement is the vector $\overrightarrow{PQ}$.

[2] If the net external torque acting on a system is zero,the angular momentum L(vector) of the system remains constant,no matter what changes take place within the system.L(vector)=a constant (net external torque acting on system is zero)

[3] An example where law of conservation of angular momentum holds:
The Law of conservation of angular momentum holds in the case of a ballet dancer performing a pirouette.

When the dancer extends her arms outward, the angular velocity of her rotation decreases whereas when she keeps her arms close to her body, the angular velocity increases. This is because her moment of inertia changes as she moves her arms outward and inward. It can be noted that she as a system has no external torque acting upon her.

[4] In the motion of earth around sun, the angular momentum of the earth about an axis passing through the sun and perpendicular to the plane of motion of earth is conserved.

[5] Only the z component of the angular momentum of a conical pendulum is conserved w.r.t. the origin fixed at the point of suspension. SetId=482

[6] In the example of skew rod the angular velocity does not change even though the torque applied is nonzero. However there is no contradiction as in this case the law of conservation of momentum is not applicable. conservation is violated.

[7] If a bullet hits a wooden board and gets embedded in the board, both total energy and the total momentum of the bullet and the board are not conserved.

[8] In order to apply the law of conservation of momentum we must first identify the system. Then even if there is no *net external forces* acting on the system, all the three conservation laws of momentum, angular momentum and energy may not hold due to presence of internal forces.

SetId=482

[9] In this type of force the work done depends on the path taken by the body.Mechanical energy is not conserved in the system if non conservative force acts on it.

[10] The motion of a bomb dropped from a plane does is not a uniform motion as it follows a parabolic path and not a straight line path.

[11] Distance is a scalar quantity where as the displacement is a vector quantity.

[12] Assume bullet train, moving with out any jerks, is going on a circular arc of radius R with constant speed. Then an experiment is to be performed entirely within the train without any measurement on objects outside the train. Such an experiment can tell only speed of the track.

[13] when a ball is dropped from a height, it gains momentum down if we consider the ball as our system.This is because the force of gravity acts as an external force.

However, if we change our system and consider earth as a part of our system too, then the momentum remains conserved because the earth gains momentum up.

[14] A particle is acted upon by a force of constant magnitude which is always perpendicular to the velocity of the particle and the motion of the particle takes place in a plane, Then its kinetic energy, speed, velocity acceleration will not change. SetId=482

[15] A psuedo force is an apparent force that acts on all masses whose motion is described with respect to a non-inertial frame of reference like a rotating frame of reference. This force is needed by an observer in an non-inertial frame to make all the Newtons second laws to write correct equation of motion..

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SetId=483

[1] If two bodies starting from a point A reach a point B, following different paths, their displacement will be, in general different, but the distances covered will always be the same.

[2] The Law of conservation of angular momentum states that when no external torque acts on an object or a closed system of objects undergoing motion about a given axis, the change in angular momentum is zero. Therefore, considering an event where only internal torque or no torque is involved, the total angular momentum of the system before the event is equal to the total angular momentum after the event

[3] In case of a skater, who can be considered an isolated system, so no torue will be acting on him/her. When the arms are extended, the moment of inertia is more. When his hands are closely held, the moment of inertia is lesser. Since the angular momentum is same, the angular acceleration changes accordingly.

[4] For the motion of earth around sun, the angular momentum of the earth about the center of mass of the sun + earth system and perpendicular to the plane of motion of earth is conserved.

[5] The z component of angular momentum of a conical pendulum is not conserved w.r.t. the origin fixed at the point of suspension; but the x and y components are conserved.

SetId=483

[6] Example where law of conservation of angular momentum does not hold:If a particle undergoes conical motion and the only force acting on particle is central force like tension of the string.Then total external torque about fixed point A is zero,yet angular momentum is not conserved,as angular momentum keeps on changing direction.

[7] There are certain situations where it appears that the law of conservation of linear momentum does not hold. For example if we take some amount of a substance like construction putty, cement, cake batter, playing dough,etc and drop it on the ground, it does not bounce back like a rubber ball would and hence the momentum it had before striking the ground seems to have been lost. Hence it appears that the law of conservation of linear momentum does not hold.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then check we should if the laws are applicable or not.

So if there is no *external force* acting on the system all the three quantities, total momentum, total angular momentum, and total kinetic energy will be conserved independent of the nature of forces.

[9] A force is said to be a non-conservative force if the work done by the force in a closed path is non-zero;(i.e) the cyclic integral of the work done is non-zero.

Work done by a non-conservative force is equal to change in total energy of the system.Work-Energy theorem is not applicable in the case of a non-conservative force.Work done by conservative force depends on the path.It differs with the paths taken by the partical even if the initial and final points are same.In case of non-conservative forces,the total mechanical energy is not constant as the energy is dissipated in various forms such as heat energy,sound energy,etc and cannot be recovered.

SetId=483

[10] A wagon sliding on a roller coaster designed in such a way that the wagon covers equal distances in equal times. As the motion of the wagon is uniform, there will be no net force acting on it.

[11] Both displacement and distance tell us about the motion of a body but their study does not tell much about the forces on the body

[12] A particle is observed from two frames S_1 and S_2. The frame S_2 moves with respect to S_1 with an acceleration a. If F_1 and F_2 be the pseudoforces when seen from S_1 and S_2 respectively it is not possible to have $F_1 = F_2 = 0$

[13] There is no known exception to the law of conservation of momentum in classical mechanics however when two bodies collide and their mass converts to energy, an exception in nuclear physics is observed. In real life this is observed in nuclear reactions at atomic level.

[14] The kinetic energy of a particle is continuously increasing with time, then the angle bewteen the net force and the velocity cannot be greater than or equal to 90^o at any time.

SetId=483

[15] One indication that pseudo forces are NON-NEWTONIAN is that they violate Newton's III law and violate the Newton's third law.

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[1] Displacement is equal to the vector difference $\vec{r}_f - \vec{r}_i$ of the position vectors of initial and final points. The distance covered will be $|\vec{r}_f - \vec{r}_i|$

[2] The law of conservation of angular momentum states that when no external torque acts on an object or a closed system of objects, no change of angular momentum can occur. Hence, the angular momentum before an event involving only internal torques or no torques is equal to the angular momentum after the event . Angular momentum can be calculated with the help of the formula $L = I\omega$ where L stands for Angular momentum, I stands for moment of inertia and ω stands for angular velocity

[3] Example where law of conservation of angular momentum holds:
Let us assume a student seated on a stool that can rotate freely about a vertical axis. The student has been set into rotation at a modest initial angular speed ω . He holds two dumbbells in his outstretched hands. His angular momentum vector L lies along the vertical rotation axis, pointing upwards. Now he pulls in his arms;this action reduces his rotational inertia from its value I_{initial} to a final value I_{final} because he moves the mass closer to the rotational axis. His rate of rotation increases markedly, from ω_{initial} to ω_{final}. The student can then slow down by extending his arms once more,moving the dumbbells outward. No external torque acts on the system consisting of the student, stool and the dumbbells. Thus the angular momentum of the system about the rotational axis remains constant. $I_{\text{initial}} * \omega_{\text{initial}} = I_{\text{final}} * \omega_{\text{final}}$.

[4] In the Sun Earth system the angular momentum of the Earth about the pole star is conserved

[5] Only the z component of angular momentum of a conical pendulum is conserved w.r.t. the origin fixed at the point of suspension. SetId=484

[6] A nonzero torque always causes the angular velocity to change, because a change in angular momentum means a change in angular velocity $L = I\omega$

[7] A tennis ball is dropped from height h and after hitting the ground and it bounces back and rises to the same height. In this case the momentum of the ball is conserved because (under ideal conditions) the momentum after it hits the ground will be equal to the momentum it had before hitting the ground.

[8] If we want to apply the conservation laws of momentum, energy and angular momentum, we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *external force* acting on the system, the momentum and angular momentum will be conserved, and depending on the nature of the forces but total energy may or may not be conserved.

[9] A non conservative force is a force where work done in moving a particle between two points depends on the path through which it is taken.Friction is an example of non conservative force.Mechanical energy is not conserved in case of a non conservative force

SetId=484

[10] A simple pendulum moves along a circular arc and does not have constant speed and therefore its motion is not uniform.

[11] Displacement is the shortest distance between initial and final points with direction specified.

[12] A particle is observed from two frames S_1 and S_2. The frame S_2 moves with respect to S_1 with an acceleration a. If F_1 and F_2 be the pseudoforces when seen from S_1 and S_2 respectively and if $F_1 = 0$ then we must have $F_2 \neq 0$

[13] When there is no external forces act on a system of many particles, and there are only internal forces acting on the particles. The third law gives that the internal forces are pairwise equal and opposite.Thus the sum of internal forces is zero and the momentum of each particle is conserved.

[14] A heavy body is attached from a spring and is held at point A and is such that the spring is not slack nor is it stretched. It is then released. It goes down upto a point B and then it rises upto point C and executes an oscillatory motion between B and C. During the motion from A to C is first positive (from A to B) and then it is negative from B to A and again remains negative from A to C. SetId=484

[15] The apparent force which seems to act on an object in an accelerating frame of reference if we wish to describe the object's motion is called a pseudo force.Its a non-existent force used only to describe the motion completely using Newton's second law even though the agent causing the force is undefined.

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SetId=485

[1] Distance is equal to the length of the path covered. Displacement is the shortest distance between initial and final points.

[2] Newton's Second Law of Motion is defined by the expression $F = \frac{dp}{dT}$, where F gives the force vector acting on the system and p gives its momentum vector; in linear motion. A similar expression can be written to describe angular motion, i.e. : $\tau = \frac{dL}{dt}$, where τ is the external torque vector acting on the system, and L is the angular momentum.

If the external torque on the system is zero, then we get the expression as: dL/dt=0. This points out to the fact that, when no external torque is acting on the system, then its angular momentum is constant, no matter what changes occur in the system. This is the Law of Conservation Of Angular Momentum.

[3] A bob is attached to ceiling by a string and moves in a horizontal circular plane is an example. In this case the law of conservation of angular momentum does not hold.

[4] For the motion of earth around sun, the angular momentum of the sun about the center of mass of the sun + earth system and perpendicular to the orbital plane of earth is conserved.

For the motion of earth around sun, the angular momentum of the sun about and axis passing through the Earth and perpendicular to the orbital plane of motion of earth is conserved.

[5] The projection of angular momentum of a conical pendulum in the horizontal plane is a constant of motion when the origin is chosen to be at fixed at the point of suspension. SetId=485

[6] A nonzero torque always implies change in angular momentum and may not give rise to a change in magnitude of angular velocity. A non zero torque may mean change only the direction of the angular momentum and not the angular velocity.

[7] Law of conservation of momentum does not hold when Newton's laws are not valid, e.g. in a non-inertial frame of reference. For example, when we consider collision between two bodies in a non-inertial frame of reference, the law of conservation of momentum cannot be applied because there will be a pseudo force acting on the frame itself.

[8] To apply the conservation laws of momentum, energy and angular momentum, we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *external force* acting on the system, the energy and momentum will be conserved. However, depending on the nature of the system and of the forces, the total angular momentum may not be conserved.

SetId=485

[9] A force:A force is said to be a *non-//**conservative force* if the*/ work done by it in a closed path is/*/ non-zero./For such forces,potential energy cannot be defined.

[10] A satellite goes around the earth in a circular orbit of 600km with a time period of $5.8 \times 10^3 s$. Its motion will be uniform as it will cover equal distances in equal times.

[11] Displacements, being vector quantity can not compared with, a scalar quantity such as distance.

[12] If K is an inertial frame, any frame that moves w.r.t. the frame K with uniform velocity is also an inertial frame.

[13] During collision of billiard balls momentum is conserved. During explosion of a bomb also momentum is conserved and the total momentum of the fragments of bomb will be zero. This is because all the forces are only internal forces.

[14] The kinetic energy of a body does not change if any one of the following is true
(i)force is always perpendicular to the velocity
(ii) the force is always perpendicular to the acceleration
(iii) the object remains stationary
(iv) the object moves in such a way that the point of application of the force remains fixed.

SetId=485

[15] The physically apparent, but nonexistent, force needed by an observer in a noninertial frame to make Newton's laws of motion hold true is called pseudoforce.

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SetId=486

[1] Distance is a scalar quantity where as the displacement is a vector quantity.

[2] If the net external torque acting on a system is zero, the angular momentum L of the system remains constant, no matter what changes take place within the system.

$$\sum(T_{\text{ext}}) = \frac{dL}{dt}$$

The law states that when there is no net external torque, $\frac{dL}{dt}$ is zero implying that the total angular momentum of system is constant.

i.e. $L = a$ constant (isolated system)

[3] Consider a disc rotating about an axis perpendicular to its plane. On placing a smaller disc with its surface parallel to the surface of the rotating disc, the angular momentum of the system of two discs remains constant as there is no external torque.

[4] For the motion of earth around sun, the sum of angular momenta of the Sun and the Earth about the center of mass of the sun + earth system is conserved.

[5] The law of angular momentum of a is not applicable for the conical pendulum conserved w.r.t. the origin fixed at the point of suspension. SetId=486

[6] In the example of a rotating skew rod the torque due to the external gravitational forces is zero , but the angular momentum is not constant Therefore the law of conservation of angular momentum is violated.

[7] If I throw a ball upward, it's speed decreases as it rises upwards. There is an external force (gravity) acting on the ball, so the momentum conservation law does not apply. Momentum of the ball is not conserved, however the momentum of the Earth-ball system is conserved as gravity will become an internal force in this case.

[8] In order to apply the law of conservation of momentum we must first identify the system. If there is no *external forces* acting on the system then conservation laws of momentum always holds. And depending on the nature of the system and of the forces, the total kinetic energy and the total angular momentum may not be conserved.

[9] A force that is not conservative is nonconservative force. The work done by a noconservative force cannot be represented by a potential energy function. That is work done by a nonconservative force is dependent on the path through which the system is moved. Some nonconservative forces cause the mechanical energy to be lost or dissipiated. Such forces are called dissipiative forces. There is no way to get back the lost mechanical energy. Nonconservative forces can also increase the mechanical energy. This is arrived from the concept of irreversible process.

SetId=486

[10] A uniform motion is defined to be the one in which a body covers equal distances in equal time intervals.

[11] Distance depends on the path where as the displacement depends on the end point only

[12] If K is an inertial frame, any frame that moves w.r.t. the frame K with uniform speed is also an inertial frame.

[13] Give an example where law of conservation of momentum holds: A mass exploding into several pieces in a conservative field like gravitational field(if air resistance is neglected), obeys law of conservation of momentum. If air resistance cannot be neglected then the law of conservation of momentum will not hold.

[14] The total work done on a particle is always equal to the change in kinetic energy. SetId=486

[15] Pseudo forces come into picture when Newton's laws of motion have to be applied to describe the motion of bodies in non-inertial frames. These forces have no real existence.

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SetId=487

[1] The speed is rate of change of distance and the velocity is the rate of change of displacement.

[2] When the net external torque acting on a body or a system of bodies is zero about a particular axis, then the angular momentum of each body is conserved about that axis.

[3] Consider a man standing on a spinning platform. Initially, the man spreads out his arms and he spins with a certain angular velocity. The next moment, he pulls his arms inwards keeping them close to his body. We will observe that the angular velocity with which he is spinning now increases. This phenomenon can be explained by the Law Of Conservation of Angular momentum. Initially, since his arms were spread wide, his moment of inertia was large. However, when he pulled them close to his body, his moment of inertia decreased.
In this example the angular velocity of the man increases and therefore the angular momentum also increases.The law of conservation of angular momentum does not apply because the torque of muscular forces is not zero.

[4] For the motion of the Earth around the sun, the total of angular momenta of the Earth and the Sun, about in a reference frame fixed in the pole star, is conserved.

[5] The law of angular momentum of a is not applicable for the conical pendulum conserved when the origin is chosen to be at the pendulum bob itself. SetId=487

[6] In the example of skew rod, the angular momentum changes with time and there is a non zero torque coming from action of forces other than gravitational forces. Hence the law of conservation of angular momentum dos not apply.

[7] A soldier accelerating away, after detonating a bomb, will find that the total momentum of the fragments of the bomb is zero. This is an example where the law of conservation of momentum holds as the forces on the fragments are internal forces only and sum of all such forces is zero.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then check if the laws is applicable or not.

So if there is no *net external force* acting on the system all the three conservation laws will hold.

[9] Nonconservative forces are forces, such that the work done by these forces are path dependent. Work done by these forces around a close path is not necessarily equal to zero. Hence if a particle is acted on by a non-conservative force and that particle returns to its original position, that particle will experience a net loss of energy. Energy will thus not be conserved for particle. Potential Energy can not be defined for these type of forces.

SetId=487

[10] A particle moves on a circular path. Then its speed, direction of force, velocity and acceleration must always change with time.

[11] Distance equal to zero $\Rightarrow$ displacement=0; but Displacement=0

[12] A frame rotating w.r.t K with uniform angular velocity is also an inertial frame.

[13] Also a good example of law of conservation momentum can be seen when a bullet from a rifle is fired.As the bullet is fired and gets out of the rifle, the rifle gives a backward jerk due to the phenomenon of conservation of momentum.

[14] A particle is acted upon by a force of constant magnitude which is always perpendicular to the velocity of the particle and the motion of the particle takes place in a plane, Then its kinetic energy, speed, velocity acceleration will not change. SetId=487

[15] In a non-inertial frame of reference the accelration of the body that we measure, is not the true acceleration, as the frame itself accelerates.Thus,force(F=ma) is also not the true force acting on the body.The extra force added to make it a true value is called pseudo force.Thus pseudo force does not really act on a body but just compensates the change produced by the non inertial frame, in true acceleration.

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[1] For any type of translational motion of a body, the displacement cannot be zero, where as the distance travelled can be zero.

[2] The law of conservation of angular momentum states that in absence of an external torque on an object or a closed system of objects the total angular momentum of the system remains constant. Thus if $\vec{\tau} = 0 => \vec{L} =$ constant where τ is the torque and $\vec{L}$ is the angular momentum of the system.

[3] In the Sun-Earth system, angular momentum of the earth is not conserved but the total angular momentum of the sun and the earth is constant of motion.

[4] For the motion of the Earth around the sun, the total of angular momenta of the Earth and the Sun, is conserved in every inertial frame of reference; but the angular momentum of the Earth (or of the sun)is not conserved in every inertial frame.

[5] The three components of angular momentum of a conical pendulum is conserved w.r.t. the origin at the position of the center of mass of the pendulum. SetId=488

[6] In the example of conical pendulum, the z- component of angular momentum does not change. This follows from the angular momentum conservation as there is no external torque.

[7] There is no known exception to the law of conservation of momentum in classical mechanics However, an exception to conservation of energy in nuclear physics is observed. In nuclear reactions when two nuclei collide and their mass converts to energy and energy momentum are not conserved.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then check we should if the laws are applicable or not.

So if there is no *external force* acting on the system all the three quantities, total momentum is conserved. The total angular momentum is also because the torque of internal forces will be zero. The conservation of energy depends on the nature of forces. will be conserved.

[9] Non Conservative force is a force with the property that workdone in moving an object from one point to another is dependent on the path taken .

Non Conservative Force can arise in classical physics due to neglected degrees of freedom or time dependent potentials.

SetId=488

Friction may be treated without resorting the use of non conservative forces by considering the motion of individual molecules.

[10] A particle moves on a circular path. Then its speed, direction offorce, can remain constant by velocity and acceleration must always change with time.

[11] If P and Q are the initial and the final points of a path of a particle, displacement is a vector whose direction is along PQ and has magnitude is equal to the length of line PQ

[12] The Newton's Laws of motion will hold in all frames which are at rest w.r.t. K but do not remain valid in a frame that move with respect to K.

[13] when a man walks on the ice slab where friction does not exist between the ice block and the floor but between the feet of the man and the slab the slab moves back as per the law of conservation of momentum

[14] The kinetic energy of a particle is continuously increasing with time, then the angle bewteen the net force and the velocity cannot be greater than or equal to 90^{o} at any time. SetId=488

[15] A force is any interaction which tends to change the motion of an object. It is *equal to* the rate of change of momentum by Newton's second law.

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ASSIGNMENT-II **Due On : Nov 18, 2014**

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SetId=489

[1] Displacements, being vector quantity can not compared with, a scalar quantity such as distance.

[2] If no net external torque acts on a system, the total angular momentum of the system remains constant.

[3] Consider a disc and a man system. man is standing on center of the disc rotating with angular velocity.initially man folded his hand.when man stretches his hands then momentum of inertia of system increases.and angular velocity decreases.and total angular momentum remains constant.

[4] In the Sun Earth system the angular momentum of the Earth is conserved in every frame of reference

[5] Only the z component of the angular momentum of a conical pendulum is conserved w.r.t. the origin fixed at the point of suspension. SetId=489

[6] In the example of conical pendulum, the x and$y$ components of angular momentum change. This follows from the angular momentum conservation as the z components external torque is zero and horizontal components of torque are non zero.

[7] In a system of a canon and a canon ball, total momentum of the system is zero before canon ball is fired. After firing the canon ball, the momentum of the system seems to be conserved as the ball moves forward and the canon moves backward.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *net external force* acting on the system, the momentum is conserved. The definition of angular momentum and torque depends on the choice of axes, and therefore it may not be be conserved. The conservation of total energy holds only for conservative forces.

When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *net external force* acting on the system, the energy and momentum will be conserved. However, the total angular momentum may not be conserved because the torque may not be zero.

[9] A non-conservative force is a force with the property that the work done in moving a particle between two points is dependent of the path taken . Mostly the enery of the particle in a non conservative force field dissipates in the form of heat or sound . Since the lost energy cannot be bought back ,conservation of mechanical energy does not hold true .

SetId=489

[10] A particle moves on a circular path. Then under suitable conditions its speed may remain constant, but the force, velocity and acceleration must always change with time.

[11] If P and Q are the initial and the final points of a path of a particle,the displacement is the vector $\overrightarrow{PQ}$.

[12] Staying inside a bullet train moving with constant velocity (no jerks etc) an experiment can always be performed which will tell us the numerical velocity of the bullet train

[13] When a freely falling rigid body collides another body in its path momentum the system of two particles is not conserved in the collision as there is external force mg acting on the system.

[14] A heavy body is attached from a spring and is held at point A and is such that the spring is not slack nor is it stretched. It is then released. It goes down upto a point B and then it rises upto point C and executes an oscillatory motion between B and C. During the motion from A to C is first positive (from A to B) and then it is negative from B to A and again remains negative from A to C. SetId=489

[15] Newton's laws are not valid on non-inertial frame of reference. So to validate Newton's laws of motion pseudo force (fictious or virtual force) is introduced.
Pseudo force acts in non-inertial frame. Its magnitude is always mass of the body multiplied by acceleration of the frame. It is always in direction opposite to the acceleration of the frame of reference. The resultant of pseudo forces and real forces is always zero.

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SetId=490

[1] Distance depends on the path where as the displacement depends on the end point only.

[2] The law of conservation of angular momentum states that when no external torque is applied on an object or a closed system of objects about an axis, the angular momentum about that axis remains constant.

[3] The conservation of angular momentum of a system of bodies requires that the the sum of torque due to all forces be equal to zero. Now consider a situation where the forces are such that the sum of torques of external forces is zero w.r.t. some axes K. Since the value of torque depends of the choices of axes, the sum of torques due to all internal forces will depend on the choice of axes and in general it will be non zero. Therefore, for a system of several bodies, for a given choice of axes K, there will be situations when the total angular momentum may not be conserved.

[4] In the motion of earth around sun, the angular momentum of the earth about an axis passing through the sun and perpendicular to the plane of motion of earth is conserved.

[5] The z component of angular momentum of a conical pendulum is not conserved w.r.t. the origin fixed at the point of suspension; but the x and y components are conserved. SetId=490

[6] Example where law of conservation of angular momentum does not hold: A disc rotating on a horizontal rough surface will not have a constant angular momentum because there will be a constant torque by frictional force. Hence, its angular momentum will decrease, and the law of conservation of angular momentum does not apply.

[7] When applying the conservation laws of momentum, energy and angular momentum we must define the system first.Only then check if the laws is applicable or not.

As an example: when a ball is dropped from a height, it gains momentum down if we consider the ball as our system.This is because the force of gravity acts as an external force.

However, if we change our system and consider earth as a part of our system too, then the momentum remains conserved because the earth gains momentum up.

[8] In order to apply the law of conservation of momentum we must first identify the system. If there is no *net external forces* acting on the system then conservation laws of momentum always holds. The total energy and the total angular momentum may not be conserved.

[9] If the work done by a force depends on the path followed by the particle, it is called a Non conservative force. Work done by a non conservative force is not zero in round trip.

SetId=490

[10] A particle moves on a circular path. Then under suitable conditions its speed and acceleration may remain constant, but the force, and velocity must always change with time.

[11] If two bodies starting from a point A reach a point B, following different paths, their displacement will be, in general different, but the distances covered will always be the same.

[12] Staying inside a bullet train moving with constant velocity (no jerks etc) an experiment can always be performed which will tell us the numerical value of the acceleration of the bullet train

[13] If we take some amount of a substance like construction putty, cement, cake batter, playing dough,etc and drop it on the ground, it does not bounce back, like a rubber ball would bounce, and hence the momentum it had before striking the ground seems to have been lost. Hence it appears that the law of conservation of linear momentum does not hold.

[14] The kinetic energy of a body does not change if any one of the following is true
(i)force is always perpendicular to the velocity
(ii) the force is always perpendicular to the acceleration
(iii) the object remains stationary
(iv) the object moves in such a way that the point of application of the force remains fixed.

SetId=490

[15] These forces are non-real forces but must be taken into account while applying Newton's Law's of Motion in accelerating frame of reference as compared to an inertial frame of reference.

The centrifugal and centripetal forces are examples of pesudo-forces.

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SetId=491

[1] Distance equal to zero implies displacement=0; and Displacement=0 also implies distance = 0

[2] The angular momentum of a given system of bodies shall remain conserved unless acted upon by an external unbalanced torque.

[3] Example where law of conservation of angular momentum does not hold:
When there is external force like frictional force acting on a object when it is rotating we cannot use conservation of angular momentum as the friction force acting on the object produces an external torque.

[4] For the motion of earth around sun, the angular momentum of the earth about the center of mass of the sun + earth system and perpendicular to the plane of motion of earth is conserved.

[5] Only the z component of angular momentum of a conical pendulum is conserved w.r.t. the origin fixed at the point of suspension. SetId=491

[6] Example where law of conservation of angular momentum does not hold:Consider a vertical stick on the ground falling to a horizontal position. During the fall, the conservation of angular momentum applied at the point of rotation on the ground and perpendicular to the plane of the stick is not applicable as, the gravitational force which acts vertically downwards assumed at the centre of mass produces an external torque about the axis of rotation

[7] Statement: Law of Conservation of energy states that "ENERGY CAN NEITHER BE CREATED NOR DESTROYED",but it can be changed from one form to other.

EXPLANATION: Statement implies that the total amount of energy in an isolated system remains constant although it may change forms. viz, kinetic energy may change to potential;chemical to electrical energies etc.

[8] In order to apply the law of conservation of momentum we must first identify the system. Then even if there is no *net external forces* acting on the system, all the three conservation laws of momentum, angular momentum and energy may not hold due to presence of internal forces.

SetId=491

[9] The workdone by a non conservative force is dependant on its path. the work varies as the path varies.

[10] When the force is kept constant as function of time, it is possible for a particle to move on a circular path in such a way that its speed remains constant, but the velocity and acceleration must always change with time.

[11] Distance is equal to the length of the path covered. Displacement is the shortest distance between initial and final points.

[12] Assume bullet train, moving with out any jerks, is going on a circular arc of radius R with constant speed. Then an experiment is to be performed entirely within the train without any measurement on objects outside the train. Such an experiment can tell only radius of the track.

[13] When we consider collision between two bodies in a non-inertial frame of reference, the law of conservation of momentum cannot be applied because there will be a pseudo force acting on the frame itself.

[14] The total work done on a particle is always equal to the change in kinetic energy. SetId=491

[15] When observing our system from a reference frame which is accelerating compared to an inertial frame,in order to make it easier to apply newtons laws, we can apply a pseudo force on all objects in the universe proportional to their mass capable of causing an acceleration equal and opposite to that of our reference frame. Hence serving to in a way "stop"(or make inertial) our reference frame, and making it easier for us to investigate the motion.

This application of pseudo force doesn't change the motion of the object because just as we can choose an arbitrary reference frame, we can choose an arbitrary force to cause the same acceleration in every object in the whole universe without changing the relative motions of objects. (as all motion is truly relative, we will still get correct answers for our investigations.

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[1] If P and Q are the initial and the final points of a path of a particle, displacement is a vector whose direction is along PQ and has magnitude is equal to the length of line PQ

SetId=492

[2] When the net external torque acting on a system about a given axis is zero, the total angular momentum of the system about that axis remains consant.

[3] A bob attached to a ceiling by a string moving in a horizontal circular plane is an example where the total angular momentum of the bob about the point of suspension is not conserved. This is because the the torque due to the weight of the bob about the point of suspension does not vanish and has non zero horizontal component. Only the vertical component of the angular component is conserved.

[4] In the Sun Earth system the angular momentum of the Earth about the pole star is conserved

[5] The projection of angular momentum of a conical pendulum in the horizontal plane is a constant of motion when the origin is chosen to be at fixed at the point of suspension.

SetId=492

[6] We have a conical pendulum .The forces acting on the bob are tension (along the direction of the string) and gravitational force acting in the vertically downward direction.we have an additional force called the drag force which is tangential to the motion of the bob and acts in the direction opposite to the motion of the bob.The axis of rotation passes through the hinge point and is vertical.The torque due to tension is 0 because the force passes through the axis of rotation.The torque due to mg is also zero since it is parallel to the axis of rotation.but the torque due to drag force is not zero.since the net external torque acting on the bob is not zero,therefore the law of conservation of angular momentum does not hold here

[7] Oscillating simple pendulum is a very good example where potential energy gets converted to kinetic energy and kinetic to potential energy. Some energy gets dissipated as heat if we consider air resistance. Energy as a whole is conserved if we consider universe as system, the energy has just changed its form.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then check we should if the laws are applicable or not.

So if there is no *external force* acting on the system all the three quantities, total momentum, total angular momentum, and total kinetic energy will be conserved independent of the nature of forces.

SetId=492

[9] A non conservative force is a force with the property that the work done in moving a particle between two points is dependent on the path followed.

[10] It is not possible for a particle to move on a circular path in such a way that its speed and force remains constant, and only the velocity and acceleration may (or may not) always change with time.

[11] Distance is a scalar quantity where as the displacement is a vector quantity.

[12] Assume bullet train, moving with out any jerks, is going on a circular arc of radius R with constant speed. Then an experiment is to be performed entirely within the train without any measurement on objects outside the train. Such an experiment can tell both speed of the train and radius of the track.

[13] When a system is acted upon by external forces like friction etc, the conservation principle does not hold good,there will be impulse imparted and so we cant conserve momentum. This is case when a collision between two elastic balls take place on a rough horizontal table. The total momentum just after the collision will be different from the total momentum just before the collision. Here momentum is not conserved as there is external force friction is present.

[14] A particle is acted upon by a force of constant magnitude which is always perpendicular to the velocity of the particle and the motion of the particle takes place in a plane, Then its kinetic energy, speed, velocity acceleration will not change. SetId=492

[15] Various types of forces in nature can be grouped in four categories:
(a)Gravitational; (b)Electromagnetic; (c)Nuclear; (d)Weak
There are also some non-fundamental forces such as:
(i)Normal reaction on bodies in contact with surfaces , (ii) Friction,(iii) Tension,(iv)Elastic force.

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SetId=493

[1] If P and Q are the initial and the final points of a path of a particle,the displacement is the vector $\overrightarrow{PQ}$.

[2] This law sates that when no net torque of all forces acts on a object or a system of objects then total angular momentum of system is conserved.The angular momentum before an event is equal to angular momentum after that event.mathematically explained by when, net torque=0 ;then, total angular momentum(L)=constant.

[3] Law of conservation of angular momentum holds in case of long jump. When a athlete takes off from the ground in a running long jump, the forces on the launching foot give the athlete an angular momentum with a forward rotation around a horizontal axis. Such rotation would not allow the jumper to land properly. In the landing, the legs should be together and extended forward at an angle so that the heels mark the sand at the greatest distance. Once airborne, the angular momentum cannot change (it is conserved) because no external torque acts to change it. However, the jumper can shift most of the angular momentum to the arms by rotating them in windmill fashion. Then the body remains upright in the proper orientation of landing.

[4] For the motion of earth around sun, the angular momentum of the sun about the center of mass of the sun + earth system and perpendicular to the orbital plane of earth is conserved.

For the motion of earth around sun, the angular momentum of the sun about and axis passing through the Earth and perpendicular to the orbital plane of motion of earth is conserved.

[5] The law of angular momentum of a is not applicable for the conical pendulum conserved w.r.t. the origin fixed at the point of suspension. SetId=493

[6] When you release a toy gyroscope on its pedestal, it initially has no precessional rotation around that pedestal, i.e, the orientation of rotation is fixed. However, it instantaneously starts precessing around the pedestal. Both Kinetic Energy and Angular Momentum now exist where they did not exist a moment earlier. The Kinetic Energy is easy to explain, as appearing due to the body of the gyroscope dropping a tiny fraction of a millimeter in the Earth's gravitational field, giving up exactly the correct amount of Potential Energy. But the Angular Momentum of the Precession which just appeared, does not come from anywhere. This is therefore a Violation of the Conservation of Angular Momentum.

[7] Law of conservation of momentum does not hold whenever an external force or impulse acts on the system. For example,when a body collides with earth then it bounces back to a lesser height as it loses some velocity.

In this example the momentum of a ball is not conserved due to impulsive force by ground in the normal direction.

However, strictly speaking the system that should be considered here is the ball-earth system and the total momentum is conserved.

[8] If we want to apply the conservation laws of momentum, energy and angular momentum, we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *external force* acting on the system, the momentum and angular momentum will be conserved, and depending on the nature of the forces but total energy may or may not be conserved.

[9] A non conservative force is a force with the property that the work done in moving a particle between two points is dependent of the taken path.

Friction, for example, does less work on a book dragged across a table if the book is dragged straight across than if the book is dragged in a curved path.

To write the equation for conservation of energy for non conservative forces we need to include the work done by the non conservative force also.This is because forces like friction liberate heat which are not included in the mechanical energy.

SetId=493

[10] For a particle moving on circle the acceleration is always constant in magnitude and directed towards the centre of the circle.

[11] Both displacement and distance tell us about the motion of a body but their study does not tell much about the forces on the body

[12] Assume bullet train, moving with out any jerks, is going on a circular arc of radius R with constant speed. Then an experiment is to be performed entirely within the train without any measurement on objects outside the train. Such an experiment can tell only speed of the track.

[13] When we are in accelerating frame if we observe any collision between two bodies then the law of conservation of momentum does not hold in that frame of reference. On the other hand the law of conservation of momentum holds in all inertial frames.

[14] The kinetic energy of a particle is continuously increasing with time, then the angle bewteen the net force and the velocity cannot be greater than or equal to 90^{o} at any time.

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[15] A force is agency that which changes or tends to change the state of rest or motion of a body.

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[1] If two bodies starting from a point A reach a point B, following different paths, their displacement will be, in general different, but the distances covered will always be the same.

[2] Statement of Law of Conservation of Angular Momentum:

Differentiating $\vec{L} = \vec{r} \times \vec{p}$ w.r.t, time,

$$\begin{aligned}\frac{dL}{dt} &= \frac{d\vec{r} \times \vec{p}}{dt} = \frac{d\vec{r}}{dt} \times \vec{p} + \vec{r} \times \frac{d\vec{p}}{dt} = \vec{v} \times (m\vec{v}) + \vec{r} \times \vec{F} \\ &= \vec{r} \times \vec{F} (\because v \times v = 0) \\ &= \vec{\tau}\end{aligned}$$

here $\vec{\tau}$ represents the net torque acting on a rigid body rotating about a fixed axis.This torque must take into account of all the forces, be it external or internal forces

[3] The total angular momentum of a body remains constant of motion when the net torque of the external forces acting on the body is zero.
In general, we have a system of particles such that the net torque of the external forces on the system, w.r.t. some axes K, is zero, the total angular momentum may not remain conserved, because the torque due to the internal forces may not be zero.

[4] For the motion of earth around sun, the sum of angular momenta of the Sun and the Earth about the center of mass of the sun + earth system is conserved.

[5] The law of angular momentum of a is not applicable for the conical pendulum conserved when the origin is chosen to be at the pendulum bob itself. SetId=494

[6] There is no case where LAW OF CONSERVATION OF ANGULAR MOMENTUM does'nt hold.But there are cases where conservation of angular momentum does not hold.A body in vertical circular motion is an example where angular momentum is not conserved. Here the law of conservation does not apply.

[7] If a bullet hits a wooden board and gets embedded in the board, the total energy and the total momentum of the bullet and the board are conserved.

[8] To apply the conservation laws of momentum, energy and angular momentum, we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *external force* acting on the system, the energy and momentum will be conserved. However, depending on the nature of the system and of the forces, the total angular momentum may not be conserved.

[9] A non conservative force is a force with the property that the work done in moving a particle between two points is dependent of the taken path.

Friction, for example, does less work on a book dragged across a table if the book is dragged straight across than if the book is dragged in a curved path.

To write the equation for conservation of energy for nonconservative forces we need toinclude the work done by the non conservative force also.This is because forces like friction liberate heat which are not included in the mechanical energy.

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[10] The motion of a bomb dropped from a plane does is not a uniform motion as it follows a parabolic path and not a straight line path.

[11] Displacement is the shortest distance between initial and final points with direction specified.

[12] A particle is observed from two frames S_1 and S_2. The frame S_2 moves with respect to S_1 with an acceleration a. If F_1 and F_2 be the pseudoforces when seen from S_1 and S_2 respectively it is not possible to have $F_1 = F_2 = 0$

[13] When a freely falling body hits another rigid body in its path then momentum is not conserved as external force mg acts on both the bodies. The total momentum after the collision will be different from the total momentum before the hit.

[14] A heavy body is attached from a spring and is held at point A and is such that the spring is not slack nor is it stretched. It is then released. It goes down upto a point B and then it rises upto point C and executes an oscillatory motion between B and C. During the motion from A to C is first positive (from A to B) and then it is negative from B to A and again remains negative from A to C. SetId=494

[15] The forces may be of the following two types - *Contact forces* (those that act when bodies are in physical contact) eg. friction, normal reaction, bouyancy etc. and*Action-at-a-distance forces* (those that act when bodies are not in contact) eg. Gravity, electostatic forces, magnetic forces etc. There At the root level, forces are of the following fundamental types :- (a) *Gravitational forces* - weakest of all forces, always attractive
(b) *Electromagnetic forces* - stronger than gravitational forces, can be attractive or repulsive,
(c) *Nuclear forces* - exist at atomic level, have very short range,
(d) *Weak nuclear forces* associated with beta particle emission

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[1] Displacement is equal to the vector difference $\vec{r}_f - \vec{r}_i$ of the position vectors of initial and final points. The distance covered will be $|\vec{r}_f - \vec{r}_i|$

[2] Statement of Law of Conservation of Angular Momentum: For a system of many particles The net torque due all the forces, be it external or internal forces. But as the torque due to all the internal forces cancel out, it sufficient to consider the external forces acting on the system.

[3] An example where law of conservation of angular momentum holds:
The Law of conservation of angular momentum holds in the case of a ballet dancer performing a pirouette.

When the dancer extends her arms outward, the angular velocity of her rotation decreases whereas when she keeps her arms close to her body, the angular velocity increases. This is because her moment of inertia changes as she moves her arms outward and inward. It can be noted that she as a system has no external torque acting upon her.

[4] For the motion of the Earth around the sun, the total of angular momenta of the Earth and the Sun, about in a reference frame fixed in the pole star, is conserved.

[5] The three components of angular momentum of a conical pendulum is conserved w.r.t. the origin at the position of the center of mass of the pendulum. SetId=495

[6] A sphere rolling on a rough surface.Due to friction there is external torque so the angular momentum changes which results in the slowing of the sphere. The angular momentum keeps changing. Even in case like this one, it is wrong to say that the Law of Angular Momentum Conservation does not hold.

[7] If a bullet hits a wooden board and gets embedded in the board, the total energy of the bullet and the board system is conserved but the total momentum is not conserved.

[8] In order to apply the law of conservation of momentum we must first identify the system. If there is no *external forces* acting on the system then conservation laws of momentum always holds. And depending on the nature of the system and of the forces, the total kinetic energy and the total angular momentum may not be conserved.

[9] The non conservative force is a force with a property thet the work done between two points depends on path taken. If a particle moves along a curve path, to know about the work done by a non conservative force we should have the equation of the path along which the particle had move.The work done would be

WORK = INTEGRAL (F.dx)

The equation of conservation of mechanical energy for a non conservative force would be

SetId=495 $KE_{\text{final}} + PE_{final} = KE_{initial} + PE_{initial} + W_{nc}$

[10] A wagon sliding on a roller coaster designed in such a way that the wagon covers equal distances in equal times. As the motion of the wagon is uniform, there will be no net force acting on it.

[11] Displacements, being vector quantity can not compared with, a scalar quantity such as distance.

[12] A particle is observed from two frames S_1 and S_2. The frame S_2 moves with respect to S_1 with an acceleration a. If F_1 and F_2 be the pseudoforces when seen from S_1 and S_2 respectively and if $F_1 = 0$ then we must have $F_2 \neq 0$

[13] .The law of conservation of momentum does not hold good when net external forces acting on the system is not zero.when two bodies collide law of conservation of momentum is applicable on system of two bodies but on not individual bodies because external impulse acts on them.

[14] The kinetic energy of a body does not change if any one of the following is true
(i)force is always perpendicular to the velocity
(ii) the force is always perpendicular to the acceleration
(iii) the object remains stationary
(iv) the object moves in such a way that the point of application of the force remains fixed. SetId=495

[15] The main differences between force and pseudo force are -
(1) Forces have a real presence while pseudo forces don't.
(2) Forces can be accounted for by Newton's laws.
(3) Pseudo forces are only taken into account when the reference frame is accelerated.

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[1] Distance is equal to the length of the path covered. Displacement is the shortest distance between initial and final points.

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[2] Depending on the torques acting on a system, the angular momentum can be conserved only in one or two directions, but may not be conserved in all. For instance, if an isolated body has no torque acting on it only in the direction along the Z axis, then the angular momentum is conserved only in that direction.

[3] In case of a skater, who can be considered an isolated system, so no torue will be acting on him/her. When the arms are extended, the moment of inertia is more. When his hands are closely held, the moment of inertia is lesser. Since the angular momentum is same, the angular acceleration changes accordingly.

[4] For the motion of the Earth around the sun, the total of angular momenta of the Earth and the Sun, is conserved in every inertial frame of reference; but the angular momentum of the Earth (or of the sun)is not conserved in every inertial frame.

[5] Only the z component of the angular momentum of a conical pendulum is conserved w.r.t. the origin fixed at the point of suspension.

SetId=496

[6] Consider a rod of length l. Let us give an impulse to one end . Now the angular momentum about the oposite end is not zero since the impulse provides some torque . So the angular momentum is not conserved .

$$\text{torque} = \text{impulse} * \ell.$$

$d\ell/dt$ is not equal to zero and the law of conservation of angular momentum does not hold.

[7] If a bullet hits a wooden board and gets embedded in the board, both total energy and the total momentum of the bullet and the board are not conserved.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then check if the laws is applicable or not.

So if there is no *net external force* acting on the system all the three conservation laws will hold.

[9] Nonconservative forces arise due to neglected degrees of freedom or from time dependent potentials. The work done by a nonconservative force depends upon the path taken. It causes a change in the mechanical energy of the system. It adds or removes mechanical energy from a system.

SetId=496

[10] A simple pendulum moves along a circular arc and does not have constant speed and therefore its motion is not uniform.

[11] Distance depends on the path where as the displacement depends on the end point only

[12] If K is an inertial frame, any frame that moves w.r.t. the frame K with uniform velocity is also an inertial frame.

[13] A block moving in the air breaks up into two parts and the parts separate, then the total momentum must be the same before and after the break.

[14] The total work done on a particle is always equal to the change in kinetic energy. $\boxed{\text{SetId=496}}$

[15] A force is any interaction which tends to change the motion of an object. It is also *defined* as rate of change of momentum. It is a vector quantity.

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SetId=497 [1] Distance is a scalar quantity where as the displacement is a vector quantity.

[2] According to Law of Conservation of Angular momentum,if no external torque acts on an object or system of objects,angular momentum of an object or system of objects remains CONSTANT or no change in angular momentum can occur.

Also it states that,only external torque can change angular momentm of the system where as the torque produced by internal forces can not change the angular momentum of the system

[3] Example where law of conservation of angular momentum holds:
Let us assume a student seated on a stool that can rotate freely about a vertical axis. The student has been set into rotation at a modest initial angular speed ω . He holds two dumbbells in his outstretched hands. His angular momentum vector L lies along the vertical rotation axis, pointing upwards. Now he pulls in his arms;this action reduces his rotational inertia from its value I_{initial} to a final value I_{final} because he moves the mass closer to the rotational axis. His rate of rotation increases markedly, from ω_{initial} to ω_{final}. The student can then slow down by extending his arms once more,moving the dumbbells outward. No external torque acts on the system consisting of the student, stool and the dumbbells. Thus the angular momentum of the system about the rotational axis remains constant. $I_{\text{initial}} * \omega_{\text{initial}} = I_{\text{final}} * \omega_{\text{final}}$.

[4] In the Sun Earth system the angular momentum of the Earth is conserved in every frame of reference

[5] The z component of angular momentum of a conical pendulum is not conserved w.r.t. the origin fixed at the point of suspension; but the x and y components are conserved. SetId=497

[6] Let us consider a rotating skew rod. In the absence of friction or any other drag force, the rod should continuously spin without stopping. Here the net torque about the axis of rotation is 0 and hence angular momentum is conserved. It therefore follows from law of conservation of angular momentum that a spinning skew rod will keep rotating with constant angular velocity if there is no external torque. So law of conservation of angular momentum does not hold.

[7] There are certain situations where it appears that the law of conservation of linear momentum does not hold. For example if we take some amount of a substance like construction putty, cement, cake batter, playing dough,etc and drop it on the ground, it does not bounce back like a rubber ball would and hence the momentum it had before striking the ground seems to have been lost. Hence it appears that the law of conservation of linear momentum does not hold.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then check we should if the laws are applicable or not.

So if there is no *external force* acting on the system all the three quantities, total momentum is conserved. The total angular momentum is also because the torque of internal forces will be zero. The conservation of energy depends on the nature of forces. will be conserved.

[9] The work done by a *Nonconservative Force *is not recoverable*.*The work done by a *Non Conservative force* is usually dissipated in the form of Heat and Sound.

SetId=497 Non conservative force *cannot* be expressed in the form of *Potential Energy*.

[10] A satellite goes around the earth in a circular orbit of 600km with a time period of $5.8 \times 10^3 s$. Its motion will be uniform as it will cover equal distances in equal times.

[11] Distance equal to zero $\Rightarrow$ displacement=0; but Displacement=0

[12] If K is an inertial frame, any frame that moves w.r.t. the frame K with uniform speed is also an inertial frame.

[13] A ball hits the floor and rebounds after an inelastic collision. In this case the total momentum of the ball before and after the collsion is conserved. Also the total enrgy of the ball and the earth remains the same

[14] A particle is acted upon by a force of constant magnitude which is always perpendicular to the velocity of the particle and the motion of the particle takes place in a plane, Then its kinetic energy, speed, velocity acceleration will not change. SetId=497

[15] Explain Pseudo Force: While applying Newton's laws of motion in non-inertial frame of reference it gives answers which contradict observations. Thus, to account for this,using Newton's Laws, we introduce a "fake" or pseudo force which gives answers that match the observations in a non-inertial frame.

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SetId=498

[1] The speed is rate of change of distance and the velocity is the rate of change of displacement.

[2] The law of conservation of angular momentum states that when the net external torque acting on the system is zero, then the angular momentum of the system remains constant.both the initial and final momentum should be taken from a fixed inertial frame of reference provided.

[3] A bob is attached to ceiling by a string and moves in a horizontal circular plane is an example. In this case the law of conservation of angular momentum does not hold.

[4] In the motion of earth around sun, the angular momentum of the earth about an axis passing through the sun and perpendicular to the plane of motion of earth is conserved.

[5] Only the z component of angular momentum of a conical pendulum is conserved w.r.t. the origin fixed at the point of suspension. SetId=498

[6] In the example of skew rod the angular velocity does not change even though the torque applied is nonzero. However there is no contradiction as in this case the law of conservation of momentum is not applicable. conservation is violated.

[7] A tennis ball is dropped from height h and after hitting the ground and it bounces back and rises to the same height. In this case the momentum of the ball is conserved because (under ideal conditions) the momentum after it hits the ground will be equal to the momentum it had before hitting the ground.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *net external force* acting on the system, the momentum is conserved. The definition of angular momentum and torque depends on the choice of axes, and therefore it may not be be conserved. The conservation of total energy holds only for conservative forces.

When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *net external force* acting on the system, the energy and momentum will be conserved. However, the total angular momentum may not be conserved because the torque may not be zero.

SetId=498

[9] * A non conservative force is a force that acts on a particle(or point), such that the work done by this force in moving this particle from one point to another is */dependent of path taken/* that is the work done depends on the path itself. * For example frictional force is non conservative because the work done by friction always acts in the direction of travel and therefore depends on length L of the path taken.

[10] A uniform motion is defined to be the one in which a body covers equal distances in equal time intervals.

[11] If P and Q are the initial and the final points of a path of a particle, displacement is a vector whose direction is along PQ and has magnitude is equal to the length of line PQ

[12] A frame rotating w.r.t K with uniform angular velocity is also an inertial frame.

[13] In a head on elastic collision of two identical bodies of equal masses the velocities, the speeds, the momenta and the kinetic energy are all exchanged.

[14] The kinetic energy of a particle is continuously increasing with time, then the angle bewteen the net force and the velocity cannot be greater than or equal to 90^o at any time. SetId=498

[15] When a train is at rest and a ball is hung from the ceiling with a string, an observer in the train sees that the string is vertical. But when the train starts moving, the observer sees that the string makes an angle with the vertical and is tilted in forward direction . This means that some force other than gravity and tension must act on the ball. That force is the pseudo force.

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SetId=499

[1] For any type of translational motion of a body, the displacement cannot be zero, where as the distance travelled can be zero.

[2] The law of conservation of angular momentum states that The total angular momentum of a system is constant in both magnitude and direction if the resultant torque, of the external forces acting on the system, is zero.

[3] Consider a disc rotating about an axis perpendicular to its plane. On placing a smaller disc with its surface parallel to the surface of the rotating disc, the angular momentum of the system of two discs remains constant as there is no external torque.

[4] For the motion of earth around sun, the angular momentum of the earth about the center of mass of the sun + earth system and perpendicular to the plane of motion of earth is conserved.

[5] The projection of angular momentum of a conical pendulum in the horizontal plane is a constant of motion when the origin is chosen to be at fixed at the point of suspension.

SetId=499

[6] Example where law of conservation of angular momentum does not hold:If a particle undergoes conical motion and the only force acting on particle is central force like tension of the string.Then total external torque about fixed point A is zero,yet angular momentum is not conserved,as angular momentum keeps on changing direction.

[7] Law of conservation of momentum does not hold when Newton's laws are not valid, e.g. in a non-inertial frame of reference. For example, when we consider collision between two bodies in a non-inertial frame of reference, the law of conservation of momentum cannot be applied because there will be a pseudo force acting on the frame itself.

[8] In order to apply the law of conservation of momentum we must first identify the system. If there is no *net external forces* acting on the system then conservation laws of momentum always holds. The total energy and the total angular momentum may not be conserved.

[9] A force with the property that the work done in moving a particle is dependent on the path followed. The work done by a conservative force in moving a body from an initial location to a final location is dependent on the path taken between the two points

SetId=499

[10] A particle moves on a circular path. Then its speed, direction of force, velocity and acceleration must always change with time.

[11] If P and Q are the initial and the final points of a path of a particle,the displacement is the vector $\overrightarrow{PQ}$.

[12] The Newton's Laws of motion will hold in all frames which are at rest w.r.t. K but do not remain valid in a frame that move with respect to K.

[13] For a system of several particles the conservation of total linear momentum is equivalent to the statement that their centre of mass moves like a free particle.

[14] A heavy body is attached from a spring and is held at point A and is such that the spring is not slack nor is it stretched. It is then released. It goes down upto a point B and then it rises upto point C and executes an oscillatory motion between B and C. During the motion from A to C is first positive (from A to B) and then it is negative from B to A and again remains negative from A to C. SetId=499

[15] Since newton's laws are not valid in non-inertial frames, pseudoforces (which do not exist in reality) are used to help us formualate and use Newton's laws of motion in non-inertial frames.

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SetId=500

[1] Displacements, being vector quantity can not compared with, a scalar quantity such as distance.

[2] If the net external torque acting on a system is zero,the angular momentum L(vector) of the system remains constant,no matter what changes take place within the system.L(vector)=a constant (net external torque acting on system is zero)

[3] Consider a man standing on a spinning platform. Initially, the man spreads out his arms and he spins with a certain angular velocity. The next moment, he pulls his arms inwards keeping them close to his body. We will observe that the angular velocity with which he is spinning now increases. This phenomenon can be explained by the Law Of Conservation of Angular momentum. Initially, since his arms were spread wide, his moment of inertia was large. However, when he pulled them close to his body, his moment of inertia decreased.
In this example the angular velocity of the man increases and therefore the angular momentum also increases.The law of conservation of angular momentum does not apply because the torque of muscular forces is not zero.

[4] In the Sun Earth system the angular momentum of the Earth about the pole star is conserved

[5] The law of angular momentum of a is not applicable for the conical pendulum conserved w.r.t. the origin fixed at the point of suspension. SetId=500

[6] A nonzero torque always causes the angular velocity to change, because a change in angular momentum means a change in angular velocity $L = I\omega$

[7] If I throw a ball upward, it's speed decreases as it rises upwards. There is an external force (gravity) acting on the ball, so the momentum conservation law does not apply. Momentum of the ball is not conserved, however the momentum of the Earth-ball system is conserved as gravity will become an internal force in this case.

[8] In order to apply the law of conservation of momentum we must first identify the system. Then even if there is no *net external forces* acting on the system, all the three conservation laws of momentum, angular momentum and energy may not hold due to presence of internal forces.

SetId=500

[9] The work done by non conservative force is dependent on the path taken by the particle in reaching final position from initial position. Non conservative force depends on the distance travelled by the particle

[10] A particle moves on a circular path. Then its speed, direction offorce, can remain constant by velocity and acceleration must always change with time.

[11] If two bodies starting from a point A reach a point B, following different paths, their displacement will be, in general different, but the distances covered will always be the same.

[12] Staying inside a bullet train moving with constant velocity (no jerks etc) an experiment can always be performed which will tell us the numerical velocity of the bullet train

[13] The total mechanical energy of a system may not be conserved if there are no external forces and the internal forces are conservative.

[14] The kinetic energy of a body does not change if any one of the following is true
(i)force is always perpendicular to the velocity
(ii) the force is always perpendicular to the acceleration
(iii) the object remains stationary
(iv) the object moves in such a way that the point of application of the force remains fixed. SetId=500

[15] Force is defined as the rate of change of linear momentum. In other words it is the agency which changes or tends to change the (a) State of rest; (b)State of uniform motion (c) Direction of body's motion; (d) Shape of the body

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SetId=501

[1] Distance depends on the path where as the displacement depends on the end point only.

[2] The Law of conservation of angular momentum states that when no external torque acts on an object or a closed system of objects undergoing motion about a given axis, the change in angular momentum is zero. Therefore, considering an event where only internal torque or no torque is involved, the total angular momentum of the system before the event is equal to the total angular momentum after the event

[3] In the Sun-Earth system, angular momentum of the earth is not conserved but the total angular momentum of the sun and the earth is constant of motion.

[4] For the motion of earth around sun, the angular momentum of the sun about the center of mass of the sun + earth system and perpendicular to the orbital plane of earth is conserved.

For the motion of earth around sun, the angular momentum of the sun about and axis passing through the Earth and perpendicular to the orbital plane of motion of earth is conserved.

[5] The law of angular momentum of a is not applicable for the conical pendulum conserved when the origin is chosen to be at the pendulum bob itself. SetId=501

[6] A nonzero torque always implies change in angular momentum and may not give rise to a change in magnitude of angular velocity. A non zero torque may mean change only the direction of the angular momentum and not the angular velocity.

[7] A soldier accelerating away, after detonating a bomb, will find that the total momentum of the fragments of the bomb is zero. This is an example where the law of conservation of momentum holds as the forces on the fragments are internal forces only and sum of all such forces is zero.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then check we should if the laws are applicable or not.

So if there is no *external force* acting on the system all the three quantities, total momentum, total angular momentum, and total kinetic energy will be conserved independent of the nature of forces.

[9] The work done by non conservative force is dependent on the path taken by the particle in reaching final position from initial position. Non conservative force depends on the distance travelled by the particle

SetId=501

[10] A particle moves on a circular path. Then under suitable conditions its speed may remain constant, but the force, velocity and acceleration must always change with time.

[11] Distance is equal to the length of the path covered. Displacement is the shortest distance between initial and final points.

[12] Staying inside a bullet train moving with constant velocity (no jerks etc) an experiment can always be performed which will tell us the numerical value of the acceleration of the bullet train

[13] When a bullet fired on a wooden block, some energy is transferred to the block and the total mechanical energy of the block and the bullet is conserved.

[14] The total work done on a particle is always equal to the change in kinetic energy. SetId=501

[15] Real forces have their origin in matter such as electricity, gravitation etc., while pseudo forces are caused by inertial motion.

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SetId=502

[1] Distance equal to zero implies displacement=0; and Displacement=0 also implies distance = 0

[2] The law of conservation of angular momentum states that when no external torque acts on an object or a closed system of objects, no change of angular momentum can occur. Hence, the angular momentum before an event involving only internal torques or no torques is equal to the angular momentum after the event . Angular momentum can be calculated with the help of the formula $L = I\omega$ where L stands for Angular momentum, I stands for moment of inertia and ω stands for angular velocity

[3] Consider a disc and a man system. man is standing on center of the disc rotating with angular velocity.initially man folded his hand.when man stretches his hands then momentum of inertia of system increases.and angular velocity decreases.and total angular momentum remains constant.

[4] For the motion of earth around sun, the sum of angular momenta of the Sun and the Earth about the center of mass of the sun + earth system is conserved.

[5] The three components of angular momentum of a conical pendulum is conserved w.r.t. the origin at the position of the center of mass of the pendulum. SetId=502

[6] In the example of a rotating skew rod the torque due to the external gravitational forces is zero , but the angular momentum is not constant Therefore the law of conservation of angular momentum is violated.

[7] There is no known exception to the law of conservation of momentum in classical mechanics However, an exception to conservation of energy in nuclear physics is observed. In nuclear reactions when two nuclei collide and their mass converts to energy and energy momentum are not conserved.

[8] If we want to apply the conservation laws of momentum, energy and angular momentum, we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *external force* acting on the system, the momentum and angular momentum will be conserved, and depending on the nature of the forces but total energy may or may not be conserved.

[9] Nonconservative forces are those forces in which the work done in moving a particle is dependant on the path taken to cover the distance. Some energy woul be lost to the environment in the form of heat, sound, etc. The energy in the final state is less than that in the initial state.

SetId=502

[10] A particle moves on a circular path. Then under suitable conditions its speed and acceleration may remain constant, but the force, and velocity must always change with time.

[11] Distance is a scalar quantity where as the displacement is a vector quantity.

[12] Assume bullet train, moving with out any jerks, is going on a circular arc of radius R with constant speed. Then an experiment is to be performed entirely within the train without any measurement on objects outside the train. Such an experiment can tell only radius of the track.

[13] When a moving car hits a parked lorry and causes the parked lorry to move ,energy is transferred from moving the car to the lorry and the total energy of the lorry and the car is conserved.

[14] A particle is acted upon by a force of constant magnitude which is always perpendicular to the velocity of the particle and the motion of the particle takes place in a plane, Then its kinetic energy, speed, velocity acceleration will not change. SetId=502

[15] 1)When we start rolling a body on a rough ground, it stops rolling after certain period because of frictional force.
2)When we leave a body from a certain height, it falls due to the act of gravitational force.

1)When a body is rotating in a circular path due to the centrifugal force which is the pseudo force. 2) When the lift is accelerating upwards, the upwards force felt by passengers a pseudo force.

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[1] If P and Q are the initial and the final points of a path of a particle, displacement is a vector whose direction is along PQ and has magnitude is equal to the length of line PQ

[2] Newton's Second Law of Motion is defined by the expression $F = \frac{dp}{dT}$, where F gives the force vector acting on the system and p gives its momentum vector; in linear motion. A similar expression can be written to describe angular motion, i.e. : $\tau = \frac{dL}{dt}$, where τ is the external torque vector acting on the system, and L is the angular momentum.

If the external torque on the system is zero, then we get the expression as: dL/dt=0. This points out to the fact that, when no external torque is acting on the system, then its angular momentum is constant, no matter what changes occur in the system. This is the Law of Conservation Of Angular Momentum.

[3] The conservation of angular momentum of a system of bodies requires that the the sum of torque due to all forces be equal to zero. Now consider a situation where the forces are such that the sum of torques of external forces is zero w.r.t. some axes K. Since the value of torque depends of the choices of axes, the sum of torques due to all internal forces will depend on the choice of axes and in general it will be non zero. Therefore, for a system of several bodies, for a given choice of axes K, there will be situations when the total angular momentum may not be conserved.

[4] For the motion of the Earth around the sun, the total of angular momenta of the Earth and the Sun, about in a reference frame fixed in the pole star, is conserved.

[5] Only the z component of the angular momentum of a conical pendulum is conserved w.r.t. the origin fixed at the point of suspension. SetId=503

[6] In the example of skew rod, the angular momentum changes with time and there is a non zero torque coming from action of forces other than gravitational forces. Hence the law of conservation of angular momentum dos not apply.

[7] In a system of a canon and a canon ball, total momentum of the system is zero before canon ball is fired. After firing the canon ball, the momentum of the system seems to be conserved as the ball moves forward and the canon moves backward.

[8] To apply the conservation laws of momentum, energy and angular momentum, we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *external force* acting on the system, the energy and momentum will be conserved. However, depending on the nature of the system and of the forces, the total angular momentum may not be conserved.

[9] The work done by such forces depends on the path taken. The work done cannot be represented as a potential energy function.Work done by such forces is always negative.

SetId=503

[10] When the force is kept constant as function of time, it is possible for a particle to move on a circular path in such a way that its speed remains constant, but the velocity and acceleration must always change with time.

[11] Both displacement and distance tell us about the motion of a body but their study does not tell much about the forces on the body

[12] Assume bullet train, moving with out any jerks, is going on a circular arc of radius R with constant speed. Then an experiment is to be performed entirely within the train without any measurement on objects outside the train. Such an experiment can tell both speed of the train and radius of the track.

[13] When a bomb explodes the total mechanical energy is not conserved. But the total chemical energy and the mechanical energy is conserved.

[14] The kinetic energy of a particle is continuously increasing with time, then the angle bewteen the net force and the velocity cannot be greater than or equal to 90° at any time.

SetId=503

[15] Newton's first law defines inertial frame. An inertial frame is a frame in which the first law hold. It also makes it possible to compare and tell two force being equal or not. The second law defines the force.

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SetId=504

[1] If P and Q are the initial and the final points of a path of a particle,the displacement is the vector $\overrightarrow{PQ}$.

[2] If the net external torque acting on a system is zero, the angular momentum L of the system remains constant, no matter what changes take place within the system.

$$\sum(T_{\text{ext}}) = \frac{dL}{dt}$$

The law states that when there is no net external torque, $\frac{dL}{dt}$ is zero implying that the total angular momentum of system is constant.

i.e. $L = a$ constant (isolated system)

[3] Example where law of conservation of angular momentum does not hold:
When there is external force like frictional force acting on a object when it is rotating we cannot use conservation of angular momentum as the friction force acting on the object produces an external torque.

[4] For the motion of the Earth around the sun, the total of angular momenta of the Earth and the Sun, is conserved in every inertial frame of reference; but the angular momentum of the Earth (or of the sun)is not conserved in every inertial frame.

[5] The z component of angular momentum of a conical pendulum is not conserved w.r.t. the origin fixed at the point of suspension; but the x and y components are conserved. SetId=504

[6] In the example of conical pendulum, the z- component of angular momentum does not change. This follows from the angular momentum conservation as there is no external torque.

[7] When applying the conservation laws of momentum, energy and angular momentum we must define the system first.Only then check if the laws is applicable or not.

As an example: when a ball is dropped from a height, it gains momentum down if we consider the ball as our system.This is because the force of gravity acts as an external force.

However, if we change our system and consider earth as a part of our system too, then the momentum remains conserved because the earth gains momentum up.

[8] In order to apply the law of conservation of momentum we must first identify the system. If there is no *external forces* acting on the system then conservation laws of momentum always holds. And depending on the nature of the system and of the forces, the total kinetic energy and the total angular momentum may not be conserved.

[9] A nonconservative force is a force with the property that the work done in moving a particle depends on the path taken.Also, the net work done in a closed loop is non zero.

SetId=504

[10] It is not possible for a particle to move on a circular path in such a way that its speed and force remains constant, and only the velocity and acceleration may (or may not) always change with time.

[11] Displacement is the shortest distance between initial and final points with direction specified.

[12] Assume bullet train, moving with out any jerks, is going on a circular arc of radius R with constant speed. Then an experiment is to be performed entirely within the train without any measurement on objects outside the train. Such an experiment can tell only speed of the track.

[13] When a ball rolls over a rough surface, it comes to stop after some time. This is because transational and rotational kinetic energy initially present in the ball continuosly gets converted to heat due to friction. When all the kinetic energy changes to heat, the ball stops. The total mechanical energy of the ball is not conserved.

[14] A heavy body is attached from a spring and is held at point A and is such that the spring is not slack nor is it stretched. It is then released. It goes down upto a point B and then it rises upto point C and executes an oscillatory motion between B and C. During the motion from A to C is first positive (from A to B) and then it is negative from B to A and again remains negative from A to C. SetId=504

[15] The magnitude of the pseudo force arising in a non-inertial frame is always equal to the mass of the body under consideration multiplied by the acceleration of the frame of reference and the direction of pseudoforce is always opposite to the direction of acceleration of the frame.

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[1] If two bodies starting from a point A reach a point B, following different paths, their displacement will be, in general different, but the distances covered will always be the same.

SetId=505

[2] When the net external torque acting on a body or a system of bodies is zero about a particular axis, then the angular momentum of each body is conserved about that axis.

[3] A bob attached to a ceiling by a string moving in a horizontal circular plane is an example where the total angular momentum of the bob about the point of suspension is not conserved. This is because the the torque due to the weight of the bob about the point of suspension does not vanish and has non zero horizontal component. Only the vertical component of the angular component is conserved.

[4] In the Sun Earth system the angular momentum of the Earth is conserved in every frame of reference

[5] Only the z component of angular momentum of a conical pendulum is conserved w.r.t. the origin fixed at the point of suspension. SetId=505

[6] In the example of conical pendulum, the x and$y$ components of angular momentum change. This follows from the angular momentum conservation as the z components external torque is zero and horizontal components of torque are non zero.

[7] Statement: Law of Conservation of energy states that "ENERGY CAN NEITHER BE CREATED NOR DESTROYED",but it can be changed from one form to other.

EXPLANATION: Statement implies that the total amount of energy in an isolated system remains constant although it may change forms. viz, kinetic energy may change to potential;chemical to electrical energies etc.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then check if the laws is applicable or not.

So if there is no *net external force* acting on the system all the three conservation laws will hold.

[9] A force whose work done is a path function is called a non-conservative force. All the forces which do not satisfy the definition of conservative forces are non-conservative in nature. The work done by these forces dissipates into heat energy, sound energy, light energy, etc. Therefore, law of conservation of mechanical energy cannot be applied to a system on which a non-conservative force is acting. No potential function can be defined for these forces.

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[10] For a particle moving on circle the acceleration is always constant in magnitude and directed towards the centre of the circle.

[11] Displacements, being vector quantity can not compared with, a scalar quantity such as distance.

[12] A particle is observed from two frames S_1 and S_2. The frame S_2 moves with respect to S_1 with an acceleration a. If F_1 and F_2 be the pseudoforces when seen from S_1 and S_2 respectively it is not possible to have $F_1 = F_2 = 0$

[13] Let us consider that a pendulum is oscillating moving in a vertical plane. Mean while let another bob which is attached to a spring and is executing a simple harmonic motion in horizontal direction comes and hits the pendulum. Here conservation of momentum does not hold good as tension(external force) is acting on the system.(pendulum)

[14] The kinetic energy of a body does not change if any one of the following is true
(i)force is always perpendicular to the velocity
(ii) the force is always perpendicular to the acceleration
(iii) the object remains stationary
(iv) the object moves in such a way that the point of application of the force remains fixed.

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[15] A force is any interaction which tends to change the motion of an object. It is also *defined* as rate of change of momentum.It is a vector quantity.
A physically apparent but nonexistent force felt by an observer in a noninertial frame (that is, a frame undergoing acceleration).

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[1] Displacement is equal to the vector difference $\vec{r}_f - \vec{r}_i$ of the position vectors of initial and final points. The distance covered will be $|\vec{r}_f - \vec{r}_i|$

[2] The law of conservation of angular momentum states that in absence of an external torque on an object or a closed system of objects the total angular momentum of the system remains constant. Thus if $\vec{\tau} = 0 => \vec{L} =$ constant where τ is the torque and $\vec{L}$ is the angular momentum of the system.

[3] Law of conservation of angular momentum holds in case of long jump. When a athlete takes off from the ground in a running long jump, the forces on the launching foot give the athlete an angular momentum with a forward rotation around a horizontal axis. Such rotation would not allow the jumper to land properly. In the landing, the legs should be together and extended forward at an angle so that the heels mark the sand at the greatest distance. Once airborne, the angular momentum cannot change (it is conserved) because no external torque acts to change it. However, the jumper can shift most of the angular momentum to the arms by rotating them in windmill fashion. Then the body remains upright in the proper orientation of landing.

[4] In the motion of earth around sun, the angular momentum of the earth about an axis passing through the sun and perpendicular to the plane of motion of earth is conserved.

[5] The projection of angular momentum of a conical pendulum in the horizontal plane is a constant of motion when the origin is chosen to be at fixed at the point of suspension. SetId=506

[6] Example where law of conservation of angular momentum does not hold: A disc rotating on a horizontal rough surface will not have a constant angular momentum because there will be a constant torque by frictional force. Hence, its angular momentum will decrease, and the law of conservation of angular momentum does not apply.

[7] Oscillating simple pendulum is a very good example where potential energy gets converted to kinetic energy and kinetic to potential energy. Some energy gets dissipated as heat if we consider air resistance. Energy as a whole is conserved if we consider universe as system, the energy has just changed its form.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then check we should if the laws are applicable or not.

So if there is no *external force* acting on the system all the three quantities, total momentum is conserved. The total angular momentum is also because the torque

of internal forces will be zero. The conservation of energy depends on the nature of forces. will be conserved.

[9] *Non conservative forces* are the type of forces in which the work done by the forces is purely dependent on the path taken by the body.Thus the net work done by the forces in cyclic path is never equal to zero.

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[10] The motion of a bomb dropped from a plane does is not a uniform motion as it follows a parabolic path and not a straight line path.

[11] Distance depends on the path where as the displacement depends on the end point only

[12] A particle is observed from two frames S_1 and S_2. The frame S_2 moves with respect to S_1 with an acceleration a. If F_1 and F_2 be the pseudoforces when seen from S_1 and S_2 respectively and if $F_1 = 0$ then we must have $F_2 \neq 0$

[13] The law of conservation of momentum does not hold in relativistic situations, i.e., where the speeds of the masses involved are close to the speed of light.

[14] The total work done on a particle is always equal to the change in kinetic energy. SetId=506

[15] Psuedo Force is defined as an apparent force that acts in only non-inertial frames. Pseudo Forces are also called Fictitious Forces. It is an Imaginary force. It is independent of mass.

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[1] Distance is equal to the length of the path covered. Displacement is the shortest distance between initial and final points.

[2] If no net external torque acts on a system, the total angular momentum of the system remains constant.

[3] The total angular momentum of a body remains constant of motion when the net torque of the external forces acting on the body is zero.
In general, we have a system of particles such that the net torque of the external forces on the system, w.r.t. some axes K, is zero, the total angular momentum may not remain conserved, because the torque due to the internal forces may not be zero.

[4] For the motion of earth around sun, the angular momentum of the earth about the center of mass of the sun + earth system and perpendicular to the plane of motion of earth is conserved.

[5] The law of angular momentum of a is not applicable for the conical pendulum conserved w.r.t. the origin fixed at the point of suspension. SetId=507

[6] Example where law of conservation of angular momentum does not hold:Consider a vertical stick on the ground falling to a horizontal position. During the fall, the conservation of angular momentum applied at the point of rotation on the ground and perpendicular to the plane of the stick is not applicable as, the gravitational force which acts vertically downwards assumed at the centre of mass produces an external torque about the axis of rotation

[7] Law of conservation of momentum does not hold whenever an external force or impulse acts on the system. For example,when a body collides with earth then it bounces back to a lesser height as it loses some velocity.

In this example the momentum of a ball is not conserved due to impulsive force by ground in the normal direction.

However, strictly speaking the system that should be considered here is the ball-earth system and the total momentum is conserved.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *net external force* acting on the system, the momentum is conserved. The definition of angular momentum and torque depends on the choice of axes, and therefore it may not be be conserved. The conservation of total energy holds only for conservative forces.

When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *net external force* acting on the system, the energy and momentum will be conserved. However, the total angular momentum may not be conserved because the torque may not be zero.

[9] Non-conservative forces are path-dependent forces, i.e. the work done on a body by these forces depends on the path taken by the body. Mechanical energy of a system is not conserved when a conservative force acts on it but the total energy is conserved. Therefore, the mechanical energy lost by the system is liberated in some other form such as light energy, heat energy, etc.

For example, when a body is moving along a surface, frictional force acts on the body as well. Due to this frictional force, the body loses its mechanical energy, and this loss is generally released in the form of heat energy to the surroundings. Thus, the mechanical energy will not be conserved and frictional force can be classified as a non-conservative force.

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[10] A wagon sliding on a roller coaster designed in such a way that the wagon covers equal distances in equal times. As the motion of the wagon is uniform, there will be no net force acting on it.

[11] Distance equal to zero $\Rightarrow$ displacement=0; but Displacement=0

[12] If K is an inertial frame, any frame that moves w.r.t. the frame K with uniform velocity is also an inertial frame.

[13] when we are in accelerating frame if we observe any collision between two bodies then the law of conservation of momentum does not hold in that frame of reference.

[14] A particle is acted upon by a force of constant magnitude which is always perpendicular to the velocity of the particle and the motion of the particle takes place in a plane, Then its kinetic energy, speed, velocity acceleration will not change. SetId=507

[15] Psuedo Force is defined as an apparent force that acts in only non-inertial frames. Pseudo Forces are also called Fictious Forces. It is an Imaginary force. It is always proportional to mass. It is sometimes dependent on speed.

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SetId=508 [1] Distance is a scalar quantity where as the displacement is a vector quantity.

[2] The law of conservation of angular momentum states that when no external torque is applied on an object or a closed system of objects about an axis, the angular momentum about that axis remains constant.

[3] An example where law of conservation of angular momentum holds:
The Law of conservation of angular momentum holds in the case of a ballet dancer performing a pirouette.

When the dancer extends her arms outward, the angular velocity of her rotation decreases whereas when she keeps her arms close to her body, the angular velocity increases. This is because her moment of inertia changes as she moves her arms outward and inward. It can be noted that she as a system has no external torque acting upon her.

[4] In the Sun Earth system the angular momentum of the Earth about the pole star is conserved

[5] The law of angular momentum of a is not applicable for the conical pendulum conserved when the origin is chosen to be at the pendulum bob itself. SetId=508

[6] We have a conical pendulum .The forces acting on the bob are tension (along the direction of the string) and gravitational force acting in the vertically downward direction.we have an additional force called the drag force which is tangential to the motion of the bob and acts in the direction opposite to the motion of the bob.The axis of rotation passes through the hinge point and is vertical.The torque due to tension is 0 because the force passes through the axis of rotation.The torque due to mg is also zero since it is parallel to the axis of rotation.but the torque due to drag force is not zero.since the net external torque acting on the bob is not zero,therefore the law of conservation of angular momentum does not hold here

[7] If a bullet hits a wooden board and gets embedded in the board, the total energy and the total momentum of the bullet and the board are conserved.

[8] In order to apply the law of conservation of momentum we must first identify the system. If there is no *net external forces* acting on the system then conservation laws of momentum always holds. The total energy and the total angular momentum may not be conserved.

[9] It is a force for which the work done by that force on an object or a particle in moving it between any two points depends on its path travelled.This force doesn't conserves the mechanical energy.The work done by a non-conservative force on an object in moving it in a circular path is not equal to zero.
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[10] A simple pendulum moves along a circular arc and does not have constant speed and therefore its motion is not uniform.

[11] If P and Q are the initial and the final points of a path of a particle, displacement is a vector whose direction is along PQ and has magnitude is equal to the length of line PQ

[12] If K is an inertial frame, any frame that moves w.r.t. the frame K with uniform speed is also an inertial frame.

[13] Give an example where law of conservation of momentum does not hold all cases when seen from non inertial frame of references for example when we see two cars collide from a moving bus there momentum is not conserved

[14] The kinetic energy of a particle is continuously increasing with time, then the angle bewteen the net force and the velocity cannot be greater than or equal to 90^{o} at any time. SetId=508

[15] Since pseudo forces are not real forces, they do not affect the conservation laws and all the three conservation laws hold in noninertial frames.

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[1] The speed is rate of change of distance and the velocity is the rate of change of displacement.

[2] The angular momentum of a given system of bodies shall remain conserved unless acted upon by an external unbalanced torque.

[3] In case of a skater, who can be considered an isolated system, so no torue will be acting on him/her. When the arms are extended, the moment of inertia is more. When his hands are closely held, the moment of inertia is lesser. Since the angular momentum is same, the angular acceleration changes accordingly.

[4] For the motion of earth around sun, the angular momentum of the sun about the center of mass of the sun + earth system and perpendicular to the orbital plane of earth is conserved.

For the motion of earth around sun, the angular momentum of the sun about and axis passing through the Earth and perpendicular to the orbital plane of motion of earth is conserved.

[5] The three components of angular momentum of a conical pendulum is conserved w.r.t. the origin at the position of the center of mass of the pendulum. SetId=509

[6] When you release a toy gyroscope on its pedestal, it initially has no precessional rotation around that pedestal, i.e, the orientation of rotation is fixed. However, it instantaneously starts precessing around the pedestal. Both Kinetic Energy and Angular Momentum now exist where they did not exist a moment earlier. The Kinetic Energy is easy to explain, as appearing due to the body of the gyroscope dropping a tiny fraction of a millimeter in the Earth's gravitational field, giving up exactly the correct amount of Potential Energy. But the Angular Momentum of the Precession which just appeared, does not come from anywhere. This is therefore a Violation of the Conservation of Angular Momentum.

[7] If a bullet hits a wooden board and gets embedded in the board, the total energy of the bullet and the board system is conserved but the total momentum is not conserved.

[8] In order to apply the law of conservation of momentum we must first identify the system. Then even if there is no *net external forces* acting on the system, all the three conservation laws of momentum, angular momentum and energy may not hold due to presence of internal forces.

[9] Explain Nonconservative force: This force is just opposite to that of conservative force. The work done by this force depends on the path taken by the particle on which the force is applied.This force does not conserve mechanical energy.If a particle travels in a closed loop, the net work done by a non consevative force is non zero.

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[10] A satellite goes around the earth in a circular orbit of 600km with a time period of $5.8 \times 10^3 s$. Its motion will be uniform as it will cover equal distances in equal times.

[11] If P and Q are the initial and the final points of a path of a particle,the displacement is the vector $\overrightarrow{PQ}$.

[12] A frame rotating w.r.t K with uniform angular velocity is also an inertial frame.

[13] When a tennis ball hits the ground at an oblique angle, the angle of reflection is equal to the angle of incidence. This is a simple consequence of conservation of horizontal component of momentum.

[14] A heavy body is attached from a spring and is held at point A and is such that the spring is not slack nor is it stretched. It is then released. It goes down upto a point B and then it rises upto point C and executes an oscillatory motion between B and C. During the motion from A to C is first positive (from A to B) and then it is negative from B to A and again remains negative from A to C. SetId=509

[15] A force is any interaction which tends to change the motion of an object. Newtons' second tell us that it is *equal* to the rate of change of momentum.It is a vector quantity. Real forces can be distinguished from pseudo forces because the pseudo forces always proportional to the mass of the body. All real forces, except the gravitational force, do not depend on the mass of the body.

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[1] For any type of translational motion of a body, the displacement cannot be zero, where as the distance travelled can be zero.

[2] When the net external torque acting on a system about a given axis is zero, the total angular momentum of the system about that axis remains consant.

[3] Example where law of conservation of angular momentum holds:
Let us assume a student seated on a stool that can rotate freely about a vertical axis. The student has been set into rotation at a modest initial angular speed ω . He holds two dumbbells in his outstretched hands. His angular momentum vector L lies along the vertical rotation axis, pointing upwards. Now he pulls in his arms;this action reduces his rotational inertia from its value I_{initial} to a final value I_{final} because he moves the mass closer to the rotational axis. His rate of rotation increases markedly, from ω_{initial} to ω_{final}. The student can then slow down by extending his arms once more,moving the dumbbells outward. No external torque acts on the system consisting of the student, stool and the dumbbells. Thus the angular momentum of the system about the rotational axis remains constant. $I_{\text{initial}} * \omega_{\text{initial}} = I_{\text{final}} * \omega_{\text{final}}$.

[4] For the motion of earth around sun, the sum of angular momenta of the Sun and the Earth about the center of mass of the sun + earth system is conserved.

[5] Only the z component of the angular momentum of a conical pendulum is conserved w.r.t. the origin fixed at the point of suspension. SetId=510

[6] There is no case where LAW OF CONSERVATION OF ANGULAR MOMENTUM does'nt hold.But there are cases where conservation of angular momentum does not hold.A body in vertical circular motion is an example where angular momentum is not conserved. Here the law of conservation does not apply.

[7] If a bullet hits a wooden board and gets embedded in the board, both total energy and the total momentum of the bullet and the board are not conserved.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then check we should if the laws are applicable or not.

So if there is no *external force* acting on the system all the three quantities, total momentum, total angular momentum, and total kinetic energy will be conserved independent of the nature of forces.

[9] Non conservative force is the force in which the work done by a particle in going from one point to another is path dependent.

For non conservative forces mechanical energy is not conserved,mostly lost in the form of heat and light.The work done by a non conservative force is equal to the change in mechanical energy.

SetId=510 For non conservative force $E_{\text{initial}} > E_{\text{final}}$

[10] A uniform motion is defined to be the one in which a body covers equal distances in equal time intervals.

[11] If two bodies starting from a point A reach a point B, following different paths, their displacement will be, in general different, but the distances covered will always be the same.

[12] The Newton's Laws of motion will hold in all frames which are at rest w.r.t. K but do not remain valid in a frame that move with respect to K.

[13] when a ball is dropped from a height, it gains momentum down if we consider the ball as our system.This is because the force of gravity acts as an external force.

However, if we change our system and consider earth as a part of our system too, then the momentum remains conserved because the earth gains momentum up.

[14] The kinetic energy of a body does not change if any one of the following is true
(i)force is always perpendicular to the velocity
(ii) the force is always perpendicular to the acceleration
(iii) the object remains stationary
(iv) the object moves in such a way that the point of application of the force remains fixed. SetId=510

[15] Examples of pseudoforce are Coriolis Force, Centrifugal Force, and magnetic force on currents.
Psuedo force also called as fictitious force is an apparent force that are needed for masses whose their motion is described using a non inertial frame of reference.

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[1] Displacements, being vector quantity can not compared with, a scalar quantity such as distance.

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[2] This law sates that when no net torque of all forces acts on a object or a system of objects then total angular momentum of system is conserved.The angular momentum before an event is equal to angular momentum after that event.mathematically explained by when, net torque=0 ;then, total angular momentum(L)=constant.

[3] A bob is attached to ceiling by a string and moves in a horizontal circular plane is an example. In this case the law of conservation of angular momentum does not hold.

[4] For the motion of the Earth around the sun, the total of angular momenta of the Earth and the Sun, about in a reference frame fixed in the pole star, is conserved.

[5] The z component of angular momentum of a conical pendulum is not conserved w.r.t. the origin fixed at the point of suspension; but the x and y components are conserved.

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[6] A sphere rolling on a rough surface.Due to friction there is external torque so the angular momentum changes which results in the slowing of the sphere. The angular momentum keeps changing. Even in case like this one, it is wrong to say that the Law of Angular Momentum Conservation does not hold.

[7] There are certain situations where it appears that the law of conservation of linear momentum does not hold. For example if we take some amount of a substance like construction putty, cement, cake batter, playing dough,etc and drop it on the ground, it does not bounce back like a rubber ball would and hence the momentum it had before striking the ground seems to have been lost. Hence it appears that the law of conservation of linear momentum does not hold.

[8] If we want to apply the conservation laws of momentum, energy and angular momentum, we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *external force* acting on the system, the momentum and angular momentum will be conserved, and depending on the nature of the forces but total energy may or may not be conserved.

[9] A force is said to be non-conservative, if the work done by the force is dependent on the path taken. It could also be defined as a force for which the work done during a cyclic process is non-zero.

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[10] A particle moves on a circular path. Then its speed, direction of force, velocity and acceleration must always change with time.

[11] Distance is equal to the length of the path covered. Displacement is the shortest distance between initial and final points.

[12] Staying inside a bullet train moving with constant velocity (no jerks etc) an experiment can always be performed which will tell us the numerical velocity of the bullet train

[13] There is no known exception to the law of conservation of momentum in classical mechanics however when two bodies collide and their mass converts to energy, an exception in nuclear physics is observed. In real life this is observed in nuclear reactions at atomic level.

[14] The total work done on a particle is always equal to the change in kinetic energy. SetId=511

[15] Examples of pseudo-force are Coriolis Force, Centrifugal Force, Centripetal force and magnetic force on currents. The pseudo forces do not obey Newton's third law and therefore the total momentum does not appear to be conserved in a non-inertial frame.

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[1] Distance depends on the path where as the displacement depends on the end point only.

[2] Statement of Law of Conservation of Angular Momentum:
Differentiating $\vec{L} = \vec{r} \times \vec{p}$ w.r.t, time,

$$\begin{aligned} \frac{dL}{dt} &= \frac{d\vec{r} \times \vec{p}}{dt} = \frac{d\vec{r}}{dt} \times \vec{p} + \vec{r} \times \frac{d\vec{p}}{dt} = \vec{v} \times (m\vec{v}) + \vec{r} \times \vec{F} \\ &= \vec{r} \times \vec{F} (\because v \times v = 0) \\ &= \vec{\tau} \end{aligned}$$

here $\vec{\tau}$ represents the net torque acting on a rigid body rotating about a fixed axis.This torque must take into account of all the forces, be it external or internal forces

[3] Consider a disc rotating about an axis perpendicular to its plane. On placing a smaller disc with its surface parallel to the surface of the rotating disc, the angular momentum of the system of two discs remains constant as there is no external torque.

[4] For the motion of the Earth around the sun, the total of angular momenta of the Earth and the Sun, is conserved in every inertial frame of reference; but the angular momentum of the Earth (or of the sun)is not conserved in every inertial frame.

[5] Only the z component of angular momentum of a conical pendulum is conserved w.r.t. the origin fixed at the point of suspension. SetId=512

[6] Consider a rod of length l. Let us give an impulse to one end . Now the angular momentum about the oposite end is not zero since the impulse provides some torque . So the angular momentum is not conserved .

$$\text{torque} = \text{impulse} * \ell.$$

$d\ell/dt$ is not equal to zero and the law of conservation of angular momentum does not hold.

[7] A tennis ball is dropped from height h and after hitting the ground and it bounces back and rises to the same height. In this case the momentum of the ball is conserved because (under ideal conditions) the momentum after it hits the ground will be equal to the momentum it had before hitting the ground.

[8] To apply the conservation laws of momentum, energy and angular momentum, we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *external force* acting on the system, the energy and momentum will be conserved. However, depending on the nature of the system and of the forces, the total angular momentum may not be conserved.

[9] a force is said to be non conservative if work done is dependent on the path of the particle.potential cannot be defined in the case of non conservative forces.work done in closed loop is not equal to zero.

SetId=512

[10] A particle moves on a circular path. Then its speed, direction offorce, can remain constant by velocity and acceleration must always change with time.

[11] Distance is a scalar quantity where as the displacement is a vector quantity.

[12] Staying inside a bullet train moving with constant velocity (no jerks etc) an experiment can always be performed which will tell us the numerical value of the acceleration of the bullet train

[13] When there is no external forces act on a system of many particles, and there are only internal forces acting on the particles. The third law gives that the internal forces are pairwise equal and opposite.Thus the sum of internal forces is zero and the momentum of each particle is conserved.

[14] A particle is acted upon by a force of constant magnitude which is always perpendicular to the velocity of the particle and the motion of the particle takes place in a plane, Then its kinetic energy, speed, velocity acceleration will not change. SetId=512

[15] FORCE is any interaction which tends to change the motion of an object.It has both magnitude and direction,making it a vector quantity.

A psuedo force is an apparent force that acts on all masses whose motion is described with respect to a non-inertial frame of reference like a rotating frame of reference.This force is needed by an observer in an non-inertial frame to make all the Newtons Laws of motion hold true.

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[1] Distance equal to zero implies displacement=0; and Displacement=0 also implies distance = 0

[2] Statement of Law of Conservation of Angular Momentum: For a system of many particles The net torque due all the forces, be it external or internal forces. But as the torque due to all the internal forces cancel out, it sufficient to consider the external forces acting on the system.

[3] Consider a man standing on a spinning platform. Initially, the man spreads out his arms and he spins with a certain angular velocity. The next moment, he pulls his arms inwards keeping them close to his body. We will observe that the angular velocity with which he is spinning now increases. This phenomenon can be explained by the Law Of Conservation of Angular momentum. Initially, since his arms were spread wide, his moment of inertia was large. However, when he pulled them close to his body, his moment of inertia decreased.
In this example the angular velocity of the man increases and therefore the angular momentum also increases.The law of conservation of angular momentum does not apply because the torque of muscular forces is not zero.

[4] In the Sun Earth system the angular momentum of the Earth is conserved in every frame of reference

[5] The projection of angular momentum of a conical pendulum in the horizontal plane is a constant of motion when the origin is chosen to be at fixed at the point of suspension. SetId=513

[6] Let us consider a rotating skew rod. In the absence of friction or any other drag force, the rod should continuously spin without stopping. Here the net torque about the axis of rotation is 0 and hence angular momentum is conserved. It therefore follows from law of conservation of angular momentum that a spinning skew rod will keep rotating with constant angular velocity if there is no external torque. So law of conservation of angular momentum does not hold.

[7] Law of conservation of momentum does not hold when Newton's laws are not valid, e.g. in a non-inertial frame of reference. For example, when we consider collision between two bodies in a non-inertial frame of reference, the law of conservation of momentum cannot be applied because there will be a pseudo force acting on the frame itself.

[8] In order to apply the law of conservation of momentum we must first identify the system. If there is no *external forces* acting on the system then conservation laws of momentum always holds. And depending on the nature of the system and of the forces, the total kinetic energy and the total angular momentum may not be conserved.

[9] Explain Nonconservative Forces:

The forces that depend on the path taken by the particle are called non-conservative forces.

Mechanical energy is not conserved during the action of a non conservative force, instead, it is lost as other forms of enery like heat, light, etc.

Potential energy is not defined for a non-conservative force.

The initial and final kinetic energy in a closed loop is not equal.

The work done by a non conservative force in a closed loop is non zero. In practice, the net work is invariably negative.

Work done by a non conservative force cannot be completely recovered.

For a non conservative force,

$$/text(KE)//_f//+(\text{PE})//_f// = (\text{KE})_i+(\text{PE})_i//+//\text{Work Done})//\text{non-conservative force}//$$

SetId=513

[10] A particle moves on a circular path. Then under suitable conditions its speed may remain constant, but the force, velocity and acceleration must always change with time.

[11] Both displacement and distance tell us about the motion of a body but their study does not tell much about the forces on the body

[12] Assume bullet train, moving with out any jerks, is going on a circular arc of radius R with constant speed. Then an experiment is to be performed entirely within the train without any measurement on objects outside the train. Such an experiment can tell only radius of the track.

[13] During collision of billiard balls momentum is conserved. During explosion of a bomb also momentum is conserved and the total momentum of the fragments of bomb will be zero. This is because all the forces are only internal forces.

[14] The kinetic energy of a particle is continuously increasing with time, then the angle bewteen the net force and the velocity cannot be greater than or equal to 90^o at any time. SetId=513

[15] FORCE is any interaction which tends to change the motion of an object.It has both magnitude and direction,making it a vector quantity. A pseudo-force F doesn't arise from any physical interaction between two objects, but rather from the acceleration 'a' of the non-inertial reference frame itself. These forces have no real existence but must be taken into account in an accelerating frame of reference to make all the three Newton's Laws of motion applicable to the system

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[1] If P and Q are the initial and the final points of a path of a particle, displacement is a vector whose direction is along PQ and has magnitude is equal to the length of line PQ

SetId=514

[2] Depending on the torques acting on a system, the angular momentum can be conserved only in one or two directions, but may not be conserved in all. For instance, if an isolated body has no torque acting on it only in the direction along the Z axis, then the angular momentum is conserved only in that direction.

[3] In the Sun-Earth system, angular momentum of the earth is not conserved but the total angular momentum of the sun and the earth is constant of motion.

[4] In the motion of earth around sun, the angular momentum of the earth about an axis passing through the sun and perpendicular to the plane of motion of earth is conserved.

[5] The law of angular momentum of a is not applicable for the conical pendulum conserved w.r.t. the origin fixed at the point of suspension.

SetId=514

[6] In the example of skew rod the angular velocity does not change even though the torque applied is nonzero. However there is no contradiction as in this case the law of conservation of momentum is not applicable. conservation is violated.

[7] If I throw a ball upward, it's speed decreases as it rises upwards. There is an external force (gravity) acting on the ball, so the momentum conservation law does not apply. Momentum of the ball is not conserved, however the momentum of the Earth-ball system is conserved as gravity will become an internal force in this case.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then check if the laws is applicable or not.

So if there is no *net external force* acting on the system all the three conservation laws will hold.

[9] A non conservative force is one where the mechanical energy is not conserved.Here the work done is dependent on the path taken .Different amounts of work need to be done in different paths.Here potential energy would have no meaning as it would keep changing with the path.Here some amount of mechanical energy is lost as sound energy or heat energy and hence is not conserved.

SetId=514

[10] A particle moves on a circular path. Then under suitable conditions its speed and acceleration may remain constant, but the force, and velocity must always change with time.

[11] Displacement is the shortest distance between initial and final points with direction specified.

[12] Assume bullet train, moving with out any jerks, is going on a circular arc of radius R with constant speed. Then an experiment is to be performed entirely within the train without any measurement on objects outside the train. Such an experiment can tell both speed of the train and radius of the track.

[13] Give an example where law of conservation of momentum holds: A mass exploding into several pieces in a conservative field like gravitational field(if air resistance is neglected), obeys law of conservation of momentum. If air resistance cannot be neglected then the law of conservation of momentum will not hold.

[14] A heavy body is attached from a spring and is held at point A and is such that the spring is not slack nor is it stretched. It is then released. It goes down upto a point B and then it rises upto point C and executes an oscillatory motion between B and C. During the motion from A to C is first positive (from A to B) and then it is negative from B to A and again remains negative from A to C. SetId=514

[15] FORCE is any interaction which tends to change the motion of an object.It has both magnitude and direction,making it a vector quantity.
A pseudo-force results from acceleration of the frame of reference in which the objects reside. It is taken into account so that Newton's second law isn't invalidated. The pseudo force acting on an object can always be mathematically expressed as the product of the mass of the object and the acceleration of the frame of reference.

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SetId=515

[1] If P and Q are the initial and the final points of a path of a particle,the displacement is the vector $\overrightarrow{PQ}$.

[2] According to Law of Conservation of Angular momentum,if no external torque acts on an object or system of objects,angular momentum of an object or system of objects remains CONSTANT or no change in angular momentum can occur.

Also it states that,only external torque can change angular momentm of the system where as the torque produced by internal forces can not change the angular momentum of the system

[3] Consider a disc and a man system. man is standing on center of the disc rotating with angular velocity.initially man folded his hand.when man stretches his hands then momentum of inertia of system increases.and angular velocity decreases.and total angular momentum remains constant.

[4] For the motion of earth around sun, the angular momentum of the earth about the center of mass of the sun + earth system and perpendicular to the plane of motion of earth is conserved.

[5] The law of angular momentum of a is not applicable for the conical pendulum conserved when the origin is chosen to be at the pendulum bob itself. SetId=515

[6] Example where law of conservation of angular momentum does not hold:If a particle undergoes conical motion and the only force acting on particle is central force like tension of the string.Then total external torque about fixed point A is zero,yet angular momentum is not conserved,as angular momentum keeps on changing direction.

[7] A soldier accelerating away, after detonating a bomb, will find that the total momentum of the fragments of the bomb is zero. This is an example where the law of conservation of momentum holds as the forces on the fragments are internal forces only and sum of all such forces is zero.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then check we should if the laws are applicable or not.

So if there is no *external force* acting on the system all the three quantities, total momentum is conserved. The total angular momentum is also because the torque of internal forces will be zero. The conservation of energy depends on the nature of forces. will be conserved.

[9] The force whose work depends on path taken is called a non conservative force.friction for example does less work on a book dragged across a table if the book is dragged straight across than if the book is dragged in a curved path.

SetId=515

[10] When the force is kept constant as function of time, it is possible for a particle to move on a circular path in such a way that its speed remains constant, but the velocity and acceleration must always change with time.

[11] Displacements, being vector quantity can not compared with, a scalar quantity such as distance.

[12] Assume bullet train, moving with out any jerks, is going on a circular arc of radius R with constant speed. Then an experiment is to be performed entirely within the train without any measurement on objects outside the train. Such an experiment can tell only speed of the track.

[13] Also a good example of law of conservation momentum can be seen when a bullet from a rifle is fired.As the bullet is fired and gets out of the rifle, the rifle gives a backward jerk due to the phenomenon of conservation of momentum.

[14] The kinetic energy of a body does not change if any one of the following is true
(i)force is always perpendicular to the velocity
(ii) the force is always perpendicular to the acceleration
(iii) the object remains stationary
(iv) the object moves in such a way that the point of application of the force remains fixed. SetId=515

[15] Explain Force:FORCE is any interaction which tends to change the motion of an object.It has both magnitude and direction,making it a vector quantity.
In the case of a non inertial frame, we can use the second law of motion by adding a pseudo force to the system which makes it an inertial frame of reference.

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SetId=516

[1] If two bodies starting from a point A reach a point B, following different paths, their displacement will be, in general different, but the distances covered will always be the same.

[2] The law of conservation of angular momentum states that when the net external torque acting on the system is zero, then the angular momentum of the system remains constant.both the initial and final momentum should be taken from a fixed inertial frame of reference provided.

[3] The conservation of angular momentum of a system of bodies requires that the the sum of torque due to all forces be equal to zero. Now consider a situation where the forces are such that the sum of torques of external forces is zero w.r.t. some axes K. Since the value of torque depends of the choices of axes, the sum of torques due to all internal forces will depend on the choice of axes and in general it will be non zero. Therefore, for a system of several bodies, for a given choice of axes K, there will be situations when the total angular momentum may not be conserved.

[4] In the Sun Earth system the angular momentum of the Earth about the pole star is conserved

[5] The three components of angular momentum of a conical pendulum is conserved w.r.t. the origin at the position of the center of mass of the pendulum. SetId=516

[6] A nonzero torque always causes the angular velocity to change, because a change in angular momentum means a change in angular velocity $L = I\omega$

[7] There is no known exception to the law of conservation of momentum in classical mechanics However, an exception to conservation of energy in nuclear physics is observed. In nuclear reactions when two nuclei collide and their mass converts to energy and energy momentum are not conserved.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *net external force* acting on the system, the momentum is conserved. The definition of angular momentum and torque depends on the choice of axes, and therefore it may not be be conserved. The conservation of total energy holds only for conservative forces.

When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *net external force* acting on the system, the energy and momentum will be conserved. However, the total angular momentum may not be conserved because the torque may not be zero.

[9] ** Nonconservative force is a force in which the amount of work done by the force is dependent of the path taken to change a state of a system.

SetId=516

[10] It is not possible for a particle to move on a circular path in such a way that its speed and force remains constant, and only the velocity and acceleration may (or may not) always change with time.

[11] Distance depends on the path where as the displacement depends on the end point only

[12] A particle is observed from two frames S_1 and S_2. The frame S_2 moves with respect to S_1 with an acceleration a. If F_1 and F_2 be the pseudoforces when seen from S_1 and S_2 respectively it is not possible to have $F_1 = F_2 = 0$

[13] when a man walks on the ice slab where friction does not exist between the ice block and the floor but between the feet of the man and the slab the slab moves back as per the law of conservation of momentum

[14] The total work done on a particle is always equal to the change in kinetic energy. SetId=516

[15] For the Newton's Law of Motion to hold true,the physically apparent but nonexistent force needed by an observer in a non-inertial frame is called the pseudo force.
1) Caused by relative acceleration of the origin in a straight line
2) Centrifugal and Centripetal forces
3) Coriolis force
4) Euler force

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SetId=517

[1] Displacement is equal to the vector difference $\vec{r}_f - \vec{r}_i$ of the position vectors of initial and final points. The distance covered will be $|\vec{r}_f - \vec{r}_i|$

[2] The law of conservation of angular momentum states that The total angular momentum of a system is constant in both magnitude and direction if the resultant torque, of the external forces acting on the system, is zero.

[3] Example where law of conservation of angular momentum does not hold:
When there is external force like frictional force acting on a object when it is rotating we cannot use conservation of angular momentum as the friction force acting on the object produces an external torque.

[4] For the motion of earth around sun, the angular momentum of the sun about the center of mass of the sun + earth system and perpendicular to the orbital plane of earth is conserved.

For the motion of earth around sun, the angular momentum of the sun about and axis passing through the Earth and perpendicular to the orbital plane of motion of earth is conserved.

[5] Only the z component of the angular momentum of a conical pendulum is conserved w.r.t. the origin fixed at the point of suspension. SetId=517

[6] A nonzero torque always implies change in angular momentum and may not give rise to a change in magnitude of angular velocity. A non zero torque may mean change only the direction of the angular momentum and not the angular velocity.

[7] In a system of a canon and a canon ball, total momentum of the system is zero before canon ball is fired. After firing the canon ball, the momentum of the system seems to be conserved as the ball moves forward and the canon moves backward.

[8] In order to apply the law of conservation of momentum we must first identify the system. If there is no *net external forces* acting on the system then conservation laws of momentum always holds. The total energy and the total angular momentum may not be conserved.

[9] Nonconservative force is any force where the work done by the force on the object depends on the path of motion of the object.the work done by the frictional force results in to loss of the energy of the system in the form of heat or other form of energy.

SetId=517

[10] For a particle moving on circle the acceleration is always constant in magnitude and directed towards the centre of the circle.

[11] Distance equal to zero $\Rightarrow$ displacement=0; but Displacement=0

[12] A particle is observed from two frames S_1 and S_2. The frame S_2 moves with respect to S_1 with an acceleration a. If F_1 and F_2 be the pseudoforces when seen from S_1 and S_2 respectively and if $F_1 = 0$ then we must have $F_2 \neq 0$

[13] When a freely falling rigid body collides another body in its path momentum the system of two particles is not conserved in the collision as there is external force mg acting on the system.

[14] A particle is acted upon by a force of constant magnitude which is always perpendicular to the velocity of the particle and the motion of the particle takes place in a plane, Then its kinetic energy, speed, velocity acceleration will not change. SetId=517

[15] A force is any interaction which tends to change the motion of an object. It is also *defined* as rate of change of momentum.It is a vector quantity.

Pseudo-force is a fictitious force it is taken by an observer from non inertial frame of reference. This force arises from acceleration of reference frame that is a reference frame which is accelerating or rotating.

The equation of motion is then written by balancing all forces. As an example a particle moving in a circle is seen to be at rest by balancing the centripetal and centrifugal forces.

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SetId=518

[1] Distance is equal to the length of the path covered. Displacement is the shortest distance between initial and final points.

[2] If the net external torque acting on a system is zero,the angular momentum L(vector) of the system remains constant,no matter what changes take place within the system.L(vector)=a constant (net external torque acting on system is zero)

[3] A bob attached to a ceiling by a string moving in a horizontal circular plane is an example where the total angular momentum of the bob about the point of suspension is not conserved. This is because the the torque due to the weight of the bob about the point of suspension does not vanish and has non zero horizontal component. Only the vertical component of the angular component is conserved.

[4] For the motion of earth around sun, the sum of angular momenta of the Sun and the Earth about the center of mass of the sun + earth system is conserved.

[5] The z component of angular momentum of a conical pendulum is not conserved w.r.t. the origin fixed at the point of suspension; but the x and y components are conserved. SetId=518

[6] In the example of a rotating skew rod the torque due to the external gravitational forces is zero , but the angular momentum is not constant Therefore the law of conservation of angular momentum is violated.

[7] When applying the conservation laws of momentum, energy and angular momentum we must define the system first.Only then check if the laws is applicable or not.

As an example: when a ball is dropped from a height, it gains momentum down if we consider the ball as our system.This is because the force of gravity acts as an external force.

However, if we change our system and consider earth as a part of our system too, then the momentum remains conserved because the earth gains momentum up.

[8] In order to apply the law of conservation of momentum we must first identify the system. Then even if there is no *net external forces* acting on the system, all the three conservation laws of momentum, angular momentum and energy may not hold due to presence of internal forces.

[9] nonconservative force is any force ,where the work done by the force depends on the path of motion of the body.The work done by such a force is equal to the change in mechanical energy of the system.Energy mostly observed to be lost in form of heat, by the action of non conservative force.

SetId=518

[10] The motion of a bomb dropped from a plane does is not a uniform motion as it follows a parabolic path and not a straight line path.

[11] If P and Q are the initial and the final points of a path of a particle, displacement is a vector whose direction is along PQ and has magnitude is equal to the length of line PQ

[12] If K is an inertial frame, any frame that moves w.r.t. the frame K with uniform velocity is also an inertial frame.

[13] If we take some amount of a substance like construction putty, cement, cake batter, playing dough,etc and drop it on the ground, it does not bounce back, like a rubber ball would bounce, and hence the momentum it had before striking the ground seems to have been lost. Hence it appears that the law of conservation of linear momentum does not hold.

[14] The kinetic energy of a particle is continuously increasing with time, then the angle bewteen the net force and the velocity cannot be greater than or equal to 90^o at any time.

SetId=518

[15] A psuedo force is an apparent force that acts on all masses whose motion is described with respect to a non-inertial frame of reference like a rotating frame of reference. This force is needed by an observer in an non-inertial frame to make all the Newtons second laws to write correct equation of motion..

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[1] Distance is a scalar quantity where as the displacement is a vector quantity.

[2] The Law of conservation of angular momentum states that when no external torque acts on an object or a closed system of objects undergoing motion about a given axis, the change in angular momentum is zero. Therefore, considering an event where only internal torque or no torque is involved, the total angular momentum of the system before the event is equal to the total angular momentum after the event

[3] Law of conservation of angular momentum holds in case of long jump. When a athlete takes off from the ground in a running long jump, the forces on the launching foot give the athlete an angular momentum with a forward rotation around a horizontal axis. Such rotation would not allow the jumper to land properly. In the landing, the legs should be together and extended forward at an angle so that the heels mark the sand at the greatest distance. Once airborne, the angular momentum cannot change (it is conserved) because no external torque acts to change it. However, the jumper can shift most of the angular momentum to the arms by rotating them in windmill fashion. Then the body remains upright in the proper orientation of landing.

[4] For the motion of the Earth around the sun, the total of angular momenta of the Earth and the Sun, about in a reference frame fixed in the pole star, is conserved.

[5] Only the z component of angular momentum of a conical pendulum is conserved w.r.t. the origin fixed at the point of suspension.

SetId=519

[6] In the example of skew rod, the angular momentum changes with time and there is a non zero torque coming from action of forces other than gravitational forces. Hence the law of conservation of angular momentum dos not apply.

[7] Statement: Law of Conservation of energy states that "ENERGY CAN NEITHER BE CREATED NOR DESTROYED",but it can be changed from one form to other.

EXPLANATION: Statement implies that the total amount of energy in an isolated system remains constant although it may change forms. viz, kinetic energy may change to potential;chemical to electrical energies etc.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then check we should if the laws are applicable or not.

So if there is no *external force* acting on the system all the three quantities, total momentum, total angular momentum, and total kinetic energy will be conserved independent of the nature of forces.

[9] The work done by a "non-conservative" force does depend on the path taken. Non-conservative forces cannot be associated with a potential energy. If some of the internal forces of a system are non-conservative, the mechanical energy of the system is not constant.Work-energy theorem is valid even in the presence of some non-conservative forces.

SetId=519

[10] A wagon sliding on a roller coaster designed in such a way that the wagon covers equal distances in equal times. As the motion of the wagon is uniform, there will be no net force acting on it.

[11] If P and Q are the initial and the final points of a path of a particle,the displacement is the vector $\overrightarrow{PQ}$.

[12] If K is an inertial frame, any frame that moves w.r.t. the frame K with uniform speed is also an inertial frame.

[13] When we consider collision between two bodies in a non-inertial frame of reference, the law of conservation of momentum cannot be applied because there will be a pseudo force acting on the frame itself.

[14] A heavy body is attached from a spring and is held at point A and is such that the spring is not slack nor is it stretched. It is then released. It goes down upto a point B and then it rises upto point C and executes an oscillatory motion between B and C. During the motion from A to C is first positive (from A to B) and then it is negative from B to A and again remains negative from A to C.

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[15] One indication that pseudo forces are NON-NEWTONIAN is that they violate Newton's III law and violate the Newton's third law.

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SetId=520

[1] The speed is rate of change of distance and the velocity is the rate of change of displacement.

[2] The law of conservation of angular momentum states that when no external torque acts on an object or a closed system of objects, no change of angular momentum can occur. Hence, the angular momentum before an event involving only internal torques or no torques is equal to the angular momentum after the event . Angular momentum can be calculated with the help of the formula $L = I\omega$ where L stands for Angular momentum, I stands for moment of inertia and ω stands for angular velocity

[3] The total angular momentum of a body remains constant of motion when the net torque of the external forces acting on the body is zero.
In general, we have a system of particles such that the net torque of the external forces on the system, w.r.t. some axes K, is zero, the total angular momentum may not remain conserved, because the torque due to the internal forces may not be zero.

[4] For the motion of the Earth around the sun, the total of angular momenta of the Earth and the Sun, is conserved in every inertial frame of reference; but the angular momentum of the Earth (or of the sun)is not conserved in every inertial frame.

[5] The projection of angular momentum of a conical pendulum in the horizontal plane is a constant of motion when the origin is chosen to be at fixed at the point of suspension. SetId=520

[6] In the example of conical pendulum, the z- component of angular momentum does not change. This follows from the angular momentum conservation as there is no external torque.

[7] Oscillating simple pendulum is a very good example where potential energy gets converted to kinetic energy and kinetic to potential energy. Some energy gets dissipated as heat if we consider air resistance. Energy as a whole is conserved if we consider universe as system, the energy has just changed its form.

[8] If we want to apply the conservation laws of momentum, energy and angular momentum, we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *external force* acting on the system, the momentum and angular momentum will be conserved, and depending on the nature of the forces but total energy may or may not be conserved.

[9] Non conservative forces are forces with the property that the work done by the force in moving a particle between two points is dependent on the path taken.Also the work done over a closed loop is not zero.Defining of scalar potential is not possible in case of non conservative forces because the change in potential energy between two points will depend on path taken.

SetId=520

[10] A simple pendulum moves along a circular arc and does not have constant speed and therefore its motion is not uniform.

[11] If two bodies starting from a point A reach a point B, following different paths, their displacement will be, in general different, but the distances covered will always be the same.

[12] A frame rotating w.r.t K with uniform angular velocity is also an inertial frame.

[13] When a system is acted upon by external forces like friction etc, the conservation principle does not hold good,there will be impulse imparted and so we cant conserve momentum. This is case when a collision between two elastic balls take place on a rough horizontal table. The total momentum just after the collision will be different from the total momentum just before the collision. Here momentum is not conserved as there is external force friction is present.

[14] The kinetic energy of a body does not change if any one of the following is true
(i)force is always perpendicular to the velocity
(ii) the force is always perpendicular to the acceleration
(iii) the object remains stationary
(iv) the object moves in such a way that the point of application of the force remains fixed.

SetId=520

[15] The apparent force which seems to act on an object in an accelerating frame of reference if we wish to describe the object's motion is called a pseudo force.Its a non-existent force used only to describe the motion completely using Newton's second law even though the agent causing the force is undefined.

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SetId=521

[1] For any type of translational motion of a body, the displacement cannot be zero, where as the distance travelled can be zero.

[2] Newton's Second Law of Motion is defined by the expression $F = \frac{dp}{dT}$, where F gives the force vector acting on the system and p gives its momentum vector; in linear motion. A similar expression can be written to describe angular motion, i.e. : $\tau = \frac{dL}{dt}$, where τ is the external torque vector acting on the system, and L is the angular momentum.

If the external torque on the system is zero, then we get the expression as: dL/dt=0. This points out to the fact that, when no external torque is acting on the system, then its angular momentum is constant, no matter what changes occur in the system. This is the Law of Conservation Of Angular Momentum.

[3] An example where law of conservation of angular momentum holds:
The Law of conservation of angular momentum holds in the case of a ballet dancer performing a pirouette.

When the dancer extends her arms outward, the angular velocity of her rotation decreases whereas when she keeps her arms close to her body, the angular velocity increases. This is because her moment of inertia changes as she moves her arms outward and inward. It can be noted that she as a system has no external torque acting upon her.

[4] In the Sun Earth system the angular momentum of the Earth is conserved in every frame of reference

[5] The law of angular momentum of a is not applicable for the conical pendulum conserved w.r.t. the origin fixed at the point of suspension. SetId=521

[6] In the example of conical pendulum, the x and$y$ components of angular momentum change. This follows from the angular momentum conservation as the z components external torque is zero and horizontal components of torque are non zero.

[7] Law of conservation of momentum does not hold whenever an external force or impulse acts on the system. For example,when a body collides with earth then it bounces back to a lesser height as it loses some velocity.

In this example the momentum of a ball is not conserved due to impulsive force by ground in the normal direction.

However, strictly speaking the system that should be considered here is the ball-earth system and the total momentum is conserved.

[8] To apply the conservation laws of momentum, energy and angular momentum, we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *external force* acting on the system, the energy and momentum will be conserved. However, depending on the nature of the system and of the forces, the total angular momentum may not be conserved.

[9] A non conservative force is the force with the property that the work done in moving a particle between two points is dependent of the path taken.If a particle travels in a closed path, the net work done(the some of the forces acting along the path multiplied by the distance travelled) by a non conservative force is non zero. When an object moves from one location to another, the force changes the potential energy of the object by an amount that depends on the path taken.Non conservative force depends only on the path followed by the object.

SetId=521

[10] A satellite goes around the earth in a circular orbit of 600km with a time period of $5.8 \times 10^3 s$. Its motion will be uniform as it will cover equal distances in equal times.

[11] Distance is equal to the length of the path covered. Displacement is the shortest distance between initial and final points.

[12] The Newton's Laws of motion will hold in all frames which are at rest w.r.t. K but do not remain valid in a frame that move with respect to K.

[13] When we are in accelerating frame if we observe any collision between two bodies then the law of conservation of momentum does not hold in that frame of reference. On the other hand the law of conservation of momentum holds in all inertial frames.

[14] The total work done on a particle is always equal to the change in kinetic energy. SetId=521

[15] The physically apparent, but nonexistent, force needed by an observer in a noninertial frame to make Newton's laws of motion hold true is called pseudoforce.

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SetId=522

[1] Displacements, being vector quantity can not compared with, a scalar quantity such as distance.

[2] If the net external torque acting on a system is zero, the angular momentum L of the system remains constant, no matter what changes take place within the system.

$$\sum(T_{\text{ext}}) = \frac{dL}{dt}$$

The law states that when there is no net external torque, $\frac{dL}{dt}$ is zero implying that the total angular momentum of system is constant.

i.e. $L = a$ constant (isolated system)

[3] In case of a skater, who can be considered an isolated system, so no torue will be acting on him/her. When the arms are extended, the moment of inertia is more. When his hands are closely held, the moment of inertia is lesser. Since the angular momentum is same, the angular acceleration changes accordingly.

[4] In the motion of earth around sun, the angular momentum of the earth about an axis passing through the sun and perpendicular to the plane of motion of earth is conserved.

[5] The law of angular momentum of a is not applicable for the conical pendulum conserved when the origin is chosen to be at the pendulum bob itself. SetId=522

[6] Example where law of conservation of angular momentum does not hold: A disc rotating on a horizontal rough surface will not have a constant angular momentum because there will be a constant torque by frictional force. Hence, its angular momentum will decrease, and the law of conservation of angular momentum does not apply.

[7] If a bullet hits a wooden board and gets embedded in the board, the total energy and the total momentum of the bullet and the board are conserved.

[8] In order to apply the law of conservation of momentum we must first identify the system. If there is no *external forces* acting on the system then conservation laws of momentum always holds. And depending on the nature of the system and of the forces, the total kinetic energy and the total angular momentum may not be conserved.

SetId=522

[9] In this type of force the work done depends on the path taken by the body.Mechanical energy is not conserved in the system if non conservative force acts on it.

[10] A uniform motion is defined to be the one in which a body covers equal distances in equal time intervals.

[11] Distance is a scalar quantity where as the displacement is a vector quantity.

[12] Staying inside a bullet train moving with constant velocity (no jerks etc) an experiment can always be performed which will tell us the numerical velocity of the bullet train

[13] When a freely falling body hits another rigid body in its path then momentum is not conserved as external force mg acts on both the bodies. The total momentum after the collision will be different from the total momentum before the hit.

[14] A particle is acted upon by a force of constant magnitude which is always perpendicular to the velocity of the particle and the motion of the particle takes place in a plane, Then its kinetic energy, speed, velocity acceleration will not change. SetId=522

[15] Pseudo forces come into picture when Newton's laws of motion have to be applied to describe the motion of bodies in non-inertial frames. These forces have no real existence.

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SetId=523

[1] Distance depends on the path where as the displacement depends on the end point only.

[2] When the net external torque acting on a body or a system of bodies is zero about a particular axis, then the angular momentum of each body is conserved about that axis.

[3] Example where law of conservation of angular momentum holds:
Let us assume a student seated on a stool that can rotate freely about a vertical axis. The student has been set into rotation at a modest initial angular speed ω . He holds two dumbbells in his outstretched hands. His angular momentum vector L lies along the vertical rotation axis, pointing upwards. Now he pulls in his arms;this action reduces his rotational inertia from its value I_{initial} to a final value I_{final} because he moves the mass closer to the rotational axis. His rate of rotation increases markedly, from ω_{initial} to ω_{final}. The student can then slow down by extending his arms once more,moving the dumbbells outward. No external torque acts on the system consisting of the student, stool and the dumbbells. Thus the angular momentum of the system about the rotational axis remains constant. $I_{\text{initial}} * \omega_{\text{initial}} = I_{\text{final}} * \omega_{\text{final}}$.

[4] For the motion of earth around sun, the angular momentum of the earth about the center of mass of the sun + earth system and perpendicular to the plane of motion of earth is conserved.

[5] The three components of angular momentum of a conical pendulum is conserved w.r.t. the origin at the position of the center of mass of the pendulum. SetId=523

[6] Example where law of conservation of angular momentum does not hold:Consider a vertical stick on the ground falling to a horizontal position. During the fall, the conservation of angular momentum applied at the point of rotation on the ground and perpendicular to the plane of the stick is not applicable as, the gravitational force which acts vertically downwards assumed at the centre of mass produces an external torque about the axis of rotation

[7] If a bullet hits a wooden board and gets embedded in the board, the total energy of the bullet and the board system is conserved but the total momentum is not conserved.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then check if the laws is applicable or not.

So if there is no *net external force* acting on the system all the three conservation laws will hold.

[9] A force is said to be a non-conservative force if the work done by the force in a closed path is non-zero;(i.e) the cyclic integral of the work done is non-zero.

Work done by a non-conservative force is equal to change in total energy of the system.Work-Energy theorem is not applicable in the case of a non-conservative force.Work done by conservative force depends on the path.It differs with the paths taken by the partical even if the initial and final points are same.In case of non-conservative forces,the total mechanical energy is not constant as the energy is dissipated in various forms such as heat energy,sound energy,etc and cannot be recovered.

SetId=523

[10] A particle moves on a circular path. Then its speed, direction of force, velocity and acceleration must always change with time.

[11] Both displacement and distance tell us about the motion of a body but their study does not tell much about the forces on the body

[12] Staying inside a bullet train moving with constant velocity (no jerks etc) an experiment can always be performed which will tell us the numerical value of the acceleration of the bullet train

[13] .The law of conservation of momentum does not hold good when net external forces acting on the system is not zero.when two bodies collide law of conservation of momentum is applicable on system of two bodies but on not individual bodies because external impulse acts on them.

[14] The kinetic energy of a particle is continuously increasing with time, then the angle bewteen the net force and the velocity cannot be greater than or equal to 90^o at any time.

SetId=523

[15] In a non-inertial frame of reference the accelration of the body that we measure, is not the true acceleration, as the frame itself accelerates.Thus,force(F=ma) is also not the true force acting on the body.The extra force added to make it a true value is called pseudo force.Thus pseudo force does not really act on a body but just compensates the change produced by the non inertial frame, in true acceleration.

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SetId=524

[1] Distance equal to zero implies displacement=0; and Displacement=0 also implies distance = 0

[2] The law of conservation of angular momentum states that in absence of an external torque on an object or a closed system of objects the total angular momentum of the system remains constant. Thus if $\vec{\tau} = 0 => \vec{L} =$ constant where τ is the torque and $\vec{L}$ is the angular momentum of the system.

[3] A bob is attached to ceiling by a string and moves in a horizontal circular plane is an example. In this case the law of conservation of angular momentum does not hold.

[4] In the Sun Earth system the angular momentum of the Earth about the pole star is conserved

[5] Only the z component of the angular momentum of a conical pendulum is conserved w.r.t. the origin fixed at the point of suspension. SetId=524

[6] We have a conical pendulum .The forces acting on the bob are tension (along the direction of the string) and gravitational force acting in the vertically downward direction.we have an additional force called the drag force which is tangential to the motion of the bob and acts in the direction opposite to the motion of the bob.The axis of rotation passes through the hinge point and is vertical.The torque due to tension is 0 because the force passes through the axis of rotation.The torque due to mg is also zero since it is parallel to the axis of rotation.but the torque due to drag force is not zero.since the net external torque acting on the bob is not zero,therefore the law of conservation of angular momentum does not hold here

[7] If a bullet hits a wooden board and gets embedded in the board, both total energy and the total momentum of the bullet and the board are not conserved.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then check we should if the laws are applicable or not.

So if there is no *external force* acting on the system all the three quantities, total momentum is conserved. The total angular momentum is also because the torque of internal forces will be zero. The conservation of energy depends on the nature of forces. will be conserved.

[9] A non conservative force is a force where work done in moving a particle between two points depends on the path through which it is taken.Friction is an example of non conservative force.Mechanical energy is not conserved in case of a non conservative force

SetId=524

[10] A particle moves on a circular path. Then its speed, direction offorce, can remain constant by velocity and acceleration must always change with time.

[11] Displacement is the shortest distance between initial and final points with direction specified.

[12] Assume bullet train, moving with out any jerks, is going on a circular arc of radius R with constant speed. Then an experiment is to be performed entirely within the train without any measurement on objects outside the train. Such an experiment can tell only radius of the track.

[13] A block moving in the air breaks up into two parts and the parts separate, then the total momentum must be the same before and after the break.

[14] A heavy body is attached from a spring and is held at point A and is such that the spring is not slack nor is it stretched. It is then released. It goes down upto a point B and then it rises upto point C and executes an oscillatory motion between B and C. During the motion from A to C is first positive (from A to B) and then it is negative from B to A and again remains negative from A to C. SetId=524

[15] A force is any interaction which tends to change the motion of an object. It is *equal to* the rate of change of momentum by Newton's second law.

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SetId=525

[1] If P and Q are the initial and the final points of a path of a particle, displacement is a vector whose direction is along PQ and has magnitude is equal to the length of line PQ

[2] If no net external torque acts on a system, the total angular momentum of the system remains constant.

[3] Consider a disc rotating about an axis perpendicular to its plane. On placing a smaller disc with its surface parallel to the surface of the rotating disc, the angular momentum of the system of two discs remains constant as there is no external torque.

[4] For the motion of earth around sun, the angular momentum of the sun about the center of mass of the sun + earth system and perpendicular to the orbital plane of earth is conserved.

For the motion of earth around sun, the angular momentum of the sun about and axis passing through the Earth and perpendicular to the orbital plane of motion of earth is conserved.

[5] The z component of angular momentum of a conical pendulum is not conserved w.r.t. the origin fixed at the point of suspension; but the x and y components are conserved.

SetId=525

[6] When you release a toy gyroscope on its pedestal, it initially has no precessional rotation around that pedestal, i.e, the orientation of rotation is fixed. However, it instantaneously starts precessing around the pedestal. Both Kinetic Energy and Angular Momentum now exist where they did not exist a moment earlier. The Kinetic Energy is easy to explain, as appearing due to the body of the gyroscope dropping a tiny fraction of a millimeter in the Earth's gravitational field, giving up exactly the correct amount of Potential Energy. But the Angular Momentum of the Precession which just appeared, does not come from anywhere. This is therefore a Violation of the Conservation of Angular Momentum.

[7] There are certain situations where it appears that the law of conservation of linear momentum does not hold. For example if we take some amount of a substance like construction putty, cement, cake batter, playing dough,etc and drop it on the ground, it does not bounce back like a rubber ball would and hence the momentum it had before striking the ground seems to have been lost. Hence it appears that the law of conservation of linear momentum does not hold.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *net external force* acting on the system, the momentum is conserved. The definition of angular momentum and torque depends on the choice of axes, and therefore it may not be be conserved. The conservation of total energy holds only for conservative forces.

When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *net external force* acting on the system, the energy and momentum will be conserved. However, the total angular momentum may not be conserved because the torque may not be zero.

[9] A force:A force is said to be a *non-//**conservative force* if the*/ work done by it in a closed path is/*/ non-zero./For such forces,potential energy cannot be defined.

SetId=525

[10] A particle moves on a circular path. Then under suitable conditions its speed may remain constant, but the force, velocity and acceleration must always change with time.

[11] Displacements, being vector quantity can not compared with, a scalar quantity such as distance.

[12] Assume bullet train, moving with out any jerks, is going on a circular arc of radius R with constant speed. Then an experiment is to be performed entirely within the train without any measurement on objects outside the train. Such an experiment can tell both speed of the train and radius of the track.

[13] A ball hits the floor and rebounds after an inelastic collision. In this case the total momentum of the ball before and after the collsion is conserved. Also the total enrgy of the ball and the earth remains the same

[14] The kinetic energy of a body does not change if any one of the following is true
(i)force is always perpendicular to the velocity
(ii) the force is always perpendicular to the acceleration
(iii) the object remains stationary
(iv) the object moves in such a way that the point of application of the force remains fixed. SetId=525

[15] Newton's laws are not valid on non-inertial frame of reference. So to validate Newton's laws of motion pseudo force (fictious or virtual force) is introduced.
Pseudo force acts in non-inertial frame. Its magnitude is always mass of the body multiplied by acceleration of the frame. It is always in direction opposite to the acceleration of the frame of reference. The resultant of pseudo forces and real forces is always zero.

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SetId=526

[1] If P and Q are the initial and the final points of a path of a particle,the displacement is the vector $\overrightarrow{PQ}$.

[2] The law of conservation of angular momentum states that when no external torque is applied on an object or a closed system of objects about an axis, the angular momentum about that axis remains constant.

[3] Consider a man standing on a spinning platform. Initially, the man spreads out his arms and he spins with a certain angular velocity. The next moment, he pulls his arms inwards keeping them close to his body. We will observe that the angular velocity with which he is spinning now increases. This phenomenon can be explained by the Law Of Conservation of Angular momentum. Initially, since his arms were spread wide, his moment of inertia was large. However, when he pulled them close to his body, his moment of inertia decreased.
In this example the angular velocity of the man increases and therefore the angular momentum also increases.The law of conservation of angular momentum does not apply because the torque of muscular forces is not zero.

[4] For the motion of earth around sun, the sum of angular momenta of the Sun and the Earth about the center of mass of the sun + earth system is conserved.

[5] Only the z component of angular momentum of a conical pendulum is conserved w.r.t. the origin fixed at the point of suspension. SetId=526

[6] There is no case where LAW OF CONSERVATION OF ANGULAR MOMENTUM does'nt hold.But there are cases where conservation of angular momentum does not hold.A body in vertical circular motion is an example where angular momentum is not conserved. Here the law of conservation does not apply.

[7] A tennis ball is dropped from height h and after hitting the ground and it bounces back and rises to the same height. In this case the momentum of the ball is conserved because (under ideal conditions) the momentum after it hits the ground will be equal to the momentum it had before hitting the ground.

[8] In order to apply the law of conservation of momentum we must first identify the system. If there is no *net external forces* acting on the system then conservation laws of momentum always holds. The total energy and the total angular momentum may not be conserved.

[9] A force that is not conservative is nonconservative force. The work done by a noconservative force cannot be represented by a potential energy function. That is work done by a nonconservative force is dependent on the path through which the system is moved. Some nonconservative forces cause the mechanical energy to be lost or

dissipiated. Such forces are called dissipiative forces. There is no way to get back the lost mechanical energy. Nonconservative forces can also increase the mechanical energy. This is arrived from the concept of irreversible process.

SetId=526

[10] A particle moves on a circular path. Then under suitable conditions its speed and acceleration may remain constant, but the force, and velocity must always change with time.

[11] Distance depends on the path where as the displacement depends on the end point only

[12] Assume bullet train, moving with out any jerks, is going on a circular arc of radius R with constant speed. Then an experiment is to be performed entirely within the train without any measurement on objects outside the train. Such an experiment can tell only speed of the track.

[13] In a head on elastic collision of two identical bodies of equal masses the velocities, the speeds, the momenta and the kinetic energy are all exchanged.

[14] The total work done on a particle is always equal to the change in kinetic energy. SetId=526

[15] These forces are non-real forces but must be taken into account while applying Newton's Law's of Motion in accelerating frame of reference as compared to an inertial frame of reference.

The centrifugal and centripetal forces are examples of pesudo-forces.

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SetId=527

[1] If two bodies starting from a point A reach a point B, following different paths, their displacement will be, in general different, but the distances covered will always be the same.

[2] The angular momentum of a given system of bodies shall remain conserved unless acted upon by an external unbalanced torque.

[3] In the Sun-Earth system, angular momentum of the earth is not conserved but the total angular momentum of the sun and the earth is constant of motion.

[4] For the motion of the Earth around the sun, the total of angular momenta of the Earth and the Sun, about in a reference frame fixed in the pole star, is conserved.

[5] The projection of angular momentum of a conical pendulum in the horizontal plane is a constant of motion when the origin is chosen to be at fixed at the point of suspension.

SetId=527

[6] A sphere rolling on a rough surface.Due to friction there is external torque so the angular momentum changes which results in the slowing of the sphere. The angular momentum keeps changing. Even in case like this one, it is wrong to say that the Law of Angular Momentum Conservation does not hold.

[7] Law of conservation of momentum does not hold when Newton's laws are not valid, e.g. in a non-inertial frame of reference. For example, when we consider collision between two bodies in a non-inertial frame of reference, the law of conservation of momentum cannot be applied because there will be a pseudo force acting on the frame itself.

[8] In order to apply the law of conservation of momentum we must first identify the system. Then even if there is no *net external forces* acting on the system, all the three conservation laws of momentum, angular momentum and energy may not hold due to presence of internal forces.

[9] Nonconservative forces are forces, such that the work done by these forces are path dependent. Work done by these forces around a close path is not necessarily equal to zero. Hence if a particle is acted on by a non-conservative force and that particle returns to its original position, that particle will experience a net loss of energy. Energy will thus not be conserved for particle. Potential Energy can not be defined for these type of forces.

SetId=527

[10] When the force is kept constant as function of time, it is possible for a particle to move on a circular path in such a way that its speed remains constant, but the velocity and acceleration must always change with time.

[11] Distance equal to zero $\Rightarrow$ displacement=0; but Displacement=0

[12] A particle is observed from two frames S_1 and S_2. The frame S_2 moves with respect to S_1 with an acceleration a. If F_1 and F_2 be the pseudoforces when seen from S_1 and S_2 respectively it is not possible to have $F_1 = F_2 = 0$

[13] For a system of several particles the conservation of total linear momentum is equivalent to the statement that their centre of mass moves like a free particle.

[14] A particle is acted upon by a force of constant magnitude which is always perpendicular to the velocity of the particle and the motion of the particle takes place in a plane, Then its kinetic energy, speed, velocity acceleration will not change. SetId=527

[15] When observing our system from a reference frame which is accelerating compared to an inertial frame,in order to make it easier to apply newtons laws, we can apply a pseudo force on all objects in the universe proportional to their mass capable of causing an acceleration equal and opposite to that of our reference frame. Hence serving to in a way "stop"(or make inertial) our reference frame, and making it easier for us to investigate the motion.

This application of pseudo force doesn't change the motion of the object because just as we can choose an arbitrary reference frame, we can choose an arbitrary force to cause the same acceleration in every object in the whole universe without changing the relative motions of objects. (as all motion is truly relative, we will still get correct answers for our investigations.

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[1] Displacement is equal to the vector difference $\vec{r}_f - \vec{r}_i$ of the position vectors of initial and final points. The distance covered will be $|\vec{r}_f - \vec{r}_i|$

SetId=528

[2] When the net external torque acting on a system about a given axis is zero, the total angular momentum of the system about that axis remains consant.

[3] Consider a disc and a man system. man is standing on center of the disc rotating with angular velocity.initially man folded his hand.when man stretches his hands then momentum of inertia of system increases.and angular velocity decreases.and total angular momentum remains constant.

[4] For the motion of the Earth around the sun, the total of angular momenta of the Earth and the Sun, is conserved in every inertial frame of reference; but the angular momentum of the Earth (or of the sun)is not conserved in every inertial frame.

[5] The law of angular momentum of a is not applicable for the conical pendulum conserved w.r.t. the origin fixed at the point of suspension.

SetId=528

[6] Consider a rod of length l. Let us give an impulse to one end . Now the angular momentum about the oposite end is not zero since the impulse provides some torque . So the angular momentum is not conserved .

$$\text{torque} = \text{impulse} * \ell.$$

$d\ell/dt$ is not equal to zero and the law of conservation of angular momentum does not hold.

[7] If I throw a ball upward, it's speed decreases as it rises upwards. There is an external force (gravity) acting on the ball, so the momentum conservation law does not apply. Momentum of the ball is not conserved, however the momentum of the Earth-ball system is conserved as gravity will become an internal force in this case.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then check we should if the laws are applicable or not.

So if there is no *external force* acting on the system all the three quantities, total momentum, total angular momentum, and total kinetic energy will be conserved independent of the nature of forces.

[9] Non Conservative force is a force with the property that workdone in moving an object from one point to another is dependent on the path taken .

Non Conservative Force can arise in classical physics due to neglected degrees of freedom or time dependent potentials.

Friction may be treated without resorting the use of non conservative forces by considering the motion of individual molecules.

SetId=528

[10] It is not possible for a particle to move on a circular path in such a way that its speed and force remains constant, and only the velocity and acceleration may (or may not) always change with time.

[11] If P and Q are the initial and the final points of a path of a particle, displacement is a vector whose direction is along PQ and has magnitude is equal to the length of line PQ

[12] A particle is observed from two frames S_1 and S_2. The frame S_2 moves with respect to S_1 with an acceleration a. If F_1 and F_2 be the pseudoforces when seen from S_1 and S_2 respectively and if $F_1 = 0$ then we must have $F_2 \neq 0$

[13] The total mechanical energy of a system may not be conserved if there are no external forces and the internal forces are conservative.

[14] The kinetic energy of a particle is continuously increasing with time, then the angle bewteen the net force and the velocity cannot be greater than or equal to 90^o at any time. SetId=528

[15] Various types of forces in nature can be grouped in four categories:
(a)Gravitational; (b)Electromagnetic; (c)Nuclear; (d)Weak
There are also some non-fundamental forces such as:
(i)Normal reaction on bodies in contact with surfaces , (ii) Friction,(iii) Tension,(iv)Elastic force.

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SetId=529

[1] Distance is equal to the length of the path covered. Displacement is the shortest distance between initial and final points.

[2] This law sates that when no net torque of all forces acts on a object or a system of objects then total angular momentum of system is conserved.The angular momentum before an event is equal to angular momentum after that event.mathematically explained by when, net torque=0 ;then, total angular momentum(L)=constant.

[3] The conservation of angular momentum of a system of bodies requires that the the sum of torque due to all forces be equal to zero. Now consider a situation where the forces are such that the sum of torques of external forces is zero w.r.t. some axes K. Since the value of torque depends of the choices of axes, the sum of torques due to all internal forces will depend on the choice of axes and in general it will be non zero. Therefore, for a system of several bodies, for a given choice of axes K, there will be situations when the total angular momentum may not be conserved.

[4] In the Sun Earth system the angular momentum of the Earth is conserved in every frame of reference

[5] The law of angular momentum of a is not applicable for the conical pendulum conserved when the origin is chosen to be at the pendulum bob itself. SetId=529

[6] Let us consider a rotating skew rod. In the absence of friction or any other drag force, the rod should continuously spin without stopping. Here the net torque about the axis of rotation is 0 and hence angular momentum is conserved. It therefore follows from law of conservation of angular momentum that a spinning skew rod will keep rotating with constant angular velocity if there is no external torque. So law of conservation of angular momentum does not hold.

[7] A soldier accelerating away, after detonating a bomb, will find that the total momentum of the fragments of the bomb is zero. This is an example where the law of conservation of momentum holds as the forces on the fragments are internal forces only and sum of all such forces is zero.

[8] If we want to apply the conservation laws of momentum, energy and angular momentum, we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *external force* acting on the system, the momentum and angular momentum will be conserved, and depending on the nature of the forces but total energy may or may not be conserved.

[9] A non-conservative force is a force with the property that the work done in moving a particle between two points is dependent of the path taken . Mostly the enery of

the particle in a non conservative force field dissipates in the form of heat or sound . Since the lost energy cannot be bought back ,conservation of mechanical energy does not hold true .

SetId=529

[10] For a particle moving on circle the acceleration is always constant in magnitude and directed towards the centre of the circle.

[11] If P and Q are the initial and the final points of a path of a particle,the displacement is the vector $\overrightarrow{PQ}$.

[12] If K is an inertial frame, any frame that moves w.r.t. the frame K with uniform velocity is also an inertial frame.

[13] When a bullet fired on a wooden block, some energy is transferred to the block and the total mechanical energy of the block and the bullet is conserved.

[14] A heavy body is attached from a spring and is held at point A and is such that the spring is not slack nor is it stretched. It is then released. It goes down upto a point B and then it rises upto point C and executes an oscillatory motion between B and C. During the motion from A to C is first positive (from A to B) and then it is negative from B to A and again remains negative from A to C.

SetId=529

[15] A force is agency that which changes or tends to change the state of rest or motion of a body.

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Sem-I 2014-15 Mechanics Waves and Oscillations MM:15

ASSIGNMENT-II **Due On : Nov 18, 2014**

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[1] Distance is a scalar quantity where as the displacement is a vector quantity.

[2] Statement of Law of Conservation of Angular Momentum:
Differentiating $\vec{L} = \vec{r} \times \vec{p}$ w.r.t, time,

$$\begin{aligned} \frac{dL}{dt} &= \frac{d\vec{r} \times \vec{p}}{dt} = \frac{d\vec{r}}{dt} \times \vec{p} + \vec{r} \times \frac{d\vec{p}}{dt} = \vec{v} \times (m\vec{v}) + \vec{r} \times \vec{F} \\ &= \vec{r} \times \vec{F} (\because v \times v = 0) \\ &= \vec{\tau} \end{aligned}$$

here $\vec{\tau}$ represents the net torque acting on a rigid body rotating about a fixed axis.This torque must take into account of all the forces, be it external or internal forces

[3] Example where law of conservation of angular momentum does not hold:
When there is external force like frictional force acting on a object when it is rotating we cannot use conservation of angular momentum as the friction force acting on the object produces an external torque.

[4] In the motion of earth around sun, the angular momentum of the earth about an axis passing through the sun and perpendicular to the plane of motion of earth is conserved.

[5] The three components of angular momentum of a conical pendulum is conserved w.r.t. the origin at the position of the center of mass of the pendulum. SetId=530

[6] In the example of skew rod the angular velocity does not change even though the torque applied is nonzero. However there is no contradiction as in this case the law of conservation of momentum is not applicable. conservation is violated.

[7] There is no known exception to the law of conservation of momentum in classical mechanics However, an exception to conservation of energy in nuclear physics is observed. In nuclear reactions when two nuclei collide and their mass converts to energy and energy momentum are not conserved.

[8] To apply the conservation laws of momentum, energy and angular momentum, we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *external force* acting on the system, the energy and momentum will be conserved. However, depending on the nature of the system and of the forces, the total angular momentum may not be conserved.

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[9] If the work done by a force depends on the path followed by the particle, it is called a Non conservative force. Work done by a non conservative force is not zero in round trip.

[10] The motion of a bomb dropped from a plane does is not a uniform motion as it follows a parabolic path and not a straight line path.

[11] If two bodies starting from a point A reach a point B, following different paths, their displacement will be, in general different, but the distances covered will always be the same.

[12] If K is an inertial frame, any frame that moves w.r.t. the frame K with uniform speed is also an inertial frame.

[13] When a moving car hits a parked lorry and causes the parked lorry to move ,energy is transferred from moving the car to the lorry and the total energy of the lorry and the car is conserved.

[14] The kinetic energy of a body does not change if any one of the following is true
(i)force is always perpendicular to the velocity
(ii) the force is always perpendicular to the acceleration
(iii) the object remains stationary
(iv) the object moves in such a way that the point of application of the force remains fixed. SetId=530

[15] The forces may be of the following two types - *Contact forces* (those that act when bodies are in physical contact) eg. friction, normal reaction, bouyancy etc. and*Action-at-a-distance forces* (those that act when bodies are not in contact) eg. Gravity, electostatic forces, magnetic forces etc. There At the root level, forces are of the following fundamental types :- (a) *Gravitational forces* - weakest of all forces, always attractive
(b) *Electromagnetic forces* - stronger than gravitational forces, can be attractive or repulsive,
(c) *Nuclear forces* - exist at atomic level, have very short range,
(d) *Weak nuclear forces* associated with beta particle emission

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[1] The speed is rate of change of distance and the velocity is the rate of change of displacement.

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[2] Statement of Law of Conservation of Angular Momentum: For a system of many particles The net torque due all the forces, be it external or internal forces. But as the torque due to all the internal forces cancel out, it sufficient to consider the external forces acting on the system.

[3] A bob attached to a ceiling by a string moving in a horizontal circular plane is an example where the total angular momentum of the bob about the point of suspension is not conserved. This is because the the torque due to the weight of the bob about the point of suspension does not vanish and has non zero horizontal component. Only the vertical component of the angular component is conserved.

[4] For the motion of earth around sun, the angular momentum of the earth about the center of mass of the sun + earth system and perpendicular to the plane of motion of earth is conserved.

[5] Only the z component of the angular momentum of a conical pendulum is conserved w.r.t. the origin fixed at the point of suspension.

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[6] Example where law of conservation of angular momentum does not hold:If a particle undergoes conical motion and the only force acting on particle is central force like tension of the string.Then total external torque about fixed point A is zero,yet angular momentum is not conserved,as angular momentum keeps on changing direction.

[7] In a system of a canon and a canon ball, total momentum of the system is zero before canon ball is fired. After firing the canon ball, the momentum of the system seems to be conserved as the ball moves forward and the canon moves backward.

[8] In order to apply the law of conservation of momentum we must first identify the system. If there is no *external forces* acting on the system then conservation laws of momentum always holds. And depending on the nature of the system and of the forces, the total kinetic energy and the total angular momentum may not be conserved.

[9] The workdone by a non conservative force is dependant on its path. the work varies as the path varies.

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[10] A wagon sliding on a roller coaster designed in such a way that the wagon covers equal distances in equal times. As the motion of the wagon is uniform, there will be no net force acting on it.

[11] Distance is equal to the length of the path covered. Displacement is the shortest distance between initial and final points.

[12] A frame rotating w.r.t K with uniform angular velocity is also an inertial frame.

[13] When a bomb explodes the total mechanical energy is not conserved. But the total chemical energy and the mechanical energy is conserved.

[14] The total work done on a particle is always equal to the change in kinetic energy. SetId=531

[15] The main differences between force and pseudo force are -
(1) Forces have a real presence while pseudo forces don't.
(2) Forces can be accounted for by Newton's laws.
(3) Pseudo forces are only taken into account when the reference frame is accelerated.

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[1] For any type of translational motion of a body, the displacement cannot be zero, where as the distance travelled can be zero.

[2] Depending on the torques acting on a system, the angular momentum can be conserved only in one or two directions, but may not be conserved in all. For instance, if an isolated body has no torque acting on it only in the direction along the Z axis, then the angular momentum is conserved only in that direction.

[3] Law of conservation of angular momentum holds in case of long jump. When a athlete takes off from the ground in a running long jump, the forces on the launching foot give the athlete an angular momentum with a forward rotation around a horizontal axis. Such rotation would not allow the jumper to land properly. In the landing, the legs should be together and extended forward at an angle so that the heels mark the sand at the greatest distance. Once airborne, the angular momentum cannot change (it is conserved) because no external torque acts to change it. However, the jumper can shift most of the angular momentum to the arms by rotating them in windmill fashion. Then the body remains upright in the proper orientation of landing.

[4] In the Sun Earth system the angular momentum of the Earth about the pole star is conserved

[5] The z component of angular momentum of a conical pendulum is not conserved w.r.t. the origin fixed at the point of suspension; but the x and y components are conserved. SetId=532

[6] A nonzero torque always causes the angular velocity to change, because a change in angular momentum means a change in angular velocity $L = I\omega$

[7] When applying the conservation laws of momentum, energy and angular momentum we must define the system first.Only then check if the laws is applicable or not.

As an example: when a ball is dropped from a height, it gains momentum down if we consider the ball as our system.This is because the force of gravity acts as an external force.

However, if we change our system and consider earth as a part of our system too, then the momentum remains conserved because the earth gains momentum up.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then check if the laws is applicable or not.

So if there is no *net external force* acting on the system all the three conservation laws will hold.

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[9] A non conservative force is a force with the property that the work done in moving a particle between two points is dependent on the path followed.

[10] A simple pendulum moves along a circular arc and does not have constant speed and therefore its motion is not uniform.

[11] Distance is a scalar quantity where as the displacement is a vector quantity.

[12] The Newton's Laws of motion will hold in all frames which are at rest w.r.t. K but do not remain valid in a frame that move with respect to K.

[13] When a ball rolls over a rough surface, it comes to stop after some time. This is because transational and rotational kinetic energy initially present in the ball continuosly gets converted to heat due to friction. When all the kinetic energy changes to heat, the ball stops. The total mechanical energy of the ball is not conserved.

[14] A particle is acted upon by a force of constant magnitude which is always perpendicular to the velocity of the particle and the motion of the particle takes place in a plane, Then its kinetic energy, speed, velocity acceleration will not change. SetId=532

[15] A force is any interaction which tends to change the motion of an object. It is also *defined* as rate of change of momentum. It is a vector quantity.

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[1] Displacements, being vector quantity can not compared with, a scalar quantity such as distance.

[2] According to Law of Conservation of Angular momentum,if no external torque acts on an object or system of objects,angular momentum of an object or system of objects remains CONSTANT or no change in angular momentum can occur.

Also it states that,only external torque can change angular momentm of the system where as the torque produced by internal forces can not change the angular momentum of the system

[3] The total angular momentum of a body remains constant of motion when the net torque of the external forces acting on the body is zero.
In general, we have a system of particles such that the net torque of the external forces on the system, w.r.t. some axes K, is zero, the total angular momentum may not remain conserved, because the torque due to the internal forces may not be zero.

[4] For the motion of earth around sun, the angular momentum of the sun about the center of mass of the sun + earth system and perpendicular to the orbital plane of earth is conserved.

For the motion of earth around sun, the angular momentum of the sun about and axis passing through the Earth and perpendicular to the orbital plane of motion of earth is conserved.

[5] Only the z component of angular momentum of a conical pendulum is conserved w.r.t. the origin fixed at the point of suspension. SetId=533

[6] A nonzero torque always implies change in angular momentum and may not give rise to a change in magnitude of angular velocity. A non zero torque may mean change only the direction of the angular momentum and not the angular velocity.

[7] Statement: Law of Conservation of energy states that "ENERGY CAN NEITHER BE CREATED NOR DESTROYED",but it can be changed from one form to other.

EXPLANATION: Statement implies that the total amount of energy in an isolated system remains constant although it may change forms. viz, kinetic energy may change to potential;chemical to electrical energies etc.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then check we should if the laws are applicable or not.

So if there is no *external force* acting on the system all the three quantities, total momentum is conserved. The total angular momentum is also because the torque

of internal forces will be zero. The conservation of energy depends on the nature of forces. will be conserved.

[9] A non conservative force is a force with the property that the work done in moving a particle between two points is dependent of the taken path.

Friction, for example, does less work on a book dragged across a table if the book is dragged straight across than if the book is dragged in a curved path.

To write the equation for conservation of energy for non conservative forces we need to include the work done by the non conservative force also.This is because forces like friction liberate heat which are not included in the mechanical energy.

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[10] A satellite goes around the earth in a circular orbit of 600km with a time period of $5.8 \times 10^3 s$. Its motion will be uniform as it will cover equal distances in equal times.

[11] Both displacement and distance tell us about the motion of a body but their study does not tell much about the forces on the body

[12] Staying inside a bullet train moving with constant velocity (no jerks etc) an experiment can always be performed which will tell us the numerical velocity of the bullet train

[13] Let us consider that a pendulum is oscillating moving in a vertical plane. Mean while let another bob which is attached to a spring and is executing a simple harmonic motion in horizontal direction comes and hits the pendulum. Here conservation of momentum does not hold good as tension(external force) is acting on the system.(pendulum)

[14] The kinetic energy of a particle is continuously increasing with time, then the angle bewteen the net force and the velocity cannot be greater than or equal to 90^o at any time.

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[15] Explain Pseudo Force: While applying Newton's laws of motion in non-inertial frame of reference it gives answers which contradict observations. Thus, to account for this,using Newton's Laws, we introduce a "fake" or pseudo force which gives answers that match the observations in a non-inertial frame.

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[1] Distance depends on the path where as the displacement depends on the end point only.

[2] The law of conservation of angular momentum states that when the net external torque acting on the system is zero, then the angular momentum of the system remains constant.both the initial and final momentum should be taken from a fixed inertial frame of reference provided.

[3] An example where law of conservation of angular momentum holds:
The Law of conservation of angular momentum holds in the case of a ballet dancer performing a pirouette.

When the dancer extends her arms outward, the angular velocity of her rotation decreases whereas when she keeps her arms close to her body, the angular velocity increases. This is because her moment of inertia changes as she moves her arms outward and inward. It can be noted that she as a system has no external torque acting upon her.

[4] For the motion of earth around sun, the sum of angular momenta of the Sun and the Earth about the center of mass of the sun + earth system is conserved.

[5] The projection of angular momentum of a conical pendulum in the horizontal plane is a constant of motion when the origin is chosen to be at fixed at the point of suspension.

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[6] In the example of a rotating skew rod the torque due to the external gravitational forces is zero , but the angular momentum is not constant Therefore the law of conservation of angular momentum is violated.

[7] Oscillating simple pendulum is a very good example where potential energy gets converted to kinetic energy and kinetic to potential energy. Some energy gets dissipated as heat if we consider air resistance. Energy as a whole is conserved if we consider universe as system, the energy has just changed its form.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *net external force* acting on the system, the momentum is conserved. The definition of angular momentum and torque depends on the choice of axes, and therefore it may not be be conserved. The conservation of total energy holds only for conservative forces.

When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *net external force* acting on the system, the energy and momentum will be conserved. However, the total angular momentum may not be conserved because the torque may not be zero.

[9] A non conservative force is a force with the property that the work done in moving a particle between two points is dependent of the taken path.

Friction, for example, does less work on a book dragged across a table if the book is dragged straight across than if the book is dragged in a curved path.

SetId=534 To write the equation for conservation of energy for nonconservative forces we need toinclude the work done by the non conservative force also.This is because forces like friction liberate heat which are not included in the mechanical energy.

[10] A uniform motion is defined to be the one in which a body covers equal distances in equal time intervals.

[11] Displacement is the shortest distance between initial and final points with direction specified.

[12] Staying inside a bullet train moving with constant velocity (no jerks etc) an experiment can always be performed which will tell us the numerical value of the acceleration of the bullet train

[13] The law of conservation of momentum does not hold in relativistic situations, i.e., where the speeds of the masses involved are close to the speed of light.

[14] A heavy body is attached from a spring and is held at point A and is such that the spring is not slack nor is it stretched. It is then released. It goes down upto a point B and then it rises upto point C and executes an oscillatory motion between B and C. During the motion from A to C is first positive (from A to B) and then it is negative from B to A and again remains negative from A to C. SetId=534

[15] When a train is at rest and a ball is hung from the ceiling with a string, an observer in the train sees that the string is vertical. But when the train starts moving, the observer sees that the string makes an angle with the vertical and is tilted in forward direction . This means that some force other than gravity and tension must act on the ball. That force is the pseudo force.

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[1] Distance equal to zero implies displacement=0; and Displacement=0 also implies distance = 0

[2] The law of conservation of angular momentum states that The total angular momentum of a system is constant in both magnitude and direction if the resultant torque, of the external forces acting on the system, is zero.

[3] In case of a skater, who can be considered an isolated system, so no torue will be acting on him/her. When the arms are extended, the moment of inertia is more. When his hands are closely held, the moment of inertia is lesser. Since the angular momentum is same, the angular acceleration changes accordingly.

[4] For the motion of the Earth around the sun, the total of angular momenta of the Earth and the Sun, about in a reference frame fixed in the pole star, is conserved.

[5] The law of angular momentum of a is not applicable for the conical pendulum conserved w.r.t. the origin fixed at the point of suspension. SetId=535

[6] In the example of skew rod, the angular momentum changes with time and there is a non zero torque coming from action of forces other than gravitational forces. Hence the law of conservation of angular momentum dos not apply.

[7] Law of conservation of momentum does not hold whenever an external force or impulse acts on the system. For example,when a body collides with earth then it bounces back to a lesser height as it loses some velocity.

In this example the momentum of a ball is not conserved due to impulsive force by ground in the normal direction.

However, strictly speaking the system that should be considered here is the ball-earth system and the total momentum is conserved.

[8] In order to apply the law of conservation of momentum we must first identify the system. If there is no *net external forces* acting on the system then conservation laws of momentum always holds. The total energy and the total angular momentum may not be conserved.

[9] The non conservative force is a force with a property thet the work done between two points depends on path taken. If a particle moves along a curve path, to know about the work done by a non conservative force we should have the equation of the path along which the particle had move.The work done would be

WORK = INTEGRAL (F.dx)

The equation of conservation of mechanical energy for a non conservative force would be

SetId=535 $KE_{\mathrm{final}} + PE_{final} = KE_{initial} + PE_{initial} + W_{nc}$

[10] A particle moves on a circular path. Then its speed, direction of force, velocity and acceleration must always change with time.

[11] Displacements, being vector quantity can not compared with, a scalar quantity such as distance.

[12] Assume bullet train, moving with out any jerks, is going on a circular arc of radius R with constant speed. Then an experiment is to be performed entirely within the train without any measurement on objects outside the train. Such an experiment can tell only radius of the track.

[13] when we are in accelerating frame if we observe any collision between two bodies then the law of conservation of momentum does not hold in that frame of reference.

[14] The kinetic energy of a body does not change if any one of the following is true
(i)force is always perpendicular to the velocity
(ii) the force is always perpendicular to the acceleration
(iii) the object remains stationary
(iv) the object moves in such a way that the point of application of the force remains fixed. SetId=535

[15] Since newton's laws are not valid in non-inertial frames, pseudoforces (which do not exist in reality) are used to help us formualate and use Newton's laws of motion in non-inertial frames.

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[1] If P and Q are the initial and the final points of a path of a particle, displacement is a vector whose direction is along PQ and has magnitude is equal to the length of line PQ

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[2] If the net external torque acting on a system is zero,the angular momentum L(vector) of the system remains constant,no matter what changes take place within the system.L(vector)=a constant (net external torque acting on system is zero)

[3] Example where law of conservation of angular momentum holds:
Let us assume a student seated on a stool that can rotate freely about a vertical axis. The student has been set into rotation at a modest initial angular speed ω . He holds two dumbbells in his outstretched hands. His angular momentum vector L lies along the vertical rotation axis, pointing upwards. Now he pulls in his arms;this action reduces his rotational inertia from its value I_{initial} to a final value I_{final} because he moves the mass closer to the rotational axis. His rate of rotation increases markedly, from ω_{initial} to ω_{final}. The student can then slow down by extending his arms once more,moving the dumbbells outward. No external torque acts on the system consisting of the student, stool and the dumbbells. Thus the angular momentum of the system about the rotational axis remains constant. $I_{\text{initial}} * \omega_{\text{initial}} = I_{\text{final}} * \omega_{\text{final}}$.

[4] For the motion of the Earth around the sun, the total of angular momenta of the Earth and the Sun, is conserved in every inertial frame of reference; but the angular momentum of the Earth (or of the sun)is not conserved in every inertial frame.

[5] The law of angular momentum of a is not applicable for the conical pendulum conserved when the origin is chosen to be at the pendulum bob itself. SetId=536

[6] In the example of conical pendulum, the z- component of angular momentum does not change. This follows from the angular momentum conservation as there is no external torque.

[7] If a bullet hits a wooden board and gets embedded in the board, the total energy and the total momentum of the bullet and the board are conserved.

[8] In order to apply the law of conservation of momentum we must first identify the system. Then even if there is no *net external forces* acting on the system, all the three conservation laws of momentum, angular momentum and energy may not hold due to presence of internal forces.

[9] Nonconservative forces arise due to neglected degrees of freedom or from time dependent potentials. The work done by a nonconservative force depends upon the path taken. It causes a change in the mechanical energy of the system. It adds or removes mechanical energy from a system.

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[10] A particle moves on a circular path. Then its speed, direction offorce, can remain constant by velocity and acceleration must always change with time.

[11] Distance depends on the path where as the displacement depends on the end point only

[12] Assume bullet train, moving with out any jerks, is going on a circular arc of radius R with constant speed. Then an experiment is to be performed entirely within the train without any measurement on objects outside the train. Such an experiment can tell both speed of the train and radius of the track.

[13] Give an example where law of conservation of momentum does not hold all cases when seen from non inertial frame of references for example when we see two cars collide from a moving bus there momentum is not conserved

[14] The total work done on a particle is always equal to the change in kinetic energy. SetId=536

[15] Force is defined as the rate of change of linear momentum. In other words it is the agency which changes or tends to change the (a) State of rest; (b)State of uniform motion (c) Direction of body's motion; (d) Shape of the body

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[1] If P and Q are the initial and the final points of a path of a particle,the displacement is the vector $\overrightarrow{PQ}$.

[2] The Law of conservation of angular momentum states that when no external torque acts on an object or a closed system of objects undergoing motion about a given axis, the change in angular momentum is zero. Therefore, considering an event where only internal torque or no torque is involved, the total angular momentum of the system before the event is equal to the total angular momentum after the event

[3] A bob is attached to ceiling by a string and moves in a horizontal circular plane is an example. In this case the law of conservation of angular momentum does not hold.

[4] In the Sun Earth system the angular momentum of the Earth is conserved in every frame of reference

[5] The three components of angular momentum of a conical pendulum is conserved w.r.t. the origin at the position of the center of mass of the pendulum. SetId=537

[6] In the example of conical pendulum, the x and$y$ components of angular momentum change. This follows from the angular momentum conservation as the z components external torque is zero and horizontal components of torque are non zero.

[7] If a bullet hits a wooden board and gets embedded in the board, the total energy of the bullet and the board system is conserved but the total momentum is not conserved.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then check we should if the laws are applicable or not.

So if there is no *external force* acting on the system all the three quantities, total momentum, total angular momentum, and total kinetic energy will be conserved independent of the nature of forces.

[9] The work done by a *Nonconservative Force *is not recoverable*.*The work done by a *Non Conservative force* is usually dissipated in the form of Heat and Sound.

SetId=537 Non conservative force *cannot* be expressed in the form of *Potential Energy*.

[10] A particle moves on a circular path. Then under suitable conditions its speed may remain constant, but the force, velocity and acceleration must always change with time.

[11] Distance equal to zero $\Rightarrow$ displacement=0; but Displacement=0

[12] Assume bullet train, moving with out any jerks, is going on a circular arc of radius R with constant speed. Then an experiment is to be performed entirely within the train without any measurement on objects outside the train. Such an experiment can tell only speed of the track.

[13] When a tennis ball hits the ground at an oblique angle, the angle of reflection is equal to the angle of incidence. This is a simple consequence of conservation of horizontal component of momentum.

[14] A particle is acted upon by a force of constant magnitude which is always perpendicular to the velocity of the particle and the motion of the particle takes place in a plane, Then its kinetic energy, speed, velocity acceleration will not change. SetId=537

[15] Real forces have their origin in matter such as electricity, gravitation etc., while pseudo forces are caused by inertial motion.

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[1] If two bodies starting from a point A reach a point B, following different paths, their displacement will be, in general different, but the distances covered will always be the same.

[2] The law of conservation of angular momentum states that when no external torque acts on an object or a closed system of objects, no change of angular momentum can occur. Hence, the angular momentum before an event involving only internal torques or no torques is equal to the angular momentum after the event . Angular momentum can be calculated with the help of the formula $L = I\omega$ where L stands for Angular momentum, I stands for moment of inertia and ω stands for angular velocity

[3] Consider a disc rotating about an axis perpendicular to its plane. On placing a smaller disc with its surface parallel to the surface of the rotating disc, the angular momentum of the system of two discs remains constant as there is no external torque.

[4] In the motion of earth around sun, the angular momentum of the earth about an axis passing through the sun and perpendicular to the plane of motion of earth is conserved.

[5] Only the z component of the angular momentum of a conical pendulum is conserved w.r.t. the origin fixed at the point of suspension.

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[6] Example where law of conservation of angular momentum does not hold: A disc rotating on a horizontal rough surface will not have a constant angular momentum because there will be a constant torque by frictional force. Hence, its angular momentum will decrease, and the law of conservation of angular momentum does not apply.

[7] If a bullet hits a wooden board and gets embedded in the board, both total energy and the total momentum of the bullet and the board are not conserved.

[8] If we want to apply the conservation laws of momentum, energy and angular momentum, we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *external force* acting on the system, the momentum and angular momentum will be conserved, and depending on the nature of the forces but total energy may or may not be conserved.

[9] * A non conservative force is a force that acts on a particle(or point), such that the work done by this force in moving this particle from one point to another is */dependent of path taken/* that is the work done depends on the path itself. *

For example frictional force is non conservative because the work done by friction always acts in the direction of travel and therefore depends on length L of the path taken.

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[10] A particle moves on a circular path. Then under suitable conditions its speed and acceleration may remain constant, but the force, and velocity must always change with time.

[11] If P and Q are the initial and the final points of a path of a particle, displacement is a vector whose direction is along PQ and has magnitude is equal to the length of line PQ

[12] A particle is observed from two frames S_1 and S_2. The frame S_2 moves with respect to S_1 with an acceleration a. If F_1 and F_2 be the pseudoforces when seen from S_1 and S_2 respectively it is not possible to have $F_1 = F_2 = 0$

[13] when a ball is dropped from a height, it gains momentum down if we consider the ball as our system.This is because the force of gravity acts as an external force.

However, if we change our system and consider earth as a part of our system too, then the momentum remains conserved because the earth gains momentum up.

[14] The kinetic energy of a particle is continuously increasing with time, then the angle bewteen the net force and the velocity cannot be greater than or equal to 90^{o} at any time.

SetId=538

[15] 1)When we start rolling a body on a rough ground, it stops rolling after certain period because of frictional force.
2)When we leave a body from a certain height, it falls due to the act of gravitational force.

1)When a body is rotating in a circular path due to the centrifugal force which is the pseudo force. 2) When the lift is accelerating upwards, the upwards force felt by passengers a pseudo force.

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[1] Displacement is equal to the vector difference $\vec{r}_f - \vec{r}_i$ of the position vectors of initial and final points. The distance covered will be $|\vec{r}_f - \vec{r}_i|$

[2] Newton's Second Law of Motion is defined by the expression $F = \frac{dp}{dT}$, where F gives the force vector acting on the system and p gives its momentum vector; in linear motion. A similar expression can be written to describe angular motion, i.e. : $\tau = \frac{dL}{dt}$, where τ is the external torque vector acting on the system, and L is the angular momentum.

If the external torque on the system is zero, then we get the expression as: dL/dt=0. This points out to the fact that, when no external torque is acting on the system, then its angular momentum is constant, no matter what changes occur in the system. This is the Law of Conservation Of Angular Momentum.

[3] Consider a man standing on a spinning platform. Initially, the man spreads out his arms and he spins with a certain angular velocity. The next moment, he pulls his arms inwards keeping them close to his body. We will observe that the angular velocity with which he is spinning now increases. This phenomenon can be explained by the Law Of Conservation of Angular momentum. Initially, since his arms were spread wide, his moment of inertia was large. However, when he pulled them close to his body, his moment of inertia decreased.
In this example the angular velocity of the man increases and therefore the angular momentum also increases.The law of conservation of angular momentum does not apply because the torque of muscular forces is not zero.

[4] For the motion of earth around sun, the angular momentum of the earth about the center of mass of the sun + earth system and perpendicular to the plane of motion of earth is conserved.

[5] The z component of angular momentum of a conical pendulum is not conserved w.r.t. the origin fixed at the point of suspension; but the x and y components are conserved. SetId=539

[6] Example where law of conservation of angular momentum does not hold:Consider a vertical stick on the ground falling to a horizontal position. During the fall, the conservation of angular momentum applied at the point of rotation on the ground and perpendicular to the plane of the stick is not applicable as, the gravitational force which acts vertically downwards assumed at the centre of mass produces an external torque about the axis of rotation

[7] There are certain situations where it appears that the law of conservation of linear momentum does not hold. For example if we take some amount of a substance like construction putty, cement, cake batter, playing dough,etc and drop it on the

ground, it does not bounce back like a rubber ball would and hence the momentum it had before striking the ground seems to have been lost. Hence it appears that the law of conservation of linear momentum does not hold.

[8] To apply the conservation laws of momentum, energy and angular momentum, we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *external force* acting on the system, the energy and momentum will be conserved. However, depending on the nature of the system and of the forces, the total angular momentum may not be conserved.

[9] A force with the property that the work done in moving a particle is dependent on the path followed. The work done by a conservative force in moving a body from an initial location to a final location is dependent on the path taken between the two points

SetId=539

[10] When the force is kept constant as function of time, it is possible for a particle to move on a circular path in such a way that its speed remains constant, but the velocity and acceleration must always change with time.

[11] If P and Q are the initial and the final points of a path of a particle,the displacement is the vector $\overrightarrow{PQ}$.

[12] A particle is observed from two frames S_1 and S_2. The frame S_2 moves with respect to S_1 with an acceleration a. If F_1 and F_2 be the pseudoforces when seen from S_1 and S_2 respectively and if $F_1 = 0$ then we must have $F_2 \neq 0$

[13] There is no known exception to the law of conservation of momentum in classical mechanics however when two bodies collide and their mass converts to energy, an exception in nuclear physics is observed. In real life this is observed in nuclear reactions at atomic level.

[14] A heavy body is attached from a spring and is held at point A and is such that the spring is not slack nor is it stretched. It is then released. It goes down upto a point B and then it rises upto point C and executes an oscillatory motion between B and C. During the motion from A to C is first positive (from A to B) and then it is negative from B to A and again remains negative from A to C. SetId=539

[15] Newton's first law defines inertial frame. An inertial frame is a frame in which the first law hold. It also makes it possible to compare and tell two force being equal or not. The second law defines the force.

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SetId=540

[1] Distance is equal to the length of the path covered. Displacement is the shortest distance between initial and final points.

[2] If the net external torque acting on a system is zero, the angular momentum L of the system remains constant, no matter what changes take place within the system.

$$\sum(T_{\text{ext}}) = \frac{dL}{dt}$$

The law states that when there is no net external torque, $\frac{dL}{dt}$ is zero implying that the total angular momentum of system is constant.

i.e. $L = a$ constant (isolated system)

[3] In the Sun-Earth system, angular momentum of the earth is not conserved but the total angular momentum of the sun and the earth is constant of motion.

[4] In the Sun Earth system the angular momentum of the Earth about the pole star is conserved

[5] Only the z component of angular momentum of a conical pendulum is conserved w.r.t. the origin fixed at the point of suspension. SetId=540

[6] We have a conical pendulum .The forces acting on the bob are tension (along the direction of the string) and gravitational force acting in the vertically downward direction.we have an additional force called the drag force which is tangential to the motion of the bob and acts in the direction opposite to the motion of the bob.The axis of rotation passes through the hinge point and is vertical.The torque due to tension is 0 because the force passes through the axis of rotation.The torque due to mg is also zero since it is parallel to the axis of rotation.but the torque due to drag force is not zero.since the net external torque acting on the bob is not zero,therefore the law of conservation of angular momentum does not hold here

[7] A tennis ball is dropped from height h and after hitting the ground and it bounces back and rises to the same height. In this case the momentum of the ball is conserved because (under ideal conditions) the momentum after it hits the ground will be equal to the momentum it had before hitting the ground.

[8] In order to apply the law of conservation of momentum we must first identify the system. If there is no *external forces* acting on the system then conservation laws of momentum always holds. And depending on the nature of the system and of the forces, the total kinetic energy and the total angular momentum may not be conserved.

SetId=540

[9] The work done by non conservative force is dependent on the path taken by the particle in reaching final position from initial position. Non conservative force depends on the distance travelled by the particle

[10] It is not possible for a particle to move on a circular path in such a way that its speed and force remains constant, and only the velocity and acceleration may (or may not) always change with time.

[11] If two bodies starting from a point A reach a point B, following different paths, their displacement will be, in general different, but the distances covered will always be the same.

[12] If K is an inertial frame, any frame that moves w.r.t. the frame K with uniform velocity is also an inertial frame.

[13] When there is no external forces act on a system of many particles, and there are only internal forces acting on the particles. The third law gives that the internal forces are pairwise equal and opposite.Thus the sum of internal forces is zero and the momentum of each particle is conserved.

[14] The kinetic energy of a body does not change if any one of the following is true
(i)force is always perpendicular to the velocity
(ii) the force is always perpendicular to the acceleration
(iii) the object remains stationary
(iv) the object moves in such a way that the point of application of the force remains fixed.

SetId=540

[15] The magnitude of the pseudo force arising in a non-inertial frame is always equal to the mass of the body under consideration multiplied by the acceleration of the frame of reference and the direction of pseudoforce is always opposite to the direction of acceleration of the frame.

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SetId=541 [1] Distance is a scalar quantity where as the displacement is a vector quantity.

[2] When the net external torque acting on a body or a system of bodies is zero about a particular axis, then the angular momentum of each body is conserved about that axis.

[3] Consider a disc and a man system. man is standing on center of the disc rotating with angular velocity.initially man folded his hand.when man stretches his hands then momentum of inertia of system increases.and angular velocity decreases.and total angular momentum remains constant.

[4] For the motion of earth around sun, the angular momentum of the sun about the center of mass of the sun + earth system and perpendicular to the orbital plane of earth is conserved.

For the motion of earth around sun, the angular momentum of the sun about and axis passing through the Earth and perpendicular to the orbital plane of motion of earth is conserved.

[5] The projection of angular momentum of a conical pendulum in the horizontal plane is a constant of motion when the origin is chosen to be at fixed at the point of suspension. SetId=541

[6] When you release a toy gyroscope on its pedestal, it initially has no precessional rotation around that pedestal, i.e, the orientation of rotation is fixed. However, it instantaneously starts precessing around the pedestal. Both Kinetic Energy and Angular Momentum now exist where they did not exist a moment earlier. The Kinetic Energy is easy to explain, as appearing due to the body of the gyroscope dropping a tiny fraction of a millimeter in the Earth's gravitational field, giving up exactly the correct amount of Potential Energy. But the Angular Momentum of the Precession which just appeared, does not come from anywhere. This is therefore a Violation of the Conservation of Angular Momentum.

[7] Law of conservation of momentum does not hold when Newton's laws are not valid, e.g. in a non-inertial frame of reference. For example, when we consider collision between two bodies in a non-inertial frame of reference, the law of conservation of momentum cannot be applied because there will be a pseudo force acting on the frame itself.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then check if the laws is applicable or not.

So if there is no *net external force* acting on the system all the three conservation laws will hold.

[9] The work done by non conservative force is dependent on the path taken by the particle in reaching final position from initial position. Non conservative force depends on the distance travelled by the particle

SetId=541

[10] For a particle moving on circle the acceleration is always constant in magnitude and directed towards the centre of the circle.

[11] Distance is equal to the length of the path covered. Displacement is the shortest distance between initial and final points.

[12] If K is an inertial frame, any frame that moves w.r.t. the frame K with uniform speed is also an inertial frame.

[13] During collision of billiard balls momentum is conserved. During explosion of a bomb also momentum is conserved and the total momentum of the fragments of bomb will be zero. This is because all the forces are only internal forces.

[14] The total work done on a particle is always equal to the change in kinetic energy. SetId=541

[15] A force is any interaction which tends to change the motion of an object. It is also *defined* as rate of change of momentum.It is a vector quantity.
A physically apparent but nonexistent force felt by an observer in a noninertial frame (that is, a frame undergoing acceleration).

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SetId=542

[1] The speed is rate of change of distance and the velocity is the rate of change of displacement.

[2] The law of conservation of angular momentum states that in absence of an external torque on an object or a closed system of objects the total angular momentum of the system remains constant. Thus if $\vec{\tau} = 0 => \vec{L} =$ constant where τ is the torque and $\vec{L}$ is the angular momentum of the system.

[3] The conservation of angular momentum of a system of bodies requires that the the sum of torque due to all forces be equal to zero. Now consider a situation where the forces are such that the sum of torques of external forces is zero w.r.t. some axes K. Since the value of torque depends of the choices of axes, the sum of torques due to all internal forces will depend on the choice of axes and in general it will be non zero. Therefore, for a system of several bodies, for a given choice of axes K, there will be situations when the total angular momentum may not be conserved.

[4] For the motion of earth around sun, the sum of angular momenta of the Sun and the Earth about the center of mass of the sun + earth system is conserved.

[5] The law of angular momentum of a is not applicable for the conical pendulum conserved w.r.t. the origin fixed at the point of suspension. SetId=542

[6] There is no case where LAW OF CONSERVATION OF ANGULAR MOMENTUM does'nt hold.But there are cases where conservation of angular momentum does not hold.A body in vertical circular motion is an example where angular momentum is not conserved. Here the law of conservation does not apply.

[7] If I throw a ball upward, it's speed decreases as it rises upwards. There is an external force (gravity) acting on the ball, so the momentum conservation law does not apply. Momentum of the ball is not conserved, however the momentum of the Earth-ball system is conserved as gravity will become an internal force in this case.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then check we should if the laws are applicable or not.

So if there is no *external force* acting on the system all the three quantities, total momentum is conserved. The total angular momentum is also because the torque of internal forces will be zero. The conservation of energy depends on the nature of forces. will be conserved.

[9] Nonconservative forces are those forces in which the work done in moving a particle is dependant on the path taken to cover the distance. Some energy woul be lost to the environment in the form of heat, sound, etc. The energy in the final state is less than that in the initial state.

SetId=542

[10] The motion of a bomb dropped from a plane does is not a uniform motion as it follows a parabolic path and not a straight line path.

[11] Distance is a scalar quantity where as the displacement is a vector quantity.

[12] A frame rotating w.r.t K with uniform angular velocity is also an inertial frame.

[13] Give an example where law of conservation of momentum holds: A mass exploding into several pieces in a conservative field like gravitational field(if air resistance is neglected), obeys law of conservation of momentum. If air resistance cannot be neglected then the law of conservation of momentum will not hold.

[14] A particle is acted upon by a force of constant magnitude which is always perpendicular to the velocity of the particle and the motion of the particle takes place in a plane, Then its kinetic energy, speed, velocity acceleration will not change. SetId=542

[15] Psuedo Force is defined as an apparent force that acts in only non-inertial frames. Pseudo Forces are also called Fictitious Forces. It is an Imaginary force. It is independent of mass.

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SetId=543

[1] For any type of translational motion of a body, the displacement cannot be zero, where as the distance travelled can be zero.

[2] If no net external torque acts on a system, the total angular momentum of the system remains constant.

[3] Example where law of conservation of angular momentum does not hold:
When there is external force like frictional force acting on a object when it is rotating we cannot use conservation of angular momentum as the friction force acting on the object produces an external torque.

[4] For the motion of the Earth around the sun, the total of angular momenta of the Earth and the Sun, about in a reference frame fixed in the pole star, is conserved.

[5] The law of angular momentum of a is not applicable for the conical pendulum conserved when the origin is chosen to be at the pendulum bob itself. SetId=543

[6] A sphere rolling on a rough surface.Due to friction there is external torque so the angular momentum changes which results in the slowing of the sphere. The angular momentum keeps changing. Even in case like this one, it is wrong to say that the Law of Angular Momentum Conservation does not hold.

[7] A soldier accelerating away, after detonating a bomb, will find that the total momentum of the fragments of the bomb is zero. This is an example where the law of conservation of momentum holds as the forces on the fragments are internal forces only and sum of all such forces is zero.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *net external force* acting on the system, the momentum is conserved. The definition of angular momentum and torque depends on the choice of axes, and therefore it may not be be conserved. The conservation of total energy holds only for conservative forces.

When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *net external force* acting on the system, the energy and momentum will be conserved. However, the total angular momentum may not be conserved because the torque may not be zero.

[9] The work done by such forces depends on the path taken. The work done cannot be represented as a potential energy function.Work done by such forces is always negative.

SetId=543

[10] A wagon sliding on a roller coaster designed in such a way that the wagon covers equal distances in equal times. As the motion of the wagon is uniform, there will be no net force acting on it.

[11] Both displacement and distance tell us about the motion of a body but their study does not tell much about the forces on the body

[12] The Newton's Laws of motion will hold in all frames which are at rest w.r.t. K but do not remain valid in a frame that move with respect to K.

[13] Also a good example of law of conservation momentum can be seen when a bullet from a rifle is fired.As the bullet is fired and gets out of the rifle, the rifle gives a backward jerk due to the phenomenon of conservation of momentum.

[14] The kinetic energy of a particle is continuously increasing with time, then the angle bewteen the net force and the velocity cannot be greater than or equal to 90^{o} at any time.

SetId=543

[15] Psuedo Force is defined as an apparent force that acts in only non-inertial frames. Pseudo Forces are also called Fictious Forces. It is an Imaginary force. It is always proportional to mass. It is sometimes dependent on speed.

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[1] Displacements, being vector quantity can not compared with, a scalar quantity such as distance.

[2] The law of conservation of angular momentum states that when no external torque is applied on an object or a closed system of objects about an axis, the angular momentum about that axis remains constant.

[3] A bob attached to a ceiling by a string moving in a horizontal circular plane is an example where the total angular momentum of the bob about the point of suspension is not conserved. This is because the the torque due to the weight of the bob about the point of suspension does not vanish and has non zero horizontal component. Only the vertical component of the angular component is conserved.

[4] For the motion of the Earth around the sun, the total of angular momenta of the Earth and the Sun, is conserved in every inertial frame of reference; but the angular momentum of the Earth (or of the sun)is not conserved in every inertial frame.

[5] The three components of angular momentum of a conical pendulum is conserved w.r.t. the origin at the position of the center of mass of the pendulum. SetId=544

[6] Consider a rod of length l. Let us give an impulse to one end . Now the angular momentum about the oposite end is not zero since the impulse provides some torque . So the angular momentum is not conserved .

$$\text{torque} = \text{impulse} * \ell.$$

$d\ell/dt$ is not equal to zero and the law of conservation of angular momentum does not hold.

[7] There is no known exception to the law of conservation of momentum in classical mechanics However, an exception to conservation of energy in nuclear physics is observed. In nuclear reactions when two nuclei collide and their mass converts to energy and energy momentum are not conserved.

[8] In order to apply the law of conservation of momentum we must first identify the system. If there is no *net external forces* acting on the system then conservation laws of momentum always holds. The total energy and the total angular momentum may not be conserved.

[9] A nonconservative force is a force with the property that the work done in moving a particle depends on the path taken.Also, the net work done in a closed loop is non zero.

SetId=544

[10] A simple pendulum moves along a circular arc and does not have constant speed and therefore its motion is not uniform.

[11] Displacement is the shortest distance between initial and final points with direction specified.

[12] Staying inside a bullet train moving with constant velocity (no jerks etc) an experiment can always be performed which will tell us the numerical velocity of the bullet train

[13] when a man walks on the ice slab where friction does not exist between the ice block and the floor but between the feet of the man and the slab the slab moves back as per the law of conservation of momentum

[14] A heavy body is attached from a spring and is held at point A and is such that the spring is not slack nor is it stretched. It is then released. It goes down upto a point B and then it rises upto point C and executes an oscillatory motion between B and C. During the motion from A to C is first positive (from A to B) and then it is negative from B to A and again remains negative from A to C. SetId=544

[15] Since pseudo forces are not real forces, they do not affect the conservation laws and all the three conservation laws hold in noninertial frames.

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SetId=545

[1] Distance depends on the path where as the displacement depends on the end point only.

[2] The angular momentum of a given system of bodies shall remain conserved unless acted upon by an external unbalanced torque.

[3] Law of conservation of angular momentum holds in case of long jump. When a athlete takes off from the ground in a running long jump, the forces on the launching foot give the athlete an angular momentum with a forward rotation around a horizontal axis. Such rotation would not allow the jumper to land properly. In the landing, the legs should be together and extended forward at an angle so that the heels mark the sand at the greatest distance. Once airborne, the angular momentum cannot change (it is conserved) because no external torque acts to change it. However, the jumper can shift most of the angular momentum to the arms by rotating them in windmill fashion. Then the body remains upright in the proper orientation of landing.

[4] In the Sun Earth system the angular momentum of the Earth is conserved in every frame of reference

[5] Only the z component of the angular momentum of a conical pendulum is conserved w.r.t. the origin fixed at the point of suspension.

SetId=545

[6] Let us consider a rotating skew rod. In the absence of friction or any other drag force, the rod should continuously spin without stopping. Here the net torque about the axis of rotation is 0 and hence angular momentum is conserved. It therefore follows from law of conservation of angular momentum that a spinning skew rod will keep rotating with constant angular velocity if there is no external torque. So law of conservation of angular momentum does not hold.

[7] In a system of a canon and a canon ball, total momentum of the system is zero before canon ball is fired. After firing the canon ball, the momentum of the system seems to be conserved as the ball moves forward and the canon moves backward.

[8] In order to apply the law of conservation of momentum we must first identify the system. Then even if there is no *net external forces* acting on the system, all the three conservation laws of momentum, angular momentum and energy may not hold due to presence of internal forces.

[9] A force whose work done is a path function is called a non-conservative force. All the forces which do not satisfy the definition of conservative forces are non-conservative in nature. The work done by these forces dissipates into heat energy, sound energy, light energy, etc. Therefore, law of conservation of mechanical energy cannot be

applied to a system on which a non-conservative force is acting. No potential function can be defined for these forces.

SetId=545

[10] A satellite goes around the earth in a circular orbit of 600km with a time period of $5.8 \times 10^3 s$. Its motion will be uniform as it will cover equal distances in equal times.

[11] Displacements, being vector quantity can not compared with, a scalar quantity such as distance.

[12] Staying inside a bullet train moving with constant velocity (no jerks etc) an experiment can always be performed which will tell us the numerical value of the acceleration of the bullet train

[13] When a freely falling rigid body collides another body in its path momentum the system of two particles is not conserved in the collision as there is external force mg acting on the system.

[14] The kinetic energy of a body does not change if any one of the following is true
(i)force is always perpendicular to the velocity
(ii) the force is always perpendicular to the acceleration
(iii) the object remains stationary
(iv) the object moves in such a way that the point of application of the force remains fixed.

SetId=545

[15] A force is any interaction which tends to change the motion of an object. Newtons' second tell us that it is *equal* to the rate of change of momentum.It is a vector quantity. Real forces can be distinguished from pseudo forces because the pseudo forces always proportional to the mass of the body. All real forces, except the gravitational force, do not depend on the mass of the body.

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SetId=546

[1] Distance equal to zero implies displacement=0; and Displacement=0 also implies distance = 0

[2] When the net external torque acting on a system about a given axis is zero, the total angular momentum of the system about that axis remains consant.

[3] The total angular momentum of a body remains constant of motion when the net torque of the external forces acting on the body is zero.
In general, we have a system of particles such that the net torque of the external forces on the system, w.r.t. some axes K, is zero, the total angular momentum may not remain conserved, because the torque due to the internal forces may not be zero.

[4] In the motion of earth around sun, the angular momentum of the earth about an axis passing through the sun and perpendicular to the plane of motion of earth is conserved.

[5] The z component of angular momentum of a conical pendulum is not conserved w.r.t. the origin fixed at the point of suspension; but the x and y components are conserved.

SetId=546

[6] In the example of skew rod the angular velocity does not change even though the torque applied is nonzero. However there is no contradiction as in this case the law of conservation of momentum is not applicable. conservation is violated.

[7] When applying the conservation laws of momentum, energy and angular momentum we must define the system first.Only then check if the laws is applicable or not.

As an example: when a ball is dropped from a height, it gains momentum down if we consider the ball as our system.This is because the force of gravity acts as an external force.

However, if we change our system and consider earth as a part of our system too, then the momentum remains conserved because the earth gains momentum up.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then check we should if the laws are applicable or not.

So if there is no *external force* acting on the system all the three quantities, total momentum, total angular momentum, and total kinetic energy will be conserved independent of the nature of forces.

[9] *Non conservative forces* are the type of forces in which the work done by the forces is purely dependent on the path taken by the body.Thus the net work done by the forces in cyclic path is never equal to zero.

SetId=546

[10] A uniform motion is defined to be the one in which a body covers equal distances in equal time intervals.

[11] Distance depends on the path where as the displacement depends on the end point only

[12] Assume bullet train, moving with out any jerks, is going on a circular arc of radius R with constant speed. Then an experiment is to be performed entirely within the train without any measurement on objects outside the train. Such an experiment can tell only radius of the track.

[13] If we take some amount of a substance like construction putty, cement, cake batter, playing dough,etc and drop it on the ground, it does not bounce back, like a rubber ball would bounce, and hence the momentum it had before striking the ground seems to have been lost. Hence it appears that the law of conservation of linear momentum does not hold.

[14] The total work done on a particle is always equal to the change in kinetic energy. SetId=546

[15] Examples of pseudoforce are Coriolis Force, Centrifugal Force, and magnetic force on currents.
Psuedo force also called as fictitious force is an apparent force that are needed for masses whose their motion is described using a non inertial frame of reference.

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SetId=547

[1] If P and Q are the initial and the final points of a path of a particle, displacement is a vector whose direction is along PQ and has magnitude is equal to the length of line PQ

[2] This law sates that when no net torque of all forces acts on a object or a system of objects then total angular momentum of system is conserved.The angular momentum before an event is equal to angular momentum after that event.mathematically explained by when, net torque=0 ;then, total angular momentum(L)=constant.

[3] An example where law of conservation of angular momentum holds:
The Law of conservation of angular momentum holds in the case of a ballet dancer performing a pirouette.

When the dancer extends her arms outward, the angular velocity of her rotation decreases whereas when she keeps her arms close to her body, the angular velocity increases. This is because her moment of inertia changes as she moves her arms outward and inward. It can be noted that she as a system has no external torque acting upon her.

[4] For the motion of earth around sun, the angular momentum of the earth about the center of mass of the sun + earth system and perpendicular to the plane of motion of earth is conserved.

[5] Only the z component of angular momentum of a conical pendulum is conserved w.r.t. the origin fixed at the point of suspension. SetId=547

[6] Example where law of conservation of angular momentum does not hold:If a particle undergoes conical motion and the only force acting on particle is central force like tension of the string.Then total external torque about fixed point A is zero,yet angular momentum is not conserved,as angular momentum keeps on changing direction.

[7] Statement: Law of Conservation of energy states that "ENERGY CAN NEITHER BE CREATED NOR DESTROYED",but it can be changed from one form to other.

EXPLANATION: Statement implies that the total amount of energy in an isolated system remains constant although it may change forms. viz, kinetic energy may change to potential;chemical to electrical energies etc.

[8] If we want to apply the conservation laws of momentum, energy and angular momentum, we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *external force* acting on the system, the momentum and angular momentum will be conserved, and depending on the nature of the forces but total energy may or may not be conserved.

[9] Non-conservative forces are path-dependent forces, i.e. the work done on a body by these forces depends on the path taken by the body. Mechanical energy of a system is not conserved when a conservative force acts on it but the total energy is conserved. Therefore, the mechanical energy lost by the system is liberated in some other form such as light energy, heat energy, etc.

For example, when a body is moving along a surface, frictional force acts on the body as well. Due to this frictional force, the body loses its mechanical energy, and this loss is generally released in the form of heat energy to the surroundings. Thus, the mechanical energy will not be conserved and frictional force can be classified as a non-conservative force.

SetId=547

[10] A particle moves on a circular path. Then its speed, direction of force, velocity and acceleration must always change with time.

[11] Distance equal to zero $\Rightarrow$ displacement=0; but Displacement=0

[12] Assume bullet train, moving with out any jerks, is going on a circular arc of radius R with constant speed. Then an experiment is to be performed entirely within the train without any measurement on objects outside the train. Such an experiment can tell both speed of the train and radius of the track.

[13] When we consider collision between two bodies in a non-inertial frame of reference, the law of conservation of momentum cannot be applied because there will be a pseudo force acting on the frame itself.

[14] A particle is acted upon by a force of constant magnitude which is always perpendicular to the velocity of the particle and the motion of the particle takes place in a plane, Then its kinetic energy, speed, velocity acceleration will not change. SetId=547

[15] Examples of pseudo-force are Coriolis Force, Centrifugal Force, Centripetal force and magnetic force on currents. The pseudo forces do not obey Newton's third law and therefore the total momentum does not appear to be conserved in a non-inertial frame.

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[1] If P and Q are the initial and the final points of a path of a particle,the displacement is the vector $\overrightarrow{PQ}$.

[2] Statement of Law of Conservation of Angular Momentum:

Differentiating $\vec{L} = \vec{r} \times \vec{p}$ w.r.t, time,

$$\begin{aligned}
\frac{dL}{dt} &= \frac{d\vec{r} \times \vec{p}}{dt} = \frac{d\vec{r}}{dt} \times \vec{p} + \vec{r} \times \frac{d\vec{p}}{dt} = \vec{v} \times (m\vec{v}) + \vec{r} \times \vec{F} \\
&= \vec{r} \times \vec{F} (\because v \times v = 0) \\
&= \vec{\tau}
\end{aligned}$$

here $\vec{\tau}$ represents the net torque acting on a rigid body rotating about a fixed axis.This torque must take into account of all the forces, be it external or internal forces

[3] In case of a skater, who can be considered an isolated system, so no torue will be acting on him/her. When the arms are extended, the moment of inertia is more. When his hands are closely held, the moment of inertia is lesser. Since the angular momentum is same, the angular acceleration changes accordingly.

[4] In the Sun Earth system the angular momentum of the Earth about the pole star is conserved

[5] The projection of angular momentum of a conical pendulum in the horizontal plane is a constant of motion when the origin is chosen to be at fixed at the point of suspension.

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[6] A nonzero torque always causes the angular velocity to change, because a change in angular momentum means a change in angular velocity $L = I\omega$

[7] Oscillating simple pendulum is a very good example where potential energy gets converted to kinetic energy and kinetic to potential energy. Some energy gets dissipated as heat if we consider air resistance. Energy as a whole is conserved if we consider universe as system, the energy has just changed its form.

[8] To apply the conservation laws of momentum, energy and angular momentum, we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *external force* acting on the system, the energy and momentum will be conserved. However, depending on the nature of the system and of the forces, the total angular momentum may not be conserved.

[9] It is a force for which the work done by that force on an object or a particle in moving it between any two points depends on its path travelled.This force doesn't conserves the mechanical energy.The work done by a non-conservative force on an object in moving it in a circular path is not equal to zero.

SetId=548

[10] A particle moves on a circular path. Then its speed, direction offorce, can remain constant by velocity and acceleration must always change with time.

[11] If P and Q are the initial and the final points of a path of a particle, displacement is a vector whose direction is along PQ and has magnitude is equal to the length of line PQ

[12] Assume bullet train, moving with out any jerks, is going on a circular arc of radius R with constant speed. Then an experiment is to be performed entirely within the train without any measurement on objects outside the train. Such an experiment can tell only speed of the track.

[13] When a system is acted upon by external forces like friction etc, the conservation principle does not hold good,there will be impulse imparted and so we cant conserve momentum. This is case when a collision between two elastic balls take place on a rough horizontal table. The total momentum just after the collision will be different from the total momentum just before the collision. Here momentum is not conserved as there is external force friction is present.

[14] The kinetic energy of a particle is continuously increasing with time, then the angle bewteen the net force and the velocity cannot be greater than or equal to 90^o at any time.

SetId=548

[15] FORCE is any interaction which tends to change the motion of an object.It has both magnitude and direction,making it a vector quantity.

A psuedo force is an apparent force that acts on all masses whose motion is described with respect to a non-inertial frame of reference like a rotating frame of reference.This force is needed by an observer in an non-inertial frame to make all the Newtons Laws of motion hold true.

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[1] If two bodies starting from a point A reach a point B, following different paths, their displacement will be, in general different, but the distances covered will always be the same.

[2] Statement of Law of Conservation of Angular Momentum: For a system of many particles The net torque due all the forces, be it external or internal forces. But as the torque due to all the internal forces cancel out, it sufficient to consider the external forces acting on the system.

[3] Example where law of conservation of angular momentum holds:
Let us assume a student seated on a stool that can rotate freely about a vertical axis. The student has been set into rotation at a modest initial angular speed ω . He holds two dumbbells in his outstretched hands. His angular momentum vector L lies along the vertical rotation axis, pointing upwards. Now he pulls in his arms;this action reduces his rotational inertia from its value I_{initial} to a final value I_{final} because he moves the mass closer to the rotational axis. His rate of rotation increases markedly, from ω_{initial} to ω_{final}. The student can then slow down by extending his arms once more,moving the dumbbells outward. No external torque acts on the system consisting of the student, stool and the dumbbells. Thus the angular momentum of the system about the rotational axis remains constant. $I_{\text{initial}} * \omega_{\text{initial}} = I_{\text{final}} * \omega_{\text{final}}$.

[4] For the motion of earth around sun, the angular momentum of the sun about the center of mass of the sun + earth system and perpendicular to the orbital plane of earth is conserved.

For the motion of earth around sun, the angular momentum of the sun about and axis passing through the Earth and perpendicular to the orbital plane of motion of earth is conserved.

[5] The law of angular momentum of a is not applicable for the conical pendulum conserved w.r.t. the origin fixed at the point of suspension. SetId=549

[6] A nonzero torque always implies change in angular momentum and may not give rise to a change in magnitude of angular velocity. A non zero torque may mean change only the direction of the angular momentum and not the angular velocity.

[7] Law of conservation of momentum does not hold whenever an external force or impulse acts on the system. For example,when a body collides with earth then it bounces back to a lesser height as it loses some velocity.

In this example the momentum of a ball is not conserved due to impulsive force by ground in the normal direction.

However, strictly speaking the system that should be considered here is the ball-earth system and the total momentum is conserved.

[8] In order to apply the law of conservation of momentum we must first identify the system. If there is no *external forces* acting on the system then conservation laws of momentum always holds. And depending on the nature of the system and of the forces, the total kinetic energy and the total angular momentum may not be conserved.

[9] Explain Nonconservative force: This force is just opposite to that of conservative force. The work done by this force depends on the path taken by the particle on which the force is applied.This force does not conserve mechanical energy.If a particle travels in a closed loop, the net work done by a non consevative force is non zero.

SetId=549

[10] A particle moves on a circular path. Then under suitable conditions its speed may remain constant, but the force, velocity and acceleration must always change with time.

[11] If P and Q are the initial and the final points of a path of a particle,the displacement is the vector $\overrightarrow{PQ}$.

[12] A particle is observed from two frames S_1 and S_2. The frame S_2 moves with respect to S_1 with an acceleration a. If F_1 and F_2 be the pseudoforces when seen from S_1 and S_2 respectively it is not possible to have $F_1 = F_2 = 0$

[13] When we are in accelerating frame if we observe any collision between two bodies then the law of conservation of momentum does not hold in that frame of reference. On the other hand the law of conservation of momentum holds in all inertial frames.

[14] A heavy body is attached from a spring and is held at point A and is such that the spring is not slack nor is it stretched. It is then released. It goes down upto a point B and then it rises upto point C and executes an oscillatory motion between B and C. During the motion from A to C is first positive (from A to B) and then it is negative from B to A and again remains negative from A to C. SetId=549

[15] FORCE is any interaction which tends to change the motion of an object.It has both magnitude and direction,making it a vector quantity. A pseudo-force F doesn't arise from any physical interaction between two objects, but rather from the acceleration 'a' of the non-inertial reference frame itself. These forces have no real existence but must be taken into account in an accelerating frame of reference to make all the three Newton's Laws of motion applicable to the system

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[1] Displacement is equal to the vector difference $\vec{r}_f - \vec{r}_i$ of the position vectors of initial and final points. The distance covered will be $|\vec{r}_f - \vec{r}_i|$

[2] Depending on the torques acting on a system, the angular momentum can be conserved only in one or two directions, but may not be conserved in all. For instance, if an isolated body has no torque acting on it only in the direction along the Z axis, then the angular momentum is conserved only in that direction.

[3] A bob is attached to ceiling by a string and moves in a horizontal circular plane is an example. In this case the law of conservation of angular momentum does not hold.

[4] For the motion of earth around sun, the sum of angular momenta of the Sun and the Earth about the center of mass of the sun + earth system is conserved.

[5] The law of angular momentum of a is not applicable for the conical pendulum conserved when the origin is chosen to be at the pendulum bob itself. SetId=550

[6] In the example of a rotating skew rod the torque due to the external gravitational forces is zero , but the angular momentum is not constant Therefore the law of conservation of angular momentum is violated.

[7] If a bullet hits a wooden board and gets embedded in the board, the total energy and the total momentum of the bullet and the board are conserved.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then check if the laws is applicable or not.

So if there is no *net external force* acting on the system all the three conservation laws will hold.

[9] Non conservative force is the force in which the work done by a particle in going from one point to another is path dependent.

For non conservative forces mechanical energy is not conserved,mostly lost in the form of heat and light.The work done by a non conservative force is equal to the change in mechanical energy.

SetId=550

For non conservative force $E_{\text{initial}} > E_{\text{final}}$

[10] A particle moves on a circular path. Then under suitable conditions its speed and acceleration may remain constant, but the force, and velocity must always change with time.

[11] If two bodies starting from a point A reach a point B, following different paths, their displacement will be, in general different, but the distances covered will always be the same.

[12] A particle is observed from two frames S_1 and S_2. The frame S_2 moves with respect to S_1 with an acceleration a. If F_1 and F_2 be the pseudoforces when seen from S_1 and S_2 respectively and if $F_1 = 0$ then we must have $F_2 \neq 0$

[13] When a freely falling body hits another rigid body in its path then momentum is not conserved as external force mg acts on both the bodies. The total momentum after the collision will be different from the total momentum before the hit.

[14] The kinetic energy of a body does not change if any one of the following is true
(i)force is always perpendicular to the velocity
(ii) the force is always perpendicular to the acceleration
(iii) the object remains stationary
(iv) the object moves in such a way that the point of application of the force remains fixed.

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[15] FORCE is any interaction which tends to change the motion of an object.It has both magnitude and direction,making it a vector quantity.
A pseudo-force results from acceleration of the frame of reference in which the objects reside. It is taken into account so that Newton's second law isn't invalidated. The pseudo force acting on an object can always be mathematically expressed as the product of the mass of the object and the acceleration of the frame of reference.

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SetId=551

[1] Distance is equal to the length of the path covered. Displacement is the shortest distance between initial and final points.

[2] According to Law of Conservation of Angular momentum,if no external torque acts on an object or system of objects,angular momentum of an object or system of objects remains CONSTANT or no change in angular momentum can occur.

Also it states that,only external torque can change angular momentm of the system where as the torque produced by internal forces can not change the angular momentum of the system

[3] Consider a disc rotating about an axis perpendicular to its plane. On placing a smaller disc with its surface parallel to the surface of the rotating disc, the angular momentum of the system of two discs remains constant as there is no external torque.

[4] For the motion of the Earth around the sun, the total of angular momenta of the Earth and the Sun, about in a reference frame fixed in the pole star, is conserved.

[5] The three components of angular momentum of a conical pendulum is conserved w.r.t. the origin at the position of the center of mass of the pendulum. SetId=551

[6] In the example of skew rod, the angular momentum changes with time and there is a non zero torque coming from action of forces other than gravitational forces. Hence the law of conservation of angular momentum dos not apply.

[7] If a bullet hits a wooden board and gets embedded in the board, the total energy of the bullet and the board system is conserved but the total momentum is not conserved.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then check we should if the laws are applicable or not.

So if there is no *external force* acting on the system all the three quantities, total momentum is conserved. The total angular momentum is also because the torque of internal forces will be zero. The conservation of energy depends on the nature of forces. will be conserved.

[9] A force is said to be non-conservative, if the work done by the force is dependent on the path taken. It could also be defined as a force for which the work done during a cyclic process is non-zero.

SetId=551

[10] When the force is kept constant as function of time, it is possible for a particle to move on a circular path in such a way that its speed remains constant, but the velocity and acceleration must always change with time.

[11] Distance is equal to the length of the path covered. Displacement is the shortest distance between initial and final points.

[12] If K is an inertial frame, any frame that moves w.r.t. the frame K with uniform velocity is also an inertial frame.

[13] .The law of conservation of momentum does not hold good when net external forces acting on the system is not zero.when two bodies collide law of conservation of momentum is applicable on system of two bodies but on not individual bodies because external impulse acts on them.

[14] The total work done on a particle is always equal to the change in kinetic energy. SetId=551

[15] Explain Force:FORCE is any interaction which tends to change the motion of an object.It has both magnitude and direction,making it a vector quantity.
In the case of a non inertial frame, we can use the second law of motion by adding a pseudo force to the system which makes it an inertial frame of reference.

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SetId=552 [1] Distance is a scalar quantity where as the displacement is a vector quantity.

[2] The law of conservation of angular momentum states that when the net external torque acting on the system is zero, then the angular momentum of the system remains constant.both the initial and final momentum should be taken from a fixed inertial frame of reference provided.

[3] Consider a man standing on a spinning platform. Initially, the man spreads out his arms and he spins with a certain angular velocity. The next moment, he pulls his arms inwards keeping them close to his body. We will observe that the angular velocity with which he is spinning now increases. This phenomenon can be explained by the Law Of Conservation of Angular momentum. Initially, since his arms were spread wide, his moment of inertia was large. However, when he pulled them close to his body, his moment of inertia decreased.
In this example the angular velocity of the man increases and therefore the angular momentum also increases.The law of conservation of angular momentum does not apply because the torque of muscular forces is not zero.

[4] For the motion of the Earth around the sun, the total of angular momenta of the Earth and the Sun, is conserved in every inertial frame of reference; but the angular momentum of the Earth (or of the sun)is not conserved in every inertial frame.

[5] Only the z component of the angular momentum of a conical pendulum is conserved w.r.t. the origin fixed at the point of suspension. SetId=552

[6] In the example of conical pendulum, the z- component of angular momentum does not change. This follows from the angular momentum conservation as there is no external torque.

[7] If a bullet hits a wooden board and gets embedded in the board, both total energy and the total momentum of the bullet and the board are not conserved.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *net external force* acting on the system, the momentum is conserved. The definition of angular momentum and torque depends on the choice of axes, and therefore it may not be be conserved. The conservation of total energy holds only for conservative forces.

When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *net external force* acting on the system, the energy and momentum will be conserved. However, the total angular momentum may not be conserved because the torque may not be zero.

[9] a force is said to be non conservative if work done is dependent on the path of the particle.potential cannot be defined in the case of non conservative forces.work done in closed loop is not equal to zero.

SetId=552

[10] It is not possible for a particle to move on a circular path in such a way that its speed and force remains constant, and only the velocity and acceleration may (or may not) always change with time.

[11] Distance is a scalar quantity where as the displacement is a vector quantity.

[12] If K is an inertial frame, any frame that moves w.r.t. the frame K with uniform speed is also an inertial frame.

[13] A block moving in the air breaks up into two parts and the parts separate, then the total momentum must be the same before and after the break.

[14] A particle is acted upon by a force of constant magnitude which is always perpendicular to the velocity of the particle and the motion of the particle takes place in a plane, Then its kinetic energy, speed, velocity acceleration will not change. SetId=552

[15] For the Newton's Law of Motion to hold true,the physically apparent but nonexistent force needed by an observer in a non-inertial frame is called the pseudo force.
1) Caused by relative acceleration of the origin in a straight line
2) Centrifugal and Centripetal forces
3) Coriolis force
4) Euler force

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[1] The speed is rate of change of distance and the velocity is the rate of change of displacement.

[2] The law of conservation of angular momentum states that The total angular momentum of a system is constant in both magnitude and direction if the resultant torque, of the external forces acting on the system, is zero.

[3] In the Sun-Earth system, angular momentum of the earth is not conserved but the total angular momentum of the sun and the earth is constant of motion.

[4] In the Sun Earth system the angular momentum of the Earth is conserved in every frame of reference

[5] The z component of angular momentum of a conical pendulum is not conserved w.r.t. the origin fixed at the point of suspension; but the x and y components are conserved.

SetId=553

[6] In the example of conical pendulum, the x and$y$ components of angular momentum change. This follows from the angular momentum conservation as the z components external torque is zero and horizontal components of torque are non zero.

[7] There are certain situations where it appears that the law of conservation of linear momentum does not hold. For example if we take some amount of a substance like construction putty, cement, cake batter, playing dough,etc and drop it on the ground, it does not bounce back like a rubber ball would and hence the momentum it had before striking the ground seems to have been lost. Hence it appears that the law of conservation of linear momentum does not hold.

[8] In order to apply the law of conservation of momentum we must first identify the system. If there is no *net external forces* acting on the system then conservation laws of momentum always holds. The total energy and the total angular momentum may not be conserved.

[9] Explain Nonconservative Forces:

The forces that depend on the path taken by the particle are called non-conservative forces.

Mechanical energy is not conserved during the action of a non conservative force, instead, it is lost as other forms of enery like heat, light, etc.

Potential energy is not defined for a non-conservative force.

The initial and final kinetic energy in a closed loop is not equal.

The work done by a non conservative force in a closed loop is non zero. In practice, the net work is invariably negative.

Work done by a non conservative force cannot be completely recovered.

For a non conservative force,

$$/text(KE)//_f//+(\text{PE})//_f// = (\text{KE})_i+(\text{PE})_i//+//\text{Work Done})//\text{non-conservative force}//$$

SetId=553

[10] For a particle moving on circle the acceleration is always constant in magnitude and directed towards the centre of the circle.

[11] Both displacement and distance tell us about the motion of a body but their study does not tell much about the forces on the body

[12] A frame rotating w.r.t K with uniform angular velocity is also an inertial frame.

[13] A ball hits the floor and rebounds after an inelastic collision. In this case the total momentum of the ball before and after the collsion is conserved. Also the total enrgy of the ball and the earth remains the same

[14] The kinetic energy of a particle is continuously increasing with time, then the angle bewteen the net force and the velocity cannot be greater than or equal to 90^{o} at any time. SetId=553

[15] A force is any interaction which tends to change the motion of an object. It is also *defined* as rate of change of momentum.It is a vector quantity.

Pseudo-force is a fictitious force it is taken by an observer from non inertial frame of reference. This force arises from acceleration of reference frame that is a reference frame which is accelerating or rotating.

The equation of motion is then written by balancing all forces. As an example a particle moving in a circle is seen to be at rest by balancing the centripetal and centrifugal forces.

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[1] For any type of translational motion of a body, the displacement cannot be zero, where as the distance travelled can be zero.

[2] If the net external torque acting on a system is zero,the angular momentum L(vector) of the system remains constant,no matter what changes take place within the system.L(vector)=a constant (net external torque acting on system is zero)

[3] Consider a disc and a man system. man is standing on center of the disc rotating with angular velocity.initially man folded his hand.when man stretches his hands then momentum of inertia of system increases.and angular velocity decreases.and total angular momentum remains constant.

[4] In the motion of earth around sun, the angular momentum of the earth about an axis passing through the sun and perpendicular to the plane of motion of earth is conserved.

[5] Only the z component of angular momentum of a conical pendulum is conserved w.r.t. the origin fixed at the point of suspension. SetId=554

[6] Example where law of conservation of angular momentum does not hold: A disc rotating on a horizontal rough surface will not have a constant angular momentum because there will be a constant torque by frictional force. Hence, its angular momentum will decrease, and the law of conservation of angular momentum does not apply.

[7] A tennis ball is dropped from height h and after hitting the ground and it bounces back and rises to the same height. In this case the momentum of the ball is conserved because (under ideal conditions) the momentum after it hits the ground will be equal to the momentum it had before hitting the ground.

[8] In order to apply the law of conservation of momentum we must first identify the system. Then even if there is no *net external forces* acting on the system, all the three conservation laws of momentum, angular momentum and energy may not hold due to presence of internal forces.

[9] A non conservative force is one where the mechanical energy is not conserved.Here the work done is dependent on the path taken .Different amounts of work need to be done in different paths.Here potential energy would have no meaning as it would keep changing with the path.Here some amount of mechanical energy is lost as sound energy or heat energy and hence is not conserved.

SetId=554

[10] The motion of a bomb dropped from a plane does is not a uniform motion as it follows a parabolic path and not a straight line path.

[11] Displacement is the shortest distance between initial and final points with direction specified.

[12] The Newton's Laws of motion will hold in all frames which are at rest w.r.t. K but do not remain valid in a frame that move with respect to K.

[13] In a head on elastic collision of two identical bodies of equal masses the velocities, the speeds, the momenta and the kinetic energy are all exchanged.

[14] A heavy body is attached from a spring and is held at point A and is such that the spring is not slack nor is it stretched. It is then released. It goes down upto a point B and then it rises upto point C and executes an oscillatory motion between B and C. During the motion from A to C is first positive (from A to B) and then it is negative from B to A and again remains negative from A to C. SetId=554

[15] A psuedo force is an apparent force that acts on all masses whose motion is described with respect to a non-inertial frame of reference like a rotating frame of reference. This force is needed by an observer in an non-inertial frame to make all the Newtons second laws to write correct equation of motion..

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SetId=555

[1] Displacements, being vector quantity can not compared with, a scalar quantity such as distance.

[2] The Law of conservation of angular momentum states that when no external torque acts on an object or a closed system of objects undergoing motion about a given axis, the change in angular momentum is zero. Therefore, considering an event where only internal torque or no torque is involved, the total angular momentum of the system before the event is equal to the total angular momentum after the event

[3] The conservation of angular momentum of a system of bodies requires that the the sum of torque due to all forces be equal to zero. Now consider a situation where the forces are such that the sum of torques of external forces is zero w.r.t. some axes K. Since the value of torque depends of the choices of axes, the sum of torques due to all internal forces will depend on the choice of axes and in general it will be non zero. Therefore, for a system of several bodies, for a given choice of axes K, there will be situations when the total angular momentum may not be conserved.

[4] For the motion of earth around sun, the angular momentum of the earth about the center of mass of the sun + earth system and perpendicular to the plane of motion of earth is conserved.

[5] The projection of angular momentum of a conical pendulum in the horizontal plane is a constant of motion when the origin is chosen to be at fixed at the point of suspension.

SetId=555

[6] Example where law of conservation of angular momentum does not hold:Consider a vertical stick on the ground falling to a horizontal position. During the fall, the conservation of angular momentum applied at the point of rotation on the ground and perpendicular to the plane of the stick is not applicable as, the gravitational force which acts vertically downwards assumed at the centre of mass produces an external torque about the axis of rotation

[7] Law of conservation of momentum does not hold when Newton's laws are not valid, e.g. in a non-inertial frame of reference. For example, when we consider collision between two bodies in a non-inertial frame of reference, the law of conservation of momentum cannot be applied because there will be a pseudo force acting on the frame itself.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then check we should if the laws are applicable or not.

So if there is no *external force* acting on the system all the three quantities, total momentum, total angular momentum, and total kinetic energy will be conserved independent of the nature of forces.

[9] The force whose work depends on path taken is called a non conservative force.friction for example does less work on a book dragged across a table if the book is dragged straight across than if the book is dragged in a curved path.

SetId=555

[10] A wagon sliding on a roller coaster designed in such a way that the wagon covers equal distances in equal times. As the motion of the wagon is uniform, there will be no net force acting on it.

[11] Displacements, being vector quantity can not compared with, a scalar quantity such as distance.

[12] Staying inside a bullet train moving with constant velocity (no jerks etc) an experiment can always be performed which will tell us the numerical velocity of the bullet train

[13] For a system of several particles the conservation of total linear momentum is equivalent to the statement that their centre of mass moves like a free particle.

[14] The kinetic energy of a body does not change if any one of the following is true
(i)force is always perpendicular to the velocity
(ii) the force is always perpendicular to the acceleration
(iii) the object remains stationary
(iv) the object moves in such a way that the point of application of the force remains fixed.

SetId=555

[15] One indication that pseudo forces are NON-NEWTONIAN is that they violate Newton's III law and violate the Newton's third law.

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SetId=556

[1] Distance depends on the path where as the displacement depends on the end point only.

[2] The law of conservation of angular momentum states that when no external torque acts on an object or a closed system of objects, no change of angular momentum can occur. Hence, the angular momentum before an event involving only internal torques or no torques is equal to the angular momentum after the event . Angular momentum can be calculated with the help of the formula $L = I\omega$ where L stands for Angular momentum, I stands for moment of inertia and ω stands for angular velocity

[3] Example where law of conservation of angular momentum does not hold:
When there is external force like frictional force acting on a object when it is rotating we cannot use conservation of angular momentum as the friction force acting on the object produces an external torque.

[4] In the Sun Earth system the angular momentum of the Earth about the pole star is conserved

[5] The law of angular momentum of a is not applicable for the conical pendulum conserved w.r.t. the origin fixed at the point of suspension. SetId=556

[6] We have a conical pendulum .The forces acting on the bob are tension (along the direction of the string) and gravitational force acting in the vertically downward direction.we have an additional force called the drag force which is tangential to the motion of the bob and acts in the direction opposite to the motion of the bob.The axis of rotation passes through the hinge point and is vertical.The torque due to tension is 0 because the force passes through the axis of rotation.The torque due to mg is also zero since it is parallel to the axis of rotation.but the torque due to drag force is not zero.since the net external torque acting on the bob is not zero,therefore the law of conservation of angular momentum does not hold here

[7] If I throw a ball upward, it's speed decreases as it rises upwards. There is an external force (gravity) acting on the ball, so the momentum conservation law does not apply. Momentum of the ball is not conserved, however the momentum of the Earth-ball system is conserved as gravity will become an internal force in this case.

[8] If we want to apply the conservation laws of momentum, energy and angular momentum, we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *external force* acting on the system, the momentum and angular momentum will be conserved, and depending on the nature of the forces but total energy may or may not be conserved.

[9] ** Nonconservative force is a force in which the amount of work done by the force is dependent of the path taken to change a state of a system.

SetId=556

[10] A simple pendulum moves along a circular arc and does not have constant speed and therefore its motion is not uniform.

[11] Distance depends on the path where as the displacement depends on the end point only

[12] Staying inside a bullet train moving with constant velocity (no jerks etc) an experiment can always be performed which will tell us the numerical value of the acceleration of the bullet train

[13] The total mechanical energy of a system may not be conserved if there are no external forces and the internal forces are conservative.

[14] The total work done on a particle is always equal to the change in kinetic energy. SetId=556

[15] The apparent force which seems to act on an object in an accelerating frame of reference if we wish to describe the object's motion is called a pseudo force.Its a non-existent force used only to describe the motion completely using Newton's second law even though the agent causing the force is undefined.

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SetId=557

[1] Distance equal to zero implies displacement=0; and Displacement=0 also implies distance = 0

[2] Newton's Second Law of Motion is defined by the expression $F = \frac{dp}{dT}$, where F gives the force vector acting on the system and p gives its momentum vector; in linear motion. A similar expression can be written to describe angular motion, i.e. : $\tau = \frac{dL}{dt}$, where τ is the external torque vector acting on the system, and L is the angular momentum.

If the external torque on the system is zero, then we get the expression as: dL/dt=0. This points out to the fact that, when no external torque is acting on the system, then its angular momentum is constant, no matter what changes occur in the system. This is the Law of Conservation Of Angular Momentum.

[3] A bob attached to a ceiling by a string moving in a horizontal circular plane is an example where the total angular momentum of the bob about the point of suspension is not conserved. This is because the the torque due to the weight of the bob about the point of suspension does not vanish and has non zero horizontal component. Only the vertical component of the angular component is conserved.

[4] For the motion of earth around sun, the angular momentum of the sun about the center of mass of the sun + earth system and perpendicular to the orbital plane of earth is conserved.

For the motion of earth around sun, the angular momentum of the sun about and axis passing through the Earth and perpendicular to the orbital plane of motion of earth is conserved.

[5] The law of angular momentum of a is not applicable for the conical pendulum conserved when the origin is chosen to be at the pendulum bob itself. SetId=557

[6] When you release a toy gyroscope on its pedestal, it initially has no precessional rotation around that pedestal, i.e, the orientation of rotation is fixed. However, it instantaneously starts precessing around the pedestal. Both Kinetic Energy and Angular Momentum now exist where they did not exist a moment earlier. The Kinetic Energy is easy to explain, as appearing due to the body of the gyroscope dropping a tiny fraction of a millimeter in the Earth's gravitational field, giving up exactly the correct amount of Potential Energy. But the Angular Momentum of the Precession which just appeared, does not come from anywhere. This is therefore a Violation of the Conservation of Angular Momentum.

[7] A soldier accelerating away, after detonating a bomb, will find that the total momentum of the fragments of the bomb is zero. This is an example where the law of conservation of momentum holds as the forces on the fragments are internal forces only and sum of all such forces is zero.

[8] To apply the conservation laws of momentum, energy and angular momentum, we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *external force* acting on the system, the energy and momentum will be conserved. However, depending on the nature of the system and of the forces, the total angular momentum may not be conserved.

[9] Nonconservative force is any force where the work done by the force on the object depends on the path of motion of the object.the work done by the frictional force results in to loss of the energy of the system in the form of heat or other form of energy.

SetId=557

[10] A satellite goes around the earth in a circular orbit of 600km with a time period of $5.8 \times 10^3 s$. Its motion will be uniform as it will cover equal distances in equal times.

[11] Distance equal to zero $\Rightarrow$ displacement=0; but Displacement=0

[12] Assume bullet train, moving with out any jerks, is going on a circular arc of radius R with constant speed. Then an experiment is to be performed entirely within the train without any measurement on objects outside the train. Such an experiment can tell only radius of the track.

[13] When a bullet fired on a wooden block, some energy is transferred to the block and the total mechanical energy of the block and the bullet is conserved.

[14] A particle is acted upon by a force of constant magnitude which is always perpendicular to the velocity of the particle and the motion of the particle takes place in a plane, Then its kinetic energy, speed, velocity acceleration will not change. SetId=557

[15] The physically apparent, but nonexistent, force needed by an observer in a noninertial frame to make Newton's laws of motion hold true is called pseudoforce.

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SetId=558

[1] If P and Q are the initial and the final points of a path of a particle, displacement is a vector whose direction is along PQ and has magnitude is equal to the length of line PQ

[2] If the net external torque acting on a system is zero, the angular momentum L of the system remains constant, no matter what changes take place within the system.

$$\sum(T_{\text{ext}}) = \frac{dL}{dt}$$

The law states that when there is no net external torque, $\frac{dL}{dt}$ is zero implying that the total angular momentum of system is constant.

i.e. $L = a$ constant (isolated system)

[3] Law of conservation of angular momentum holds in case of long jump. When a athlete takes off from the ground in a running long jump, the forces on the launching foot give the athlete an angular momentum with a forward rotation around a horizontal axis. Such rotation would not allow the jumper to land properly. In the landing, the legs should be together and extended forward at an angle so that the heels mark the sand at the greatest distance. Once airborne, the angular momentum cannot change (it is conserved) because no external torque acts to change it. However, the jumper can shift most of the angular momentum to the arms by rotating them in windmill fashion. Then the body remains upright in the proper orientation of landing.

[4] For the motion of earth around sun, the sum of angular momenta of the Sun and the Earth about the center of mass of the sun + earth system is conserved.

[5] The three components of angular momentum of a conical pendulum is conserved w.r.t. the origin at the position of the center of mass of the pendulum. SetId=558

[6] There is no case where LAW OF CONSERVATION OF ANGULAR MOMENTUM does'nt hold.But there are cases where conservation of angular momentum does not hold.A body in vertical circular motion is an example where angular momentum is not conserved. Here the law of conservation does not apply.

[7] There is no known exception to the law of conservation of momentum in classical mechanics However, an exception to conservation of energy in nuclear physics is observed. In nuclear reactions when two nuclei collide and their mass converts to energy and energy momentum are not conserved.

[8] In order to apply the law of conservation of momentum we must first identify the system. If there is no *external forces* acting on the system then conservation laws

of momentum always holds. And depending on the nature of the system and of the forces, the total kinetic energy and the total angular momentum may not be conserved.

[9] nonconservative force is any force ,where the work done by the force depends on the path of motion of the body.The work done by such a force is equal to the change in mechanical energy of the system.Energy mostly observed to be lost in form of heat, by the action of non conservative force.

SetId=558

[10] A uniform motion is defined to be the one in which a body covers equal distances in equal time intervals.

[11] If P and Q are the initial and the final points of a path of a particle, displacement is a vector whose direction is along PQ and has magnitude is equal to the length of line PQ

[12] Assume bullet train, moving with out any jerks, is going on a circular arc of radius R with constant speed. Then an experiment is to be performed entirely within the train without any measurement on objects outside the train. Such an experiment can tell both speed of the train and radius of the track.

[13] When a moving car hits a parked lorry and causes the parked lorry to move ,energy is transferred from moving the car to the lorry and the total energy of the lorry and the car is conserved.

[14] The kinetic energy of a particle is continuously increasing with time, then the angle bewteen the net force and the velocity cannot be greater than or equal to 90^{o} at any time.

SetId=558

[15] Pseudo forces come into picture when Newton's laws of motion have to be applied to describe the motion of bodies in non-inertial frames. These forces have no real existence.

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SetId=559

[1] If P and Q are the initial and the final points of a path of a particle,the displacement is the vector $\overrightarrow{PQ}$.

[2] When the net external torque acting on a body or a system of bodies is zero about a particular axis, then the angular momentum of each body is conserved about that axis.

[3] The total angular momentum of a body remains constant of motion when the net torque of the external forces acting on the body is zero.
In general, we have a system of particles such that the net torque of the external forces on the system, w.r.t. some axes K, is zero, the total angular momentum may not remain conserved, because the torque due to the internal forces may not be zero.

[4] For the motion of the Earth around the sun, the total of angular momenta of the Earth and the Sun, about in a reference frame fixed in the pole star, is conserved.

[5] Only the z component of the angular momentum of a conical pendulum is conserved w.r.t. the origin fixed at the point of suspension. SetId=559

[6] A sphere rolling on a rough surface.Due to friction there is external torque so the angular momentum changes which results in the slowing of the sphere. The angular momentum keeps changing. Even in case like this one, it is wrong to say that the Law of Angular Momentum Conservation does not hold.

[7] In a system of a canon and a canon ball, total momentum of the system is zero before canon ball is fired. After firing the canon ball, the momentum of the system seems to be conserved as the ball moves forward and the canon moves backward.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then check if the laws is applicable or not.

So if there is no *net external force* acting on the system all the three conservation laws will hold.

[9] The work done by a "non-conservative" force does depend on the path taken. Non-conservative forces cannot be associated with a potential energy. If some of the internal forces of a system are non-conservative, the mechanical energy of the system is not constant.Work-energy theorem is valid even in the presence of some non-conservative forces.

SetId=559

[10] A particle moves on a circular path. Then its speed, direction of force, velocity and acceleration must always change with time.

[11] If P and Q are the initial and the final points of a path of a particle,the displacement is the vector $\overrightarrow{PQ}$.

[12] Assume bullet train, moving with out any jerks, is going on a circular arc of radius R with constant speed. Then an experiment is to be performed entirely within the train without any measurement on objects outside the train. Such an experiment can tell only speed of the track.

[13] When a bomb explodes the total mechanical energy is not conserved. But the total chemical energy and the mechanical energy is conserved.

[14] A heavy body is attached from a spring and is held at point A and is such that the spring is not slack nor is it stretched. It is then released. It goes down upto a point B and then it rises upto point C and executes an oscillatory motion between B and C. During the motion from A to C is first positive (from A to B) and then it is negative from B to A and again remains negative from A to C. SetId=559

[15] In a non-inertial frame of reference the accelration of the body that we measure, is not the true acceleration, as the frame itself accelerates.Thus,force(F=ma) is also not the true force acting on the body.The extra force added to make it a true value is called pseudo force.Thus pseudo force does not really act on a body but just compensates the change produced by the non inertial frame, in true acceleration.

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SetId=560

[1] If two bodies starting from a point A reach a point B, following different paths, their displacement will be, in general different, but the distances covered will always be the same.

[2] The law of conservation of angular momentum states that in absence of an external torque on an object or a closed system of objects the total angular momentum of the system remains constant. Thus if $\vec{\tau} = 0 => \vec{L} =$ constant where τ is the torque and $\vec{L}$ is the angular momentum of the system.

[3] An example where law of conservation of angular momentum holds:
The Law of conservation of angular momentum holds in the case of a ballet dancer performing a pirouette.

When the dancer extends her arms outward, the angular velocity of her rotation decreases whereas when she keeps her arms close to her body, the angular velocity increases. This is because her moment of inertia changes as she moves her arms outward and inward. It can be noted that she as a system has no external torque acting upon her.

[4] For the motion of the Earth around the sun, the total of angular momenta of the Earth and the Sun, is conserved in every inertial frame of reference; but the angular momentum of the Earth (or of the sun)is not conserved in every inertial frame.

[5] The z component of angular momentum of a conical pendulum is not conserved w.r.t. the origin fixed at the point of suspension; but the x and y components are conserved.

SetId=560

[6] Consider a rod of length l. Let us give an impulse to one end . Now the angular momentum about the oposite end is not zero since the impulse provides some torque . So the angular momentum is not conserved .

$$\text{torque} = \text{impulse} * \ell.$$

$d\ell/dt$ is not equal to zero and the law of conservation of angular momentum does not hold.

[7] When applying the conservation laws of momentum, energy and angular momentum we must define the system first.Only then check if the laws is applicable or not.

As an example: when a ball is dropped from a height, it gains momentum down if we consider the ball as our system.This is because the force of gravity acts as an external force.

However, if we change our system and consider earth as a part of our system too, then the momentum remains conserved because the earth gains momentum up.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then check we should if the laws are applicable or not.

So if there is no *external force* acting on the system all the three quantities, total momentum is conserved. The total angular momentum is also because the torque of internal forces will be zero. The conservation of energy depends on the nature of forces. will be conserved.

[9] Non conservative forces are forces with the property that the work done by the force in moving a particle between two points is dependent on the path taken.Also the work done over a closed loop is not zero.Defining of scalar potential is not possible in case of non conservative forces because the change in potential energy between two points will depend on path taken.

SetId=560

[10] A particle moves on a circular path. Then its speed, direction offorce, can remain constant by velocity and acceleration must always change with time.

[11] If two bodies starting from a point A reach a point B, following different paths, their displacement will be, in general different, but the distances covered will always be the same.

[12] A particle is observed from two frames S_1 and S_2. The frame S_2 moves with respect to S_1 with an acceleration a. If F_1 and F_2 be the pseudoforces when seen from S_1 and S_2 respectively it is not possible to have $F_1 = F_2 = 0$

[13] When a ball rolls over a rough surface, it comes to stop after some time. This is because transational and rotational kinetic energy initially present in the ball continuosly gets converted to heat due to friction. When all the kinetic energy changes to heat, the ball stops. The total mechanical energy of the ball is not conserved.

[14] The kinetic energy of a body does not change if any one of the following is true
(i)force is always perpendicular to the velocity
(ii) the force is always perpendicular to the acceleration
(iii) the object remains stationary
(iv) the object moves in such a way that the point of application of the force remains fixed.

SetId=560

[15] A force is any interaction which tends to change the motion of an object. It is *equal to* the rate of change of momentum by Newton's second law.

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SetId=561

[1] Displacement is equal to the vector difference $\vec{r}_f - \vec{r}_i$ of the position vectors of initial and final points. The distance covered will be $|\vec{r}_f - \vec{r}_i|$

[2] If no net external torque acts on a system, the total angular momentum of the system remains constant.

[3] In case of a skater, who can be considered an isolated system, so no torue will be acting on him/her. When the arms are extended, the moment of inertia is more. When his hands are closely held, the moment of inertia is lesser. Since the angular momentum is same, the angular acceleration changes accordingly.

[4] In the Sun Earth system the angular momentum of the Earth is conserved in every frame of reference

[5] Only the z component of angular momentum of a conical pendulum is conserved w.r.t. the origin fixed at the point of suspension. SetId=561

[6] Let us consider a rotating skew rod. In the absence of friction or any other drag force, the rod should continuously spin without stopping. Here the net torque about the axis of rotation is 0 and hence angular momentum is conserved. It therefore follows from law of conservation of angular momentum that a spinning skew rod will keep rotating with constant angular velocity if there is no external torque. So law of conservation of angular momentum does not hold.

[7] Statement: Law of Conservation of energy states that "ENERGY CAN NEITHER BE CREATED NOR DESTROYED",but it can be changed from one form to other.

EXPLANATION: Statement implies that the total amount of energy in an isolated system remains constant although it may change forms. viz, kinetic energy may change to potential;chemical to electrical energies etc.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *net external force* acting on the system, the momentum is conserved. The definition of angular momentum and torque depends on the choice of axes, and therefore it may not be be conserved. The conservation of total energy holds only for conservative forces.

When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *net external force* acting on the system, the energy and momentum will be conserved. However, the total angular momentum may not be conserved because the torque may not be zero.

[9] A non conservative force is the force with the property that the work done in moving a particle between two points is dependent of the path taken.If a particle travels in a closed path, the net work done(the some of the forces acting along the path multiplied by the distance travelled) by a non conservative force is non zero. When an object moves from one location to another, the force changes the potential energy of the object by an amount that depends on the path taken.Non conservative force depends only on the path followed by the object.

SetId=561

[10] A particle moves on a circular path. Then under suitable conditions its speed may remain constant, but the force, velocity and acceleration must always change with time.

[11] Distance is equal to the length of the path covered. Displacement is the shortest distance between initial and final points.

[12] A particle is observed from two frames S_1 and S_2. The frame S_2 moves with respect to S_1 with an acceleration a. If F_1 and F_2 be the pseudoforces when seen from S_1 and S_2 respectively and if $F_1 = 0$ then we must have $F_2 \neq 0$

[13] Let us consider that a pendulum is oscillating moving in a vertical plane. Mean while let another bob which is attached to a spring and is executing a simple harmonic motion in horizontal direction comes and hits the pendulum. Here conservation of momentum does not hold good as tension(external force) is acting on the system.(pendulum)

[14] The total work done on a particle is always equal to the change in kinetic energy.

SetId=561

[15] Newton's laws are not valid on non-inertial frame of reference. So to validate Newton's laws of motion pseudo force (fictious or virtual force) is introduced.
Pseudo force acts in non-inertial frame. Its magnitude is always mass of the body multiplied by acceleration of the frame. It is always in direction opposite to the acceleration of the frame of reference. The resultant of pseudo forces and real forces is always zero.

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SetId=562

[1] Distance is equal to the length of the path covered. Displacement is the shortest distance between initial and final points.

[2] The law of conservation of angular momentum states that when no external torque is applied on an object or a closed system of objects about an axis, the angular momentum about that axis remains constant.

[3] Example where law of conservation of angular momentum holds:
Let us assume a student seated on a stool that can rotate freely about a vertical axis. The student has been set into rotation at a modest initial angular speed ω . He holds two dumbbells in his outstretched hands. His angular momentum vector L lies along the vertical rotation axis, pointing upwards. Now he pulls in his arms;this action reduces his rotational inertia from its value I_{initial} to a final value I_{final} because he moves the mass closer to the rotational axis. His rate of rotation increases markedly, from ω_{initial} to ω_{final}. The student can then slow down by extending his arms once more,moving the dumbbells outward. No external torque acts on the system consisting of the student, stool and the dumbbells. Thus the angular momentum of the system about the rotational axis remains constant. $I_{\text{initial}} * \omega_{\text{initial}} = I_{\text{final}} * \omega_{\text{final}}$.

[4] In the motion of earth around sun, the angular momentum of the earth about an axis passing through the sun and perpendicular to the plane of motion of earth is conserved.

[5] The projection of angular momentum of a conical pendulum in the horizontal plane is a constant of motion when the origin is chosen to be at fixed at the point of suspension. SetId=562

[6] In the example of skew rod the angular velocity does not change even though the torque applied is nonzero. However there is no contradiction as in this case the law of conservation of momentum is not applicable. conservation is violated.

[7] Oscillating simple pendulum is a very good example where potential energy gets converted to kinetic energy and kinetic to potential energy. Some energy gets dissipated as heat if we consider air resistance. Energy as a whole is conserved if we consider universe as system, the energy has just changed its form.

[8] In order to apply the law of conservation of momentum we must first identify the system. If there is no *net external forces* acting on the system then conservation laws of momentum always holds. The total energy and the total angular momentum may not be conserved.

SetId=562

[9] In this type of force the work done depends on the path taken by the body.Mechanical energy is not conserved in the system if non conservative force acts on it.

[10] A particle moves on a circular path. Then under suitable conditions its speed and acceleration may remain constant, but the force, and velocity must always change with time.

[11] Distance is a scalar quantity where as the displacement is a vector quantity.

[12] If K is an inertial frame, any frame that moves w.r.t. the frame K with uniform velocity is also an inertial frame.

[13] The law of conservation of momentum does not hold in relativistic situations, i.e., where the speeds of the masses involved are close to the speed of light.

[14] A particle is acted upon by a force of constant magnitude which is always perpendicular to the velocity of the particle and the motion of the particle takes place in a plane, Then its kinetic energy, speed, velocity acceleration will not change. SetId=562

[15] These forces are non-real forces but must be taken into account while applying Newton's Law's of Motion in accelerating frame of reference as compared to an inertial frame of reference.

The centrifugal and centripetal forces are examples of pesudo-forces.

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SetId=563

[1] Distance is a scalar quantity where as the displacement is a vector quantity.

[2] The angular momentum of a given system of bodies shall remain conserved unless acted upon by an external unbalanced torque.

[3] A bob is attached to ceiling by a string and moves in a horizontal circular plane is an example. In this case the law of conservation of angular momentum does not hold.

[4] For the motion of earth around sun, the angular momentum of the earth about the center of mass of the sun + earth system and perpendicular to the plane of motion of earth is conserved.

[5] The law of angular momentum of a is not applicable for the conical pendulum conserved w.r.t. the origin fixed at the point of suspension. SetId=563

[6] Example where law of conservation of angular momentum does not hold:If a particle undergoes conical motion and the only force acting on particle is central force like tension of the string.Then total external torque about fixed point A is zero,yet angular momentum is not conserved,as angular momentum keeps on changing direction.

[7] Law of conservation of momentum does not hold whenever an external force or impulse acts on the system. For example,when a body collides with earth then it bounces back to a lesser height as it loses some velocity.

In this example the momentum of a ball is not conserved due to impulsive force by ground in the normal direction.

However, strictly speaking the system that should be considered here is the ball-earth system and the total momentum is conserved.

[8] In order to apply the law of conservation of momentum we must first identify the system. Then even if there is no *net external forces* acting on the system, all the three conservation laws of momentum, angular momentum and energy may not hold due to presence of internal forces.

[9] A force is said to be a non-conservative force if the work done by the force in a closed path is non-zero;(i.e) the cyclic integral of the work done is non-zero.

Work done by a non-conservative force is equal to change in total energy of the system.Work-Energy theorem is not applicable in the case of a non-conservative force.Work done by conservative force depends on the path.It differs with the paths taken by the partical even if the initial and final points are same.In case of non-conservative forces,the total mechanical energy is not constant as the energy is dissipated in various forms such as heat energy,sound energy,etc and cannot be recovered.

SetId=563

[10] When the force is kept constant as function of time, it is possible for a particle to move on a circular path in such a way that its speed remains constant, but the velocity and acceleration must always change with time.

[11] Both displacement and distance tell us about the motion of a body but their study does not tell much about the forces on the body

[12] If K is an inertial frame, any frame that moves w.r.t. the frame K with uniform speed is also an inertial frame.

[13] when we are in accelerating frame if we observe any collision between two bodies then the law of conservation of momentum does not hold in that frame of reference.

[14] The kinetic energy of a particle is continuously increasing with time, then the angle bewteen the net force and the velocity cannot be greater than or equal to 90^{o} at any time. SetId=563

[15] When observing our system from a reference frame which is accelerating compared to an inertial frame,in order to make it easier to apply newtons laws, we can apply a pseudo force on all objects in the universe proportional to their mass capable of causing an acceleration equal and opposite to that of our reference frame. Hence serving to in a way "stop"(or make inertial) our reference frame, and making it easier for us to investigate the motion.

This application of pseudo force doesn't change the motion of the object because just as we can choose an arbitrary reference frame, we can choose an arbitrary force to cause the same acceleration in every object in the whole universe without changing the relative motions of objects. (as all motion is truly relative, we will still get correct answers for our investigations.

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SetId=564

[1] The speed is rate of change of distance and the velocity is the rate of change of displacement.

[2] When the net external torque acting on a system about a given axis is zero, the total angular momentum of the system about that axis remains consant.

[3] Consider a disc rotating about an axis perpendicular to its plane. On placing a smaller disc with its surface parallel to the surface of the rotating disc, the angular momentum of the system of two discs remains constant as there is no external torque.

[4] In the Sun Earth system the angular momentum of the Earth about the pole star is conserved

[5] The law of angular momentum of a is not applicable for the conical pendulum conserved when the origin is chosen to be at the pendulum bob itself. SetId=564

[6] A nonzero torque always causes the angular velocity to change, because a change in angular momentum means a change in angular velocity $L = I\omega$

[7] If a bullet hits a wooden board and gets embedded in the board, the total energy and the total momentum of the bullet and the board are conserved.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then check we should if the laws are applicable or not.

So if there is no *external force* acting on the system all the three quantities, total momentum, total angular momentum, and total kinetic energy will be conserved independent of the nature of forces.

[9] A non conservative force is a force where work done in moving a particle between two points depends on the path through which it is taken.Friction is an example of non conservative force.Mechanical energy is not conserved in case of a non conservative force

SetId=564

[10] It is not possible for a particle to move on a circular path in such a way that its speed and force remains constant, and only the velocity and acceleration may (or may not) always change with time.

[11] Displacement is the shortest distance between initial and final points with direction specified.

[12] A frame rotating w.r.t K with uniform angular velocity is also an inertial frame.

[13] Give an example where law of conservation of momentum does not hold all cases when seen from non inertial frame of references for example when we see two cars collide from a moving bus there momentum is not conserved

[14] A heavy body is attached from a spring and is held at point A and is such that the spring is not slack nor is it stretched. It is then released. It goes down upto a point B and then it rises upto point C and executes an oscillatory motion between B and C. During the motion from A to C is first positive (from A to B) and then it is negative from B to A and again remains negative from A to C. SetId=564

[15] Various types of forces in nature can be grouped in four categories:
(a)Gravitational; (b)Electromagnetic; (c)Nuclear; (d)Weak
There are also some non-fundamental forces such as:
(i)Normal reaction on bodies in contact with surfaces , (ii) Friction,(iii) Tension,(iv)Elastic force.

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SetId=565

[1] For any type of translational motion of a body, the displacement cannot be zero, where as the distance travelled can be zero.

[2] This law sates that when no net torque of all forces acts on a object or a system of objects then total angular momentum of system is conserved.The angular momentum before an event is equal to angular momentum after that event.mathematically explained by when, net torque=0 ;then, total angular momentum(L)=constant.

[3] Consider a man standing on a spinning platform. Initially, the man spreads out his arms and he spins with a certain angular velocity. The next moment, he pulls his arms inwards keeping them close to his body. We will observe that the angular velocity with which he is spinning now increases. This phenomenon can be explained by the Law Of Conservation of Angular momentum. Initially, since his arms were spread wide, his moment of inertia was large. However, when he pulled them close to his body, his moment of inertia decreased.
In this example the angular velocity of the man increases and therefore the angular momentum also increases.The law of conservation of angular momentum does not apply because the torque of muscular forces is not zero.

[4] For the motion of earth around sun, the angular momentum of the sun about the center of mass of the sun + earth system and perpendicular to the orbital plane of earth is conserved.

For the motion of earth around sun, the angular momentum of the sun about and axis passing through the Earth and perpendicular to the orbital plane of motion of earth is conserved.

[5] The three components of angular momentum of a conical pendulum is conserved w.r.t. the origin at the position of the center of mass of the pendulum. SetId=565

[6] A nonzero torque always implies change in angular momentum and may not give rise to a change in magnitude of angular velocity. A non zero torque may mean change only the direction of the angular momentum and not the angular velocity.

[7] If a bullet hits a wooden board and gets embedded in the board, the total energy of the bullet and the board system is conserved but the total momentum is not conserved.

[8] If we want to apply the conservation laws of momentum, energy and angular momentum, we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *external force* acting on the system, the momentum and angular momentum will be conserved, and depending on the nature of the forces but total energy may or may not be conserved.

SetId=565

[9] A force:A force is said to be a *non-//**conservative force* if the*/ work done by it in a closed path is/*/ non-zero./For such forces,potential energy cannot be defined.

[10] For a particle moving on circle the acceleration is always constant in magnitude and directed towards the centre of the circle.

[11] Displacements, being vector quantity can not compared with, a scalar quantity such as distance.

[12] The Newton's Laws of motion will hold in all frames which are at rest w.r.t. K but do not remain valid in a frame that move with respect to K.

[13] When a tennis ball hits the ground at an oblique angle, the angle of reflection is equal to the angle of incidence. This is a simple consequence of conservation of horizontal component of momentum.

[14] The kinetic energy of a body does not change if any one of the following is true
(i)force is always perpendicular to the velocity
(ii) the force is always perpendicular to the acceleration
(iii) the object remains stationary
(iv) the object moves in such a way that the point of application of the force remains fixed. SetId=565

[15] A force is agency that which changes or tends to change the state of rest or motion of a body.

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[1] Displacements, being vector quantity can not compared with, a scalar quantity such as distance.

SetId=566

[2] Statement of Law of Conservation of Angular Momentum:
Differentiating $\vec{L} = \vec{r} \times \vec{p}$ w.r.t, time,

$$\begin{aligned} \frac{dL}{dt} &= \frac{d\vec{r} \times \vec{p}}{dt} = \frac{d\vec{r}}{dt} \times \vec{p} + \vec{r} \times \frac{d\vec{p}}{dt} = \vec{v} \times (m\vec{v}) + \vec{r} \times \vec{F} \\ &= \vec{r} \times \vec{F} (\because v \times v = 0) \\ &= \vec{\tau} \end{aligned}$$

here $\vec{\tau}$ represents the net torque acting on a rigid body rotating about a fixed axis.This torque must take into account of all the forces, be it external or internal forces

[3] In the Sun-Earth system, angular momentum of the earth is not conserved but the total angular momentum of the sun and the earth is constant of motion.

[4] For the motion of earth around sun, the sum of angular momenta of the Sun and the Earth about the center of mass of the sun + earth system is conserved.

[5] Only the z component of the angular momentum of a conical pendulum is conserved w.r.t. the origin fixed at the point of suspension. SetId=566

[6] In the example of a rotating skew rod the torque due to the external gravitational forces is zero , but the angular momentum is not constant Therefore the law of conservation of angular momentum is violated.

[7] If a bullet hits a wooden board and gets embedded in the board, both total energy and the total momentum of the bullet and the board are not conserved.

[8] To apply the conservation laws of momentum, energy and angular momentum, we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *external force* acting on the system, the energy and momentum will be conserved. However, depending on the nature of the system and of the forces, the total angular momentum may not be conserved.

[9] A force that is not conservative is nonconservative force. The work done by a noconservative force cannot be represented by a potential energy function. That is work done by a nonconservative force is dependent on the path through which the system is moved. Some nonconservative forces cause the mechanical energy to be lost or dissipiated. Such forces are called dissipiative forces. There is no way to get back the lost mechanical energy. Nonconservative forces can also increase the mechanical energy. This is arrived from the concept of irreversible process.

SetId=566

[10] The motion of a bomb dropped from a plane does is not a uniform motion as it follows a parabolic path and not a straight line path.

[11] Distance depends on the path where as the displacement depends on the end point only

[12] Staying inside a bullet train moving with constant velocity (no jerks etc) an experiment can always be performed which will tell us the numerical velocity of the bullet train

[13] when a ball is dropped from a height, it gains momentum down if we consider the ball as our system.This is because the force of gravity acts as an external force.

However, if we change our system and consider earth as a part of our system too, then the momentum remains conserved because the earth gains momentum up.

[14] The total work done on a particle is always equal to the change in kinetic energy. SetId=566

[15] The forces may be of the following two types - *Contact forces* (those that act when bodies are in physical contact) eg. friction, normal reaction, bouyancy etc. and*Action-at-a-distance forces* (those that act when bodies are not in contact) eg. Gravity, electostatic forces, magnetic forces etc. There At the root level, forces are of the following fundamental types :- (a) *Gravitational forces* - weakest of all forces, always attractive
(b) *Electromagnetic forces* - stronger than gravitational forces, can be attractive or repulsive,
(c) *Nuclear forces* - exist at atomic level, have very short range,
(d) *Weak nuclear forces* associated with beta particle emission

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SetId=567

[1] Distance depends on the path where as the displacement depends on the end point only.

[2] Statement of Law of Conservation of Angular Momentum: For a system of many particles The net torque due all the forces, be it external or internal forces. But as the torque due to all the internal forces cancel out, it sufficient to consider the external forces acting on the system.

[3] Consider a disc and a man system. man is standing on center of the disc rotating with angular velocity.initially man folded his hand.when man stretches his hands then momentum of inertia of system increases.and angular velocity decreases.and total angular momentum remains constant.

[4] For the motion of the Earth around the sun, the total of angular momenta of the Earth and the Sun, about in a reference frame fixed in the pole star, is conserved.

[5] The z component of angular momentum of a conical pendulum is not conserved w.r.t. the origin fixed at the point of suspension; but the x and y components are conserved.

SetId=567

[6] In the example of skew rod, the angular momentum changes with time and there is a non zero torque coming from action of forces other than gravitational forces. Hence the law of conservation of angular momentum dos not apply.

[7] There are certain situations where it appears that the law of conservation of linear momentum does not hold. For example if we take some amount of a substance like construction putty, cement, cake batter, playing dough,etc and drop it on the ground, it does not bounce back like a rubber ball would and hence the momentum it had before striking the ground seems to have been lost. Hence it appears that the law of conservation of linear momentum does not hold.

[8] In order to apply the law of conservation of momentum we must first identify the system. If there is no *external forces* acting on the system then conservation laws of momentum always holds. And depending on the nature of the system and of the forces, the total kinetic energy and the total angular momentum may not be conserved.

[9] Nonconservative forces are forces, such that the work done by these forces are path dependent. Work done by these forces around a close path is not necessarily equal to zero. Hence if a particle is acted on by a non-conservative force and that particle returns to its original position, that particle will experience a net loss of energy. Energy will thus not be conserved for particle. Potential Energy can not be defined for these type of forces.

SetId=567

[10] A wagon sliding on a roller coaster designed in such a way that the wagon covers equal distances in equal times. As the motion of the wagon is uniform, there will be no net force acting on it.

[11] Distance equal to zero $\Rightarrow$ displacement=0; but Displacement=0

[12] Staying inside a bullet train moving with constant velocity (no jerks etc) an experiment can always be performed which will tell us the numerical value of the acceleration of the bullet train

[13] There is no known exception to the law of conservation of momentum in classical mechanics however when two bodies collide and their mass converts to energy, an exception in nuclear physics is observed. In real life this is observed in nuclear reactions at atomic level.

[14] A particle is acted upon by a force of constant magnitude which is always perpendicular to the velocity of the particle and the motion of the particle takes place in a plane, Then its kinetic energy, speed, velocity acceleration will not change. SetId=567

[15] The main differences between force and pseudo force are -
(1) Forces have a real presence while pseudo forces don't.
(2) Forces can be accounted for by Newton's laws.
(3) Pseudo forces are only taken into account when the reference frame is accelerated.

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SetId=568

[1] Distance equal to zero implies displacement=0; and Displacement=0 also implies distance = 0

[2] Depending on the torques acting on a system, the angular momentum can be conserved only in one or two directions, but may not be conserved in all. For instance, if an isolated body has no torque acting on it only in the direction along the Z axis, then the angular momentum is conserved only in that direction.

[3] The conservation of angular momentum of a system of bodies requires that the the sum of torque due to all forces be equal to zero. Now consider a situation where the forces are such that the sum of torques of external forces is zero w.r.t. some axes K. Since the value of torque depends of the choices of axes, the sum of torques due to all internal forces will depend on the choice of axes and in general it will be non zero. Therefore, for a system of several bodies, for a given choice of axes K, there will be situations when the total angular momentum may not be conserved.

[4] For the motion of the Earth around the sun, the total of angular momenta of the Earth and the Sun, is conserved in every inertial frame of reference; but the angular momentum of the Earth (or of the sun)is not conserved in every inertial frame.

[5] Only the z component of angular momentum of a conical pendulum is conserved w.r.t. the origin fixed at the point of suspension. SetId=568

[6] In the example of conical pendulum, the z- component of angular momentum does not change. This follows from the angular momentum conservation as there is no external torque.

[7] A tennis ball is dropped from height h and after hitting the ground and it bounces back and rises to the same height. In this case the momentum of the ball is conserved because (under ideal conditions) the momentum after it hits the ground will be equal to the momentum it had before hitting the ground.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then check if the laws is applicable or not.

So if there is no *net external force* acting on the system all the three conservation laws will hold.

[9] Non Conservative force is a force with the property that workdone in moving an object from one point to another is dependent on the path taken .

Non Conservative Force can arise in classical physics due to neglected degrees of freedom or time dependent potentials.

Friction may be treated without resorting the use of non conservative forces by considering the motion of individual molecules.

SetId=568

[10] A simple pendulum moves along a circular arc and does not have constant speed and therefore its motion is not uniform.

[11] If P and Q are the initial and the final points of a path of a particle, displacement is a vector whose direction is along PQ and has magnitude is equal to the length of line PQ

[12] Assume bullet train, moving with out any jerks, is going on a circular arc of radius R with constant speed. Then an experiment is to be performed entirely within the train without any measurement on objects outside the train. Such an experiment can tell only radius of the track.

[13] When there is no external forces act on a system of many particles, and there are only internal forces acting on the particles. The third law gives that the internal forces are pairwise equal and opposite.Thus the sum of internal forces is zero and the momentum of each particle is conserved.

[14] The kinetic energy of a particle is continuously increasing with time, then the angle bewteen the net force and the velocity cannot be greater than or equal to 90^o at any time. SetId=568

[15] A force is any interaction which tends to change the motion of an object. It is also *defined* as rate of change of momentum. It is a vector quantity.

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SetId=569

[1] If P and Q are the initial and the final points of a path of a particle, displacement is a vector whose direction is along PQ and has magnitude is equal to the length of line PQ

[2] According to Law of Conservation of Angular momentum,if no external torque acts on an object or system of objects,angular momentum of an object or system of objects remains CONSTANT or no change in angular momentum can occur.

Also it states that,only external torque can change angular momentm of the system where as the torque produced by internal forces can not change the angular momentum of the system

[3] Example where law of conservation of angular momentum does not hold:
When there is external force like frictional force acting on a object when it is rotating we cannot use conservation of angular momentum as the friction force acting on the object produces an external torque.

[4] In the Sun Earth system the angular momentum of the Earth is conserved in every frame of reference

[5] The projection of angular momentum of a conical pendulum in the horizontal plane is a constant of motion when the origin is chosen to be at fixed at the point of suspension. SetId=569

[6] In the example of conical pendulum, the x and$y$ components of angular momentum change. This follows from the angular momentum conservation as the z components external torque is zero and horizontal components of torque are non zero.

[7] Law of conservation of momentum does not hold when Newton's laws are not valid, e.g. in a non-inertial frame of reference. For example, when we consider collision between two bodies in a non-inertial frame of reference, the law of conservation of momentum cannot be applied because there will be a pseudo force acting on the frame itself.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then check we should if the laws are applicable or not.

So if there is no *external force* acting on the system all the three quantities, total momentum is conserved. The total angular momentum is also because the torque of internal forces will be zero. The conservation of energy depends on the nature of forces. will be conserved.

[9] A non-conservative force is a force with the property that the work done in moving a particle between two points is dependent of the path taken . Mostly the enery of

the particle in a non conservative force field dissipates in the form of heat or sound . Since the lost energy cannot be bought back ,conservation of mechanical energy does not hold true .

SetId=569

[10] A satellite goes around the earth in a circular orbit of 600km with a time period of $5.8 \times 10^3 s$. Its motion will be uniform as it will cover equal distances in equal times.

[11] If P and Q are the initial and the final points of a path of a particle,the displacement is the vector $\overrightarrow{PQ}$.

[12] Assume bullet train, moving with out any jerks, is going on a circular arc of radius R with constant speed. Then an experiment is to be performed entirely within the train without any measurement on objects outside the train. Such an experiment can tell both speed of the train and radius of the track.

[13] During collision of billiard balls momentum is conserved. During explosion of a bomb also momentum is conserved and the total momentum of the fragments of bomb will be zero. This is because all the forces are only internal forces.

[14] A heavy body is attached from a spring and is held at point A and is such that the spring is not slack nor is it stretched. It is then released. It goes down upto a point B and then it rises upto point C and executes an oscillatory motion between B and C. During the motion from A to C is first positive (from A to B) and then it is negative from B to A and again remains negative from A to C.

SetId=569

[15] Explain Pseudo Force: While applying Newton's laws of motion in non-inertial frame of reference it gives answers which contradict observations. Thus, to account for this,using Newton's Laws, we introduce a "fake" or pseudo force which gives answers that match the observations in a non-inertial frame.

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SetId=570

[1] If P and Q are the initial and the final points of a path of a particle,the displacement is the vector $\overrightarrow{PQ}$.

[2] The law of conservation of angular momentum states that when the net external torque acting on the system is zero, then the angular momentum of the system remains constant.both the initial and final momentum should be taken from a fixed inertial frame of reference provided.

[3] A bob attached to a ceiling by a string moving in a horizontal circular plane is an example where the total angular momentum of the bob about the point of suspension is not conserved. This is because the the torque due to the weight of the bob about the point of suspension does not vanish and has non zero horizontal component. Only the vertical component of the angular component is conserved.

[4] In the motion of earth around sun, the angular momentum of the earth about an axis passing through the sun and perpendicular to the plane of motion of earth is conserved.

[5] The law of angular momentum of a is not applicable for the conical pendulum conserved w.r.t. the origin fixed at the point of suspension. SetId=570

[6] Example where law of conservation of angular momentum does not hold: A disc rotating on a horizontal rough surface will not have a constant angular momentum because there will be a constant torque by frictional force. Hence, its angular momentum will decrease, and the law of conservation of angular momentum does not apply.

[7] If I throw a ball upward, it's speed decreases as it rises upwards. There is an external force (gravity) acting on the ball, so the momentum conservation law does not apply. Momentum of the ball is not conserved, however the momentum of the Earth-ball system is conserved as gravity will become an internal force in this case.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *net external force* acting on the system, the momentum is conserved. The definition of angular momentum and torque depends on the choice of axes, and therefore it may not be be conserved. The conservation of total energy holds only for conservative forces.

When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *net external force* acting on the system, the energy and momentum will be conserved. However, the total angular momentum may not be conserved because the torque may not be zero.

[9] If the work done by a force depends on the path followed by the particle, it is called a Non conservative force. Work done by a non conservative force is not zero in round trip.

SetId=570

[10] A uniform motion is defined to be the one in which a body covers equal distances in equal time intervals.

[11] If two bodies starting from a point A reach a point B, following different paths, their displacement will be, in general different, but the distances covered will always be the same.

[12] Assume bullet train, moving with out any jerks, is going on a circular arc of radius R with constant speed. Then an experiment is to be performed entirely within the train without any measurement on objects outside the train. Such an experiment can tell only speed of the track.

[13] Give an example where law of conservation of momentum holds: A mass exploding into several pieces in a conservative field like gravitational field(if air resistance is neglected), obeys law of conservation of momentum. If air resistance cannot be neglected then the law of conservation of momentum will not hold.

[14] The kinetic energy of a body does not change if any one of the following is true
(i)force is always perpendicular to the velocity
(ii) the force is always perpendicular to the acceleration
(iii) the object remains stationary
(iv) the object moves in such a way that the point of application of the force remains fixed.

SetId=570

[15] When a train is at rest and a ball is hung from the ceiling with a string, an observer in the train sees that the string is vertical. But when the train starts moving, the observer sees that the string makes an angle with the vertical and is tilted in forward direction . This means that some force other than gravity and tension must act on the ball. That force is the pseudo force.

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SetId=571

[1] If two bodies starting from a point A reach a point B, following different paths, their displacement will be, in general different, but the distances covered will always be the same.

[2] The law of conservation of angular momentum states that The total angular momentum of a system is constant in both magnitude and direction if the resultant torque, of the external forces acting on the system, is zero.

[3] Law of conservation of angular momentum holds in case of long jump. When a athlete takes off from the ground in a running long jump, the forces on the launching foot give the athlete an angular momentum with a forward rotation around a horizontal axis. Such rotation would not allow the jumper to land properly. In the landing, the legs should be together and extended forward at an angle so that the heels mark the sand at the greatest distance. Once airborne, the angular momentum cannot change (it is conserved) because no external torque acts to change it. However, the jumper can shift most of the angular momentum to the arms by rotating them in windmill fashion. Then the body remains upright in the proper orientation of landing.

[4] For the motion of earth around sun, the angular momentum of the earth about the center of mass of the sun + earth system and perpendicular to the plane of motion of earth is conserved.

[5] The law of angular momentum of a is not applicable for the conical pendulum conserved when the origin is chosen to be at the pendulum bob itself. SetId=571

[6] Example where law of conservation of angular momentum does not hold:Consider a vertical stick on the ground falling to a horizontal position. During the fall, the conservation of angular momentum applied at the point of rotation on the ground and perpendicular to the plane of the stick is not applicable as, the gravitational force which acts vertically downwards assumed at the centre of mass produces an external torque about the axis of rotation

[7] A soldier accelerating away, after detonating a bomb, will find that the total momentum of the fragments of the bomb is zero. This is an example where the law of conservation of momentum holds as the forces on the fragments are internal forces only and sum of all such forces is zero.

[8] In order to apply the law of conservation of momentum we must first identify the system. If there is no *net external forces* acting on the system then conservation laws of momentum always holds. The total energy and the total angular momentum may not be conserved.

[9] The workdone by a non conservative force is dependant on its path. the work varies as the path varies.

SetId=571

[10] A particle moves on a circular path. Then its speed, direction of force, velocity and acceleration must always change with time.

[11] Distance is equal to the length of the path covered. Displacement is the shortest distance between initial and final points.

[12] A particle is observed from two frames S_1 and S_2. The frame S_2 moves with respect to S_1 with an acceleration a. If F_1 and F_2 be the pseudoforces when seen from S_1 and S_2 respectively it is not possible to have $F_1 = F_2 = 0$

[13] Also a good example of law of conservation momentum can be seen when a bullet from a rifle is fired.As the bullet is fired and gets out of the rifle, the rifle gives a backward jerk due to the phenomenon of conservation of momentum.

[14] The total work done on a particle is always equal to the change in kinetic energy.

SetId=571

[15] Since newton's laws are not valid in non-inertial frames, pseudoforces (which do not exist in reality) are used to help us formualate and use Newton's laws of motion in non-inertial frames.

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SetId=572

[1] Displacement is equal to the vector difference $\vec{r}_f - \vec{r}_i$ of the position vectors of initial and final points. The distance covered will be $|\vec{r}_f - \vec{r}_i|$

[2] If the net external torque acting on a system is zero,the angular momentum L(vector) of the system remains constant,no matter what changes take place within the system.L(vector)=a constant (net external torque acting on system is zero)

[3] The total angular momentum of a body remains constant of motion when the net torque of the external forces acting on the body is zero.
In general, we have a system of particles such that the net torque of the external forces on the system, w.r.t. some axes K, is zero, the total angular momentum may not remain conserved, because the torque due to the internal forces may not be zero.

[4] In the Sun Earth system the angular momentum of the Earth about the pole star is conserved

[5] The three components of angular momentum of a conical pendulum is conserved w.r.t. the origin at the position of the center of mass of the pendulum. SetId=572

[6] We have a conical pendulum .The forces acting on the bob are tension (along the direction of the string) and gravitational force acting in the vertically downward direction.we have an additional force called the drag force which is tangential to the motion of the bob and acts in the direction opposite to the motion of the bob.The axis of rotation passes through the hinge point and is vertical.The torque due to tension is 0 because the force passes through the axis of rotation.The torque due to mg is also zero since it is parallel to the axis of rotation.but the torque due to drag force is not zero.since the net external torque acting on the bob is not zero,therefore the law of conservation of angular momentum does not hold here

[7] There is no known exception to the law of conservation of momentum in classical mechanics However, an exception to conservation of energy in nuclear physics is observed. In nuclear reactions when two nuclei collide and their mass converts to energy and energy momentum are not conserved.

[8] In order to apply the law of conservation of momentum we must first identify the system. Then even if there is no *net external forces* acting on the system, all the three conservation laws of momentum, angular momentum and energy may not hold due to presence of internal forces.

SetId=572

[9] A non conservative force is a force with the property that the work done in moving a particle between two points is dependent on the path followed.

[10] A particle moves on a circular path. Then its speed, direction offorce, can remain constant by velocity and acceleration must always change with time.

[11] Distance is a scalar quantity where as the displacement is a vector quantity.

[12] A particle is observed from two frames S_1 and S_2. The frame S_2 moves with respect to S_1 with an acceleration a. If F_1 and F_2 be the pseudoforces when seen from S_1 and S_2 respectively and if $F_1 = 0$ then we must have $F_2 \neq 0$

[13] when a man walks on the ice slab where friction does not exist between the ice block and the floor but between the feet of the man and the slab the slab moves back as per the law of conservation of momentum

[14] A particle is acted upon by a force of constant magnitude which is always perpendicular to the velocity of the particle and the motion of the particle takes place in a plane, Then its kinetic energy, speed, velocity acceleration will not change. $\boxed{\text{SetId=572}}$

[15] Force is defined as the rate of change of linear momentum. In other words it is the agency which changes or tends to change the (a) State of rest; (b)State of uniform motion (c) Direction of body's motion; (d) Shape of the body

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SetId=573

[1] Distance is equal to the length of the path covered. Displacement is the shortest distance between initial and final points.

[2] The Law of conservation of angular momentum states that when no external torque acts on an object or a closed system of objects undergoing motion about a given axis, the change in angular momentum is zero. Therefore, considering an event where only internal torque or no torque is involved, the total angular momentum of the system before the event is equal to the total angular momentum after the event

[3] An example where law of conservation of angular momentum holds:
The Law of conservation of angular momentum holds in the case of a ballet dancer performing a pirouette.

When the dancer extends her arms outward, the angular velocity of her rotation decreases whereas when she keeps her arms close to her body, the angular velocity increases. This is because her moment of inertia changes as she moves her arms outward and inward. It can be noted that she as a system has no external torque acting upon her.

[4] For the motion of earth around sun, the angular momentum of the sun about the center of mass of the sun + earth system and perpendicular to the orbital plane of earth is conserved.

For the motion of earth around sun, the angular momentum of the sun about and axis passing through the Earth and perpendicular to the orbital plane of motion of earth is conserved.

[5] Only the z component of the angular momentum of a conical pendulum is conserved w.r.t. the origin fixed at the point of suspension. SetId=573

[6] When you release a toy gyroscope on its pedestal, it initially has no precessional rotation around that pedestal, i.e, the orientation of rotation is fixed. However, it instantaneously starts precessing around the pedestal. Both Kinetic Energy and Angular Momentum now exist where they did not exist a moment earlier. The Kinetic Energy is easy to explain, as appearing due to the body of the gyroscope dropping a tiny fraction of a millimeter in the Earth's gravitational field, giving up exactly the correct amount of Potential Energy. But the Angular Momentum of the Precession which just appeared, does not come from anywhere. This is therefore a Violation of the Conservation of Angular Momentum.

[7] In a system of a canon and a canon ball, total momentum of the system is zero before canon ball is fired. After firing the canon ball, the momentum of the system seems to be conserved as the ball moves forward and the canon moves backward.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then check we should if the laws are applicable or not.

So if there is no *external force* acting on the system all the three quantities, total momentum, total angular momentum, and total kinetic energy will be conserved independent of the nature of forces.

[9] A non conservative force is a force with the property that the work done in moving a particle between two points is dependent of the taken path.

Friction, for example, does less work on a book dragged across a table if the book is dragged straight across than if the book is dragged in a curved path.

To write the equation for conservation of energy for non conservative forces we need to include the work done by the non conservative force also.This is because forces like friction liberate heat which are not included in the mechanical energy.

SetId=573

[10] A particle moves on a circular path. Then under suitable conditions its speed may remain constant, but the force, velocity and acceleration must always change with time.

[11] Both displacement and distance tell us about the motion of a body but their study does not tell much about the forces on the body

[12] If K is an inertial frame, any frame that moves w.r.t. the frame K with uniform velocity is also an inertial frame.

[13] When a freely falling rigid body collides another body in its path momentum the system of two particles is not conserved in the collision as there is external force mg acting on the system.

[14] The kinetic energy of a particle is continuously increasing with time, then the angle bewteen the net force and the velocity cannot be greater than or equal to 90^{o} at any time.

SetId=573

[15] Real forces have their origin in matter such as electricity, gravitation etc., while pseudo forces are caused by inertial motion.

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SetId=574

[1] Distance is a scalar quantity where as the displacement is a vector quantity.

[2] The law of conservation of angular momentum states that when no external torque acts on an object or a closed system of objects, no change of angular momentum can occur. Hence, the angular momentum before an event involving only internal torques or no torques is equal to the angular momentum after the event . Angular momentum can be calculated with the help of the formula $L = I\omega$ where L stands for Angular momentum, I stands for moment of inertia and ω stands for angular velocity

[3] In case of a skater, who can be considered an isolated system, so no torue will be acting on him/her. When the arms are extended, the moment of inertia is more. When his hands are closely held, the moment of inertia is lesser. Since the angular momentum is same, the angular acceleration changes accordingly.

[4] For the motion of earth around sun, the sum of angular momenta of the Sun and the Earth about the center of mass of the sun + earth system is conserved.

[5] The z component of angular momentum of a conical pendulum is not conserved w.r.t. the origin fixed at the point of suspension; but the x and y components are conserved. SetId=574

[6] There is no case where LAW OF CONSERVATION OF ANGULAR MOMENTUM does'nt hold.But there are cases where conservation of angular momentum does not hold.A body in vertical circular motion is an example where angular momentum is not conserved. Here the law of conservation does not apply.

[7] When applying the conservation laws of momentum, energy and angular momentum we must define the system first.Only then check if the laws is applicable or not.

As an example: when a ball is dropped from a height, it gains momentum down if we consider the ball as our system.This is because the force of gravity acts as an external force.

However, if we change our system and consider earth as a part of our system too, then the momentum remains conserved because the earth gains momentum up.

[8] If we want to apply the conservation laws of momentum, energy and angular momentum, we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *external force* acting on the system, the momentum and angular momentum will be conserved, and depending on the nature of the forces but total energy may or may not be conserved.

[9] A non conservative force is a force with the property that the work done in moving a particle between two points is dependent of the taken path.

Friction, for example, does less work on a book dragged across a table if the book is dragged straight across than if the book is dragged in a curved path.

To write the equation for conservation of energy for nonconservative forces we need toinclude the work done by the non conservative force also.This is because forces like friction liberate heat which are not included in the mechanical energy.

SetId=574

[10] A particle moves on a circular path. Then under suitable conditions its speed and acceleration may remain constant, but the force, and velocity must always change with time.

[11] Displacement is the shortest distance between initial and final points with direction specified.

[12] If K is an inertial frame, any frame that moves w.r.t. the frame K with uniform speed is also an inertial frame.

[13] If we take some amount of a substance like construction putty, cement, cake batter, playing dough,etc and drop it on the ground, it does not bounce back, like a rubber ball would bounce, and hence the momentum it had before striking the ground seems to have been lost. Hence it appears that the law of conservation of linear momentum does not hold.

[14] A heavy body is attached from a spring and is held at point A and is such that the spring is not slack nor is it stretched. It is then released. It goes down upto a point B and then it rises upto point C and executes an oscillatory motion between B and C. During the motion from A to C is first positive (from A to B) and then it is negative from B to A and again remains negative from A to C. SetId=574

[15] 1)When we start rolling a body on a rough ground, it stops rolling after certain period because of frictional force.
2)When we leave a body from a certain height, it falls due to the act of gravitational force.

1)When a body is rotating in a circular path due to the centrifugal force which is the pseudo force. 2) When the lift is accelerating upwards, the upwards force felt by passengers a pseudo force.

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SetId=575

[1] The speed is rate of change of distance and the velocity is the rate of change of displacement.

[2] Newton's Second Law of Motion is defined by the expression $F = \frac{dp}{dT}$, where F gives the force vector acting on the system and p gives its momentum vector; in linear motion. A similar expression can be written to describe angular motion, i.e. : $\tau = \frac{dL}{dt}$, where τ is the external torque vector acting on the system, and L is the angular momentum.

If the external torque on the system is zero, then we get the expression as: dL/dt=0. This points out to the fact that, when no external torque is acting on the system, then its angular momentum is constant, no matter what changes occur in the system. This is the Law of Conservation Of Angular Momentum.

[3] Example where law of conservation of angular momentum holds:
Let us assume a student seated on a stool that can rotate freely about a vertical axis. The student has been set into rotation at a modest initial angular speed ω . He holds two dumbbells in his outstretched hands. His angular momentum vector L lies along the vertical rotation axis, pointing upwards. Now he pulls in his arms;this action reduces his rotational inertia from its value I_{initial} to a final value I_{final} because he moves the mass closer to the rotational axis. His rate of rotation increases markedly, from ω_{initial} to ω_{final}. The student can then slow down by extending his arms once more,moving the dumbbells outward. No external torque acts on the system consisting of the student, stool and the dumbbells. Thus the angular momentum of the system about the rotational axis remains constant. $I_{\text{initial}} * \omega_{\text{initial}} = I_{\text{final}} * \omega_{\text{final}}$.

[4] For the motion of the Earth around the sun, the total of angular momenta of the Earth and the Sun, about in a reference frame fixed in the pole star, is conserved.

[5] Only the z component of angular momentum of a conical pendulum is conserved w.r.t. the origin fixed at the point of suspension. SetId=575

[6] A sphere rolling on a rough surface.Due to friction there is external torque so the angular momentum changes which results in the slowing of the sphere. The angular momentum keeps changing. Even in case like this one, it is wrong to say that the Law of Angular Momentum Conservation does not hold.

[7] Statement: Law of Conservation of energy states that "ENERGY CAN NEITHER BE CREATED NOR DESTROYED",but it can be changed from one form to other.

EXPLANATION: Statement implies that the total amount of energy in an isolated system remains constant although it may change forms. viz, kinetic energy may change to potential;chemical to electrical energies etc.

[8] To apply the conservation laws of momentum, energy and angular momentum, we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *external force* acting on the system, the energy and momentum will be conserved. However, depending on the nature of the system and of the forces, the total angular momentum may not be conserved.

[9] The non conservative force is a force with a property thet the work done between two points depends on path taken. If a particle moves along a curve path, to know about the work done by a non conservative force we should have the equation of the path along which the particle had move.The work done would be

WORK = INTEGRAL (F.dx)

The equation of conservation of mechanical energy for a non conservative force would be

SetId=575 $KE_{\text{final}} + PE_{final} = KE_{initial} + PE_{initial} + W_{nc}$

[10] When the force is kept constant as function of time, it is possible for a particle to move on a circular path in such a way that its speed remains constant, but the velocity and acceleration must always change with time.

[11] Displacements, being vector quantity can not compared with, a scalar quantity such as distance.

[12] A frame rotating w.r.t K with uniform angular velocity is also an inertial frame.

[13] When we consider collision between two bodies in a non-inertial frame of reference, the law of conservation of momentum cannot be applied because there will be a pseudo force acting on the frame itself.

[14] The kinetic energy of a body does not change if any one of the following is true
(i)force is always perpendicular to the velocity
(ii) the force is always perpendicular to the acceleration
(iii) the object remains stationary
(iv) the object moves in such a way that the point of application of the force remains fixed. SetId=575

[15] Newton's first law defines inertial frame. An inertial frame is a frame in which the first law hold. It also makes it possible to compare and tell two force being equal or not. The second law defines the force.

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SetId=576

[1] For any type of translational motion of a body, the displacement cannot be zero, where as the distance travelled can be zero.

[2] If the net external torque acting on a system is zero, the angular momentum L of the system remains constant, no matter what changes take place within the system.

$$\sum(T_{\text{ext}}) = \frac{dL}{dt}$$

The law states that when there is no net external torque, $\frac{dL}{dt}$ is zero implying that the total angular momentum of system is constant.

i.e. $L = a$ constant (isolated system)

[3] A bob is attached to ceiling by a string and moves in a horizontal circular plane is an example. In this case the law of conservation of angular momentum does not hold.

[4] For the motion of the Earth around the sun, the total of angular momenta of the Earth and the Sun, is conserved in every inertial frame of reference; but the angular momentum of the Earth (or of the sun)is not conserved in every inertial frame.

[5] The projection of angular momentum of a conical pendulum in the horizontal plane is a constant of motion when the origin is chosen to be at fixed at the point of suspension. SetId=576

[6] Consider a rod of length l. Let us give an impulse to one end . Now the angular momentum about the oposite end is not zero since the impulse provides some torque . So the angular momentum is not conserved .

$$\text{torque} = \text{impulse} * \ell.$$

$d\ell/dt$ is not equal to zero and the law of conservation of angular momentum does not hold.

[7] Oscillating simple pendulum is a very good example where potential energy gets converted to kinetic energy and kinetic to potential energy. Some energy gets dissipated as heat if we consider air resistance. Energy as a whole is conserved if we consider universe as system, the energy has just changed its form.

[8] In order to apply the law of conservation of momentum we must first identify the system. If there is no *external forces* acting on the system then conservation laws of momentum always holds. And depending on the nature of the system and of the forces, the total kinetic energy and the total angular momentum may not be conserved.

[9] Nonconservative forces arise due to neglected degrees of freedom or from time dependent potentials. The work done by a nonconservative force depends upon the path taken. It causes a change in the mechanical energy of the system. It adds or removes mechanical energy from a system.

SetId=576

[10] It is not possible for a particle to move on a circular path in such a way that its speed and force remains constant, and only the velocity and acceleration may (or may not) always change with time.

[11] Distance depends on the path where as the displacement depends on the end point only

[12] The Newton's Laws of motion will hold in all frames which are at rest w.r.t. K but do not remain valid in a frame that move with respect to K.

[13] When a system is acted upon by external forces like friction etc, the conservation principle does not hold good,there will be impulse imparted and so we cant conserve momentum. This is case when a collision between two elastic balls take place on a rough horizontal table. The total momentum just after the collision will be different from the total momentum just before the collision. Here momentum is not conserved as there is external force friction is present.

[14] The total work done on a particle is always equal to the change in kinetic energy.

SetId=576

[15] The magnitude of the pseudo force arising in a non-inertial frame is always equal to the mass of the body under consideration multiplied by the acceleration of the frame of reference and the direction of pseudoforce is always opposite to the direction of acceleration of the frame.

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SetId=577

[1] Displacements, being vector quantity can not compared with, a scalar quantity such as distance.

[2] When the net external torque acting on a body or a system of bodies is zero about a particular axis, then the angular momentum of each body is conserved about that axis.

[3] Consider a disc rotating about an axis perpendicular to its plane. On placing a smaller disc with its surface parallel to the surface of the rotating disc, the angular momentum of the system of two discs remains constant as there is no external torque.

[4] In the Sun Earth system the angular momentum of the Earth is conserved in every frame of reference

[5] The law of angular momentum of a is not applicable for the conical pendulum conserved w.r.t. the origin fixed at the point of suspension.

SetId=577

[6] Let us consider a rotating skew rod. In the absence of friction or any other drag force, the rod should continuously spin without stopping. Here the net torque about the axis of rotation is 0 and hence angular momentum is conserved. It therefore follows from law of conservation of angular momentum that a spinning skew rod will keep rotating with constant angular velocity if there is no external torque. So law of conservation of angular momentum does not hold.

[7] Law of conservation of momentum does not hold whenever an external force or impulse acts on the system. For example,when a body collides with earth then it bounces back to a lesser height as it loses some velocity.

In this example the momentum of a ball is not conserved due to impulsive force by ground in the normal direction.

However, strictly speaking the system that should be considered here is the ball-earth system and the total momentum is conserved.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then check if the laws is applicable or not.

So if there is no *net external force* acting on the system all the three conservation laws will hold.

[9] The work done by a *Nonconservative Force *is not recoverable*.*The work done by a *Non Conservative force* is usually dissipated in the form of Heat and Sound.

SetId=577

Non conservative force *cannot* be expressed in the form of *Potential Energy*.

[10] For a particle moving on circle the acceleration is always constant in magnitude and directed towards the centre of the circle.

[11] Distance equal to zero $\Rightarrow$ displacement=0; but Displacement=0

[12] Staying inside a bullet train moving with constant velocity (no jerks etc) an experiment can always be performed which will tell us the numerical velocity of the bullet train

[13] When we are in accelerating frame if we observe any collision between two bodies then the law of conservation of momentum does not hold in that frame of reference. On the other hand the law of conservation of momentum holds in all inertial frames.

[14] A particle is acted upon by a force of constant magnitude which is always perpendicular to the velocity of the particle and the motion of the particle takes place in a plane, Then its kinetic energy, speed, velocity acceleration will not change. $\boxed{\text{SetId=577}}$

[15] A force is any interaction which tends to change the motion of an object. It is also *defined* as rate of change of momentum.It is a vector quantity.
A physically apparent but nonexistent force felt by an observer in a noninertial frame (that is, a frame undergoing acceleration).

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SetId=578

[1] Distance depends on the path where as the displacement depends on the end point only.

[2] The law of conservation of angular momentum states that in absence of an external torque on an object or a closed system of objects the total angular momentum of the system remains constant. Thus if $\vec{\tau} = 0 => \vec{L} =$ constant where τ is the torque and $\vec{L}$ is the angular momentum of the system.

[3] Consider a man standing on a spinning platform. Initially, the man spreads out his arms and he spins with a certain angular velocity. The next moment, he pulls his arms inwards keeping them close to his body. We will observe that the angular velocity with which he is spinning now increases. This phenomenon can be explained by the Law Of Conservation of Angular momentum. Initially, since his arms were spread wide, his moment of inertia was large. However, when he pulled them close to his body, his moment of inertia decreased.
In this example the angular velocity of the man increases and therefore the angular momentum also increases.The law of conservation of angular momentum does not apply because the torque of muscular forces is not zero.

[4] In the motion of earth around sun, the angular momentum of the earth about an axis passing through the sun and perpendicular to the plane of motion of earth is conserved.

[5] The law of angular momentum of a is not applicable for the conical pendulum conserved when the origin is chosen to be at the pendulum bob itself. SetId=578

[6] In the example of skew rod the angular velocity does not change even though the torque applied is nonzero. However there is no contradiction as in this case the law of conservation of momentum is not applicable. conservation is violated.

[7] If a bullet hits a wooden board and gets embedded in the board, the total energy and the total momentum of the bullet and the board are conserved.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then check we should if the laws are applicable or not.

So if there is no *external force* acting on the system all the three quantities, total momentum is conserved. The total angular momentum is also because the torque of internal forces will be zero. The conservation of energy depends on the nature of forces. will be conserved.

[9] * A non conservative force is a force that acts on a particle(or point), such that the work done by this force in moving this particle from one point to another is

/dependent of path taken/ that is the work done depends on the path itself. * For example frictional force is non conservative because the work done by friction always acts in the direction of travel and therefore depends on length L of the path taken.

SetId=578

[10] The motion of a bomb dropped from a plane does is not a uniform motion as it follows a parabolic path and not a straight line path.

[11] If P and Q are the initial and the final points of a path of a particle, displacement is a vector whose direction is along PQ and has magnitude is equal to the length of line PQ

[12] Staying inside a bullet train moving with constant velocity (no jerks etc) an experiment can always be performed which will tell us the numerical value of the acceleration of the bullet train

[13] When a freely falling body hits another rigid body in its path then momentum is not conserved as external force mg acts on both the bodies. The total momentum after the collision will be different from the total momentum before the hit.

[14] The kinetic energy of a particle is continuously increasing with time, then the angle bewteen the net force and the velocity cannot be greater than or equal to 90^o at any time.

SetId=578

[15] Psuedo Force is defined as an apparent force that acts in only non-inertial frames. Pseudo Forces are also called Fictitious Forces. It is an Imaginary force. It is independent of mass.

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SetId=579

[1] Distance equal to zero implies displacement=0; and Displacement=0 also implies distance = 0

[2] If no net external torque acts on a system, the total angular momentum of the system remains constant.

[3] In the Sun-Earth system, angular momentum of the earth is not conserved but the total angular momentum of the sun and the earth is constant of motion.

[4] For the motion of earth around sun, the angular momentum of the earth about the center of mass of the sun + earth system and perpendicular to the plane of motion of earth is conserved.

[5] The three components of angular momentum of a conical pendulum is conserved w.r.t. the origin at the position of the center of mass of the pendulum. SetId=579

[6] Example where law of conservation of angular momentum does not hold:If a particle undergoes conical motion and the only force acting on particle is central force like tension of the string.Then total external torque about fixed point A is zero,yet angular momentum is not conserved,as angular momentum keeps on changing direction.

[7] If a bullet hits a wooden board and gets embedded in the board, the total energy of the bullet and the board system is conserved but the total momentum is not conserved.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *net external force* acting on the system, the momentum is conserved. The definition of angular momentum and torque depends on the choice of axes, and therefore it may not be be conserved. The conservation of total energy holds only for conservative forces.

When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *net external force* acting on the system, the energy and momentum will be conserved. However, the total angular momentum may not be conserved because the torque may not be zero.

[9] A force with the property that the work done in moving a particle is dependent on the path followed. The work done by a conservative force in moving a body from an initial location to a final location is dependent on the path taken between the two points

SetId=579

[10] A wagon sliding on a roller coaster designed in such a way that the wagon covers equal distances in equal times. As the motion of the wagon is uniform, there will be no net force acting on it.

[11] If P and Q are the initial and the final points of a path of a particle,the displacement is the vector $\overrightarrow{PQ}$.

[12] Assume bullet train, moving with out any jerks, is going on a circular arc of radius R with constant speed. Then an experiment is to be performed entirely within the train without any measurement on objects outside the train. Such an experiment can tell only radius of the track.

[13] .The law of conservation of momentum does not hold good when net external forces acting on the system is not zero.when two bodies collide law of conservation of momentum is applicable on system of two bodies but on not individual bodies because external impulse acts on them.

[14] A heavy body is attached from a spring and is held at point A and is such that the spring is not slack nor is it stretched. It is then released. It goes down upto a point B and then it rises upto point C and executes an oscillatory motion between B and C. During the motion from A to C is first positive (from A to B) and then it is negative from B to A and again remains negative from A to C. SetId=579

[15] Psuedo Force is defined as an apparent force that acts in only non-inertial frames. Pseudo Forces are also called Fictious Forces. It is an Imaginary force. It is always proportional to mass. It is sometimes dependent on speed.

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[1] If P and Q are the initial and the final points of a path of a particle, displacement is a vector whose direction is along PQ and has magnitude is equal to the length of line PQ

SetId=580

[2] The law of conservation of angular momentum states that when no external torque is applied on an object or a closed system of objects about an axis, the angular momentum about that axis remains constant.

[3] Consider a disc and a man system. man is standing on center of the disc rotating with angular velocity.initially man folded his hand.when man stretches his hands then momentum of inertia of system increases.and angular velocity decreases.and total angular momentum remains constant.

[4] In the Sun Earth system the angular momentum of the Earth about the pole star is conserved

[5] Only the z component of the angular momentum of a conical pendulum is conserved w.r.t. the origin fixed at the point of suspension.

SetId=580

[6] A nonzero torque always causes the angular velocity to change, because a change in angular momentum means a change in angular velocity $L = I\omega$

[7] If a bullet hits a wooden board and gets embedded in the board, both total energy and the total momentum of the bullet and the board are not conserved.

[8] In order to apply the law of conservation of momentum we must first identify the system. If there is no *net external forces* acting on the system then conservation laws of momentum always holds. The total energy and the total angular momentum may not be conserved.

[9] The work done by non conservative force is dependent on the path taken by the particle in reaching final position from initial position. Non conservative force depends on the distance travelled by the particle

SetId=580

[10] A simple pendulum moves along a circular arc and does not have constant speed and therefore its motion is not uniform.

[11] If two bodies starting from a point A reach a point B, following different paths, their displacement will be, in general different, but the distances covered will always be the same.

[12] Assume bullet train, moving with out any jerks, is going on a circular arc of radius R with constant speed. Then an experiment is to be performed entirely within the train without any measurement on objects outside the train. Such an experiment can tell both speed of the train and radius of the track.

[13] A block moving in the air breaks up into two parts and the parts separate, then the total momentum must be the same before and after the break.

[14] The kinetic energy of a body does not change if any one of the following is true
(i)force is always perpendicular to the velocity
(ii) the force is always perpendicular to the acceleration
(iii) the object remains stationary
(iv) the object moves in such a way that the point of application of the force remains fixed. SetId=580

[15] Since pseudo forces are not real forces, they do not affect the conservation laws and all the three conservation laws hold in noninertial frames.

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SetId=581

[1] If P and Q are the initial and the final points of a path of a particle,the displacement is the vector $\overrightarrow{PQ}$.

[2] The angular momentum of a given system of bodies shall remain conserved unless acted upon by an external unbalanced torque.

[3] The conservation of angular momentum of a system of bodies requires that the the sum of torque due to all forces be equal to zero. Now consider a situation where the forces are such that the sum of torques of external forces is zero w.r.t. some axes K. Since the value of torque depends of the choices of axes, the sum of torques due to all internal forces will depend on the choice of axes and in general it will be non zero. Therefore, for a system of several bodies, for a given choice of axes K, there will be situations when the total angular momentum may not be conserved.

[4] For the motion of earth around sun, the angular momentum of the sun about the center of mass of the sun + earth system and perpendicular to the orbital plane of earth is conserved.

For the motion of earth around sun, the angular momentum of the sun about and axis passing through the Earth and perpendicular to the orbital plane of motion of earth is conserved.

[5] The z component of angular momentum of a conical pendulum is not conserved w.r.t. the origin fixed at the point of suspension; but the x and y components are conserved. SetId=581

[6] A nonzero torque always implies change in angular momentum and may not give rise to a change in magnitude of angular velocity. A non zero torque may mean change only the direction of the angular momentum and not the angular velocity.

[7] There are certain situations where it appears that the law of conservation of linear momentum does not hold. For example if we take some amount of a substance like construction putty, cement, cake batter, playing dough,etc and drop it on the ground, it does not bounce back like a rubber ball would and hence the momentum it had before striking the ground seems to have been lost. Hence it appears that the law of conservation of linear momentum does not hold.

[8] In order to apply the law of conservation of momentum we must first identify the system. Then even if there is no *net external forces* acting on the system, all the three conservation laws of momentum, angular momentum and energy may not hold due to presence of internal forces.

[9] The work done by non conservative force is dependent on the path taken by the particle in reaching final position from initial position. Non conservative force depends on the distance travelled by the particle

SetId=581

[10] A satellite goes around the earth in a circular orbit of 600km with a time period of $5.8 \times 10^3 s$. Its motion will be uniform as it will cover equal distances in equal times.

[11] Distance is equal to the length of the path covered. Displacement is the shortest distance between initial and final points.

[12] Assume bullet train, moving with out any jerks, is going on a circular arc of radius R with constant speed. Then an experiment is to be performed entirely within the train without any measurement on objects outside the train. Such an experiment can tell only speed of the track.

[13] A ball hits the floor and rebounds after an inelastic collision. In this case the total momentum of the ball before and after the collsion is conserved. Also the total enrgy of the ball and the earth remains the same

[14] The total work done on a particle is always equal to the change in kinetic energy. SetId=581

[15] A force is any interaction which tends to change the motion of an object. Newtons' second tell us that it is *equal* to the rate of change of momentum.It is a vector quantity. Real forces can be distinguished from pseudo forces because the pseudo forces always proportional to the mass of the body. All real forces, except the gravitational force, do not depend on the mass of the body.

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[1] If two bodies starting from a point A reach a point B, following different paths, their displacement will be, in general different, but the distances covered will always be the same.

SetId=582

[2] When the net external torque acting on a system about a given axis is zero, the total angular momentum of the system about that axis remains consant.

[3] Example where law of conservation of angular momentum does not hold:
When there is external force like frictional force acting on a object when it is rotating we cannot use conservation of angular momentum as the friction force acting on the object produces an external torque.

[4] For the motion of earth around sun, the sum of angular momenta of the Sun and the Earth about the center of mass of the sun + earth system is conserved.

[5] Only the z component of angular momentum of a conical pendulum is conserved w.r.t. the origin fixed at the point of suspension.

SetId=582

[6] In the example of a rotating skew rod the torque due to the external gravitational forces is zero , but the angular momentum is not constant Therefore the law of conservation of angular momentum is violated.

[7] A tennis ball is dropped from height h and after hitting the ground and it bounces back and rises to the same height. In this case the momentum of the ball is conserved because (under ideal conditions) the momentum after it hits the ground will be equal to the momentum it had before hitting the ground.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then check we should if the laws are applicable or not.

So if there is no *external force* acting on the system all the three quantities, total momentum, total angular momentum, and total kinetic energy will be conserved independent of the nature of forces.

[9] Nonconservative forces are those forces in which the work done in moving a particle is dependant on the path taken to cover the distance. Some energy woul be lost to the environment in the form of heat, sound, etc. The energy in the final state is less than that in the initial state.

SetId=582

[10] A uniform motion is defined to be the one in which a body covers equal distances in equal time intervals.

[11] Distance is a scalar quantity where as the displacement is a vector quantity.

[12] A particle is observed from two frames S_1 and S_2. The frame S_2 moves with respect to S_1 with an acceleration a. If F_1 and F_2 be the pseudoforces when seen from S_1 and S_2 respectively it is not possible to have $F_1 = F_2 = 0$

[13] In a head on elastic collision of two identical bodies of equal masses the velocities, the speeds, the momenta and the kinetic energy are all exchanged.

[14] A particle is acted upon by a force of constant magnitude which is always perpendicular to the velocity of the particle and the motion of the particle takes place in a plane, Then its kinetic energy, speed, velocity acceleration will not change. SetId=582

[15] Examples of pseudoforce are Coriolis Force, Centrifugal Force, and magnetic force on currents.
Psuedo force also called as fictitious force is an apparent force that are needed for masses whose their motion is described using a non inertial frame of reference.

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SetId=583

[1] Displacement is equal to the vector difference $\vec{r}_f - \vec{r}_i$ of the position vectors of initial and final points. The distance covered will be $|\vec{r}_f - \vec{r}_i|$

[2] This law sates that when no net torque of all forces acts on a object or a system of objects then total angular momentum of system is conserved.The angular momentum before an event is equal to angular momentum after that event.mathematically explained by when, net torque=0 ;then, total angular momentum(L)=constant.

[3] A bob attached to a ceiling by a string moving in a horizontal circular plane is an example where the total angular momentum of the bob about the point of suspension is not conserved. This is because the the torque due to the weight of the bob about the point of suspension does not vanish and has non zero horizontal component. Only the vertical component of the angular component is conserved.

[4] For the motion of the Earth around the sun, the total of angular momenta of the Earth and the Sun, about in a reference frame fixed in the pole star, is conserved.

[5] The projection of angular momentum of a conical pendulum in the horizontal plane is a constant of motion when the origin is chosen to be at fixed at the point of suspension.

SetId=583

[6] In the example of skew rod, the angular momentum changes with time and there is a non zero torque coming from action of forces other than gravitational forces. Hence the law of conservation of angular momentum dos not apply.

[7] Law of conservation of momentum does not hold when Newton's laws are not valid, e.g. in a non-inertial frame of reference. For example, when we consider collision between two bodies in a non-inertial frame of reference, the law of conservation of momentum cannot be applied because there will be a pseudo force acting on the frame itself.

[8] If we want to apply the conservation laws of momentum, energy and angular momentum, we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *external force* acting on the system, the momentum and angular momentum will be conserved, and depending on the nature of the forces but total energy may or may not be conserved.

[9] The work done by such forces depends on the path taken. The work done cannot be represented as a potential energy function.Work done by such forces is always negative.

SetId=583

[10] A particle moves on a circular path. Then its speed, direction of force, velocity and acceleration must always change with time.

[11] Both displacement and distance tell us about the motion of a body but their study does not tell much about the forces on the body

[12] A particle is observed from two frames S_1 and S_2. The frame S_2 moves with respect to S_1 with an acceleration a. If F_1 and F_2 be the pseudoforces when seen from S_1 and S_2 respectively and if $F_1 = 0$ then we must have $F_2 \neq 0$

[13] For a system of several particles the conservation of total linear momentum is equivalent to the statement that their centre of mass moves like a free particle.

[14] The kinetic energy of a particle is continuously increasing with time, then the angle bewteen the net force and the velocity cannot be greater than or equal to 90^{o} at any time. SetId=583

[15] Examples of pseudo-force are Coriolis Force, Centrifugal Force, Centripetal force and magnetic force on currents. The pseudo forces do not obey Newton's third law and therefore the total momentum does not appear to be conserved in a non-inertial frame.

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SetId=584

[1] Distance is equal to the length of the path covered. Displacement is the shortest distance between initial and final points.

[2] Statement of Law of Conservation of Angular Momentum:
Differentiating $\vec{L} = \vec{r} \times \vec{p}$ w.r.t, time,

$$\begin{aligned}\frac{dL}{dt} &= \frac{d\vec{r} \times \vec{p}}{dt} = \frac{d\vec{r}}{dt} \times \vec{p} + \vec{r} \times \frac{d\vec{p}}{dt} = \vec{v} \times (m\vec{v}) + \vec{r} \times \vec{F} \\ &= \vec{r} \times \vec{F} (\because v \times v = 0) \\ &= \vec{\tau}\end{aligned}$$

here $\vec{\tau}$ represents the net torque acting on a rigid body rotating about a fixed axis.This torque must take into account of all the forces, be it external or internal forces

[3] Law of conservation of angular momentum holds in case of long jump. When a athlete takes off from the ground in a running long jump, the forces on the launching foot give the athlete an angular momentum with a forward rotation around a horizontal axis. Such rotation would not allow the jumper to land properly. In the landing, the legs should be together and extended forward at an angle so that the heels mark the sand at the greatest distance. Once airborne, the angular momentum cannot change (it is conserved) because no external torque acts to change it. However, the jumper can shift most of the angular momentum to the arms by rotating them in windmill fashion. Then the body remains upright in the proper orientation of landing.

[4] For the motion of the Earth around the sun, the total of angular momenta of the Earth and the Sun, is conserved in every inertial frame of reference; but the angular momentum of the Earth (or of the sun)is not conserved in every inertial frame.

[5] The law of angular momentum of a is not applicable for the conical pendulum conserved w.r.t. the origin fixed at the point of suspension. SetId=584

[6] In the example of conical pendulum, the z- component of angular momentum does not change. This follows from the angular momentum conservation as there is no external torque.

[7] If I throw a ball upward, it's speed decreases as it rises upwards. There is an external force (gravity) acting on the ball, so the momentum conservation law does not apply. Momentum of the ball is not conserved, however the momentum of the Earth-ball system is conserved as gravity will become an internal force in this case.

[8] To apply the conservation laws of momentum, energy and angular momentum, we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *external force* acting on the system, the energy and momentum will be conserved. However, depending on the nature of the system and of the forces, the total angular momentum may not be conserved.

[9] A nonconservative force is a force with the property that the work done in moving a particle depends on the path taken.Also, the net work done in a closed loop is non zero.

SetId=584

[10] A particle moves on a circular path. Then its speed, direction offorce, can remain constant by velocity and acceleration must always change with time.

[11] Displacement is the shortest distance between initial and final points with direction specified.

[12] If K is an inertial frame, any frame that moves w.r.t. the frame K with uniform velocity is also an inertial frame.

[13] The total mechanical energy of a system may not be conserved if there are no external forces and the internal forces are conservative.

[14] A heavy body is attached from a spring and is held at point A and is such that the spring is not slack nor is it stretched. It is then released. It goes down upto a point B and then it rises upto point C and executes an oscillatory motion between B and C. During the motion from A to C is first positive (from A to B) and then it is negative from B to A and again remains negative from A to C.

SetId=584

[15] FORCE is any interaction which tends to change the motion of an object.It has both magnitude and direction,making it a vector quantity.

A psuedo force is an apparent force that acts on all masses whose motion is described with respect to a non-inertial frame of reference like a rotating frame of reference.This force is needed by an observer in an non-inertial frame to make all the Newtons Laws of motion hold true.

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SetId=585

[1] Distance is a scalar quantity where as the displacement is a vector quantity.

[2] Statement of Law of Conservation of Angular Momentum: For a system of many particles The net torque due all the forces, be it external or internal forces. But as the torque due to all the internal forces cancel out, it sufficient to consider the external forces acting on the system.

[3] The total angular momentum of a body remains constant of motion when the net torque of the external forces acting on the body is zero.
In general, we have a system of particles such that the net torque of the external forces on the system, w.r.t. some axes K, is zero, the total angular momentum may not remain conserved, because the torque due to the internal forces may not be zero.

[4] In the Sun Earth system the angular momentum of the Earth is conserved in every frame of reference

[5] The law of angular momentum of a is not applicable for the conical pendulum conserved when the origin is chosen to be at the pendulum bob itself. SetId=585

[6] In the example of conical pendulum, the x and$y$ components of angular momentum change. This follows from the angular momentum conservation as the z components external torque is zero and horizontal components of torque are non zero.

[7] A soldier accelerating away, after detonating a bomb, will find that the total momentum of the fragments of the bomb is zero. This is an example where the law of conservation of momentum holds as the forces on the fragments are internal forces only and sum of all such forces is zero.

[8] In order to apply the law of conservation of momentum we must first identify the system. If there is no *external forces* acting on the system then conservation laws of momentum always holds. And depending on the nature of the system and of the forces, the total kinetic energy and the total angular momentum may not be conserved.

[9] A force whose work done is a path function is called a non-conservative force. All the forces which do not satisfy the definition of conservative forces are non-conservative in nature. The work done by these forces dissipates into heat energy, sound energy, light energy, etc. Therefore, law of conservation of mechanical energy cannot be applied to a system on which a non-conservative force is acting. No potential function
SetId=585 can be defined for these forces.

[10] A particle moves on a circular path. Then under suitable conditions its speed may remain constant, but the force, velocity and acceleration must always change with time.

[11] Displacements, being vector quantity can not compared with, a scalar quantity such as distance.

[12] If K is an inertial frame, any frame that moves w.r.t. the frame K with uniform speed is also an inertial frame.

[13] When a bullet fired on a wooden block, some energy is transferred to the block and the total mechanical energy of the block and the bullet is conserved.

[14] The kinetic energy of a body does not change if any one of the following is true
(i)force is always perpendicular to the velocity
(ii) the force is always perpendicular to the acceleration
(iii) the object remains stationary
(iv) the object moves in such a way that the point of application of the force remains fixed.

SetId=585

[15] FORCE is any interaction which tends to change the motion of an object.It has both magnitude and direction,making it a vector quantity. A pseudo-force F doesn't arise from any physical interaction between two objects, but rather from the acceleration 'a' of the non-inertial reference frame itself. These forces have no real existence but must be taken into account in an accelerating frame of reference to make all the three Newton's Laws of motion applicable to the system

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[1] The speed is rate of change of distance and the velocity is the rate of change of displacement.

[2] Depending on the torques acting on a system, the angular momentum can be conserved only in one or two directions, but may not be conserved in all. For instance, if an isolated body has no torque acting on it only in the direction along the Z axis, then the angular momentum is conserved only in that direction.

[3] An example where law of conservation of angular momentum holds:
The Law of conservation of angular momentum holds in the case of a ballet dancer performing a pirouette.

When the dancer extends her arms outward, the angular velocity of her rotation decreases whereas when she keeps her arms close to her body, the angular velocity increases. This is because her moment of inertia changes as she moves her arms outward and inward. It can be noted that she as a system has no external torque acting upon her.

[4] In the motion of earth around sun, the angular momentum of the earth about an axis passing through the sun and perpendicular to the plane of motion of earth is conserved.

[5] The three components of angular momentum of a conical pendulum is conserved w.r.t. the origin at the position of the center of mass of the pendulum. SetId=586

[6] Example where law of conservation of angular momentum does not hold: A disc rotating on a horizontal rough surface will not have a constant angular momentum because there will be a constant torque by frictional force. Hence, its angular momentum will decrease, and the law of conservation of angular momentum does not apply.

[7] There is no known exception to the law of conservation of momentum in classical mechanics However, an exception to conservation of energy in nuclear physics is observed. In nuclear reactions when two nuclei collide and their mass converts to energy and energy momentum are not conserved.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then check if the laws is applicable or not.

So if there is no *net external force* acting on the system all the three conservation laws will hold.

[9] *Non conservative forces* are the type of forces in which the work done by the forces is purely dependent on the path taken by the body.Thus the net work done by the forces in cyclic path is never equal to zero.

SetId=586

[10] A particle moves on a circular path. Then under suitable conditions its speed and acceleration may remain constant, but the force, and velocity must always change with time.

[11] Distance depends on the path where as the displacement depends on the end point only

[12] A frame rotating w.r.t K with uniform angular velocity is also an inertial frame.

[13] When a moving car hits a parked lorry and causes the parked lorry to move ,energy is transferred from moving the car to the lorry and the total energy of the lorry and the car is conserved.

[14] The total work done on a particle is always equal to the change in kinetic energy. SetId=586

[15] FORCE is any interaction which tends to change the motion of an object.It has both magnitude and direction,making it a vector quantity.
A pseudo-force results from acceleration of the frame of reference in which the objects reside. It is taken into account so that Newton's second law isn't invalidated. The pseudo force acting on an object can always be mathematically expressed as the product of the mass of the object and the acceleration of the frame of reference.

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SetId=587

[1] For any type of translational motion of a body, the displacement cannot be zero, where as the distance travelled can be zero.

[2] According to Law of Conservation of Angular momentum,if no external torque acts on an object or system of objects,angular momentum of an object or system of objects remains CONSTANT or no change in angular momentum can occur.

Also it states that,only external torque can change angular momentm of the system where as the torque produced by internal forces can not change the angular momentum of the system

[3] In case of a skater, who can be considered an isolated system, so no torue will be acting on him/her. When the arms are extended, the moment of inertia is more. When his hands are closely held, the moment of inertia is lesser. Since the angular momentum is same, the angular acceleration changes accordingly.

[4] For the motion of earth around sun, the angular momentum of the earth about the center of mass of the sun + earth system and perpendicular to the plane of motion of earth is conserved.

[5] Only the z component of the angular momentum of a conical pendulum is conserved w.r.t. the origin fixed at the point of suspension. SetId=587

[6] Example where law of conservation of angular momentum does not hold:Consider a vertical stick on the ground falling to a horizontal position. During the fall, the conservation of angular momentum applied at the point of rotation on the ground and perpendicular to the plane of the stick is not applicable as, the gravitational force which acts vertically downwards assumed at the centre of mass produces an external torque about the axis of rotation

[7] In a system of a canon and a canon ball, total momentum of the system is zero before canon ball is fired. After firing the canon ball, the momentum of the system seems to be conserved as the ball moves forward and the canon moves backward.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then check we should if the laws are applicable or not.

So if there is no *external force* acting on the system all the three quantities, total momentum is conserved. The total angular momentum is also because the torque of internal forces will be zero. The conservation of energy depends on the nature of forces. will be conserved.

[9] Non-conservative forces are path-dependent forces, i.e. the work done on a body by these forces depends on the path taken by the body. Mechanical energy of a

system is not conserved when a conservative force acts on it but the total energy is conserved. Therefore, the mechanical energy lost by the system is liberated in some other form such as light energy, heat energy, etc.

For example, when a body is moving along a surface, frictional force acts on the body as well. Due to this frictional force, the body loses its mechanical energy, and this loss is generally released in the form of heat energy to the surroundings. Thus, the mechanical energy will not be conserved and frictional force can be classified as a non-conservative force.

SetId=587

[10] When the force is kept constant as function of time, it is possible for a particle to move on a circular path in such a way that its speed remains constant, but the velocity and acceleration must always change with time.

[11] Distance equal to zero $\Rightarrow$ displacement=0; but Displacement=0

[12] The Newton's Laws of motion will hold in all frames which are at rest w.r.t. K but do not remain valid in a frame that move with respect to K.

[13] When a bomb explodes the total mechanical energy is not conserved. But the total chemical energy and the mechanical energy is conserved.

[14] A particle is acted upon by a force of constant magnitude which is always perpendicular to the velocity of the particle and the motion of the particle takes place in a plane, Then its kinetic energy, speed, velocity acceleration will not change. SetId=587

[15] Explain Force:FORCE is any interaction which tends to change the motion of an object.It has both magnitude and direction,making it a vector quantity.
In the case of a non inertial frame, we can use the second law of motion by adding a pseudo force to the system which makes it an inertial frame of reference.

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SetId=588

[1] Displacements, being vector quantity can not compared with, a scalar quantity such as distance.

[2] The law of conservation of angular momentum states that when the net external torque acting on the system is zero, then the angular momentum of the system remains constant.both the initial and final momentum should be taken from a fixed inertial frame of reference provided.

[3] Example where law of conservation of angular momentum holds:
Let us assume a student seated on a stool that can rotate freely about a vertical axis. The student has been set into rotation at a modest initial angular speed ω . He holds two dumbbells in his outstretched hands. His angular momentum vector L lies along the vertical rotation axis, pointing upwards. Now he pulls in his arms;this action reduces his rotational inertia from its value I_{initial} to a final value I_{final} because he moves the mass closer to the rotational axis. His rate of rotation increases markedly, from ω_{initial} to ω_{final}. The student can then slow down by extending his arms once more,moving the dumbbells outward. No external torque acts on the system consisting of the student, stool and the dumbbells. Thus the angular momentum of the system about the rotational axis remains constant. $I_{\text{initial}} * \omega_{\text{initial}} = I_{\text{final}} * \omega_{\text{final}}$.

[4] In the Sun Earth system the angular momentum of the Earth about the pole star is conserved

[5] The z component of angular momentum of a conical pendulum is not conserved w.r.t. the origin fixed at the point of suspension; but the x and y components are conserved. SetId=588

[6] We have a conical pendulum .The forces acting on the bob are tension (along the direction of the string) and gravitational force acting in the vertically downward direction.we have an additional force called the drag force which is tangential to the motion of the bob and acts in the direction opposite to the motion of the bob.The axis of rotation passes through the hinge point and is vertical.The torque due to tension is 0 because the force passes through the axis of rotation.The torque due to mg is also zero since it is parallel to the axis of rotation.but the torque due to drag force is not zero.since the net external torque acting on the bob is not zero,therefore the law of conservation of angular momentum does not hold here

[7] When applying the conservation laws of momentum, energy and angular momentum we must define the system first.Only then check if the laws is applicable or not.

As an example: when a ball is dropped from a height, it gains momentum down if we consider the ball as our system.This is because the force of gravity acts as an external force.

However, if we change our system and consider earth as a part of our system too, then the momentum remains conserved because the earth gains momentum up.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *net external force* acting on the system, the momentum is conserved. The definition of angular momentum and torque depends on the choice of axes, and therefore it may not be be conserved. The conservation of total energy holds only for conservative forces.

When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *net external force* acting on the system, the energy and momentum will be conserved. However, the total angular momentum may not be conserved because the torque may not be zero.

[9] It is a force for which the work done by that force on an object or a particle in moving it between any two points depends on its path travelled.This force doesn't conserves the mechanical energy.The work done by a non-conservative force on an object in moving it in a circular path is not equal to zero.

SetId=588

[10] It is not possible for a particle to move on a circular path in such a way that its speed and force remains constant, and only the velocity and acceleration may (or may not) always change with time.

[11] If P and Q are the initial and the final points of a path of a particle, displacement is a vector whose direction is along PQ and has magnitude is equal to the length of line PQ

[12] Staying inside a bullet train moving with constant velocity (no jerks etc) an experiment can always be performed which will tell us the numerical velocity of the bullet train

[13] When a ball rolls over a rough surface, it comes to stop after some time. This is because transational and rotational kinetic energy initially present in the ball continuosly gets converted to heat due to friction. When all the kinetic energy changes to heat, the ball stops. The total mechanical energy of the ball is not conserved.

[14] The kinetic energy of a particle is continuously increasing with time, then the angle bewteen the net force and the velocity cannot be greater than or equal to 90^o at any time.

SetId=588

[15] For the Newton's Law of Motion to hold true,the physically apparent but nonexistent force needed by an observer in a non-inertial frame is called the pseudo force.
1) Caused by relative acceleration of the origin in a straight line
2) Centrifugal and Centripetal forces
3) Coriolis force
4) Euler force

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[1] Distance depends on the path where as the displacement depends on the end point only.

[2] The law of conservation of angular momentum states that The total angular momentum of a system is constant in both magnitude and direction if the resultant torque, of the external forces acting on the system, is zero.

[3] A bob is attached to ceiling by a string and moves in a horizontal circular plane is an example. In this case the law of conservation of angular momentum does not hold.

[4] For the motion of earth around sun, the angular momentum of the sun about the center of mass of the sun + earth system and perpendicular to the orbital plane of earth is conserved.

For the motion of earth around sun, the angular momentum of the sun about and axis passing through the Earth and perpendicular to the orbital plane of motion of earth is conserved.

[5] Only the z component of angular momentum of a conical pendulum is conserved w.r.t. the origin fixed at the point of suspension. SetId=589

[6] When you release a toy gyroscope on its pedestal, it initially has no precessional rotation around that pedestal, i.e, the orientation of rotation is fixed. However, it instantaneously starts precessing around the pedestal. Both Kinetic Energy and Angular Momentum now exist where they did not exist a moment earlier. The Kinetic Energy is easy to explain, as appearing due to the body of the gyroscope dropping a tiny fraction of a millimeter in the Earth's gravitational field, giving up exactly the correct amount of Potential Energy. But the Angular Momentum of the Precession which just appeared, does not come from anywhere. This is therefore a Violation of the Conservation of Angular Momentum.

[7] Statement: Law of Conservation of energy states that "ENERGY CAN NEITHER BE CREATED NOR DESTROYED",but it can be changed from one form to other.

EXPLANATION: Statement implies that the total amount of energy in an isolated system remains constant although it may change forms. viz, kinetic energy may change to potential;chemical to electrical energies etc.

[8] In order to apply the law of conservation of momentum we must first identify the system. If there is no *net external forces* acting on the system then conservation laws of momentum always holds. The total energy and the total angular momentum may not be conserved.

[9] Explain Nonconservative force: This force is just opposite to that of conservative force. The work done by this force depends on the path taken by the particle on

which the force is applied.This force does not conserve mechanical energy.If a particle
SetId=589 travels in a closed loop, the net work done by a non consevative force is non zero.

[10] For a particle moving on circle the acceleration is always constant in magnitude and directed towards the centre of the circle.

[11] If P and Q are the initial and the final points of a path of a particle,the displacement is the vector $\overrightarrow{PQ}$.

[12] Staying inside a bullet train moving with constant velocity (no jerks etc) an experiment can always be performed which will tell us the numerical value of the acceleration of the bullet train

[13] Let us consider that a pendulum is oscillating moving in a vertical plane. Mean while let another bob which is attached to a spring and is executing a simple harmonic motion in horizontal direction comes and hits the pendulum. Here conservation of momentum does not hold good as tension(external force) is acting on the system.(pendulum)

[14] A heavy body is attached from a spring and is held at point A and is such that the spring is not slack nor is it stretched. It is then released. It goes down upto a point B and then it rises upto point C and executes an oscillatory motion between B and C. During the motion from A to C is first positive (from A to B) and then it is negative from B to A and again remains negative from A to C. SetId=589

[15] A force is any interaction which tends to change the motion of an object. It is also *defined* as rate of change of momentum.It is a vector quantity.

Pseudo-force is a fictitious force it is taken by an observer from non inertial frame of reference. This force arises from acceleration of reference frame that is a reference frame which is accelerating or rotating.

The equation of motion is then written by balancing all forces. As an example a particle moving in a circle is seen to be at rest by balancing the centripetal and centrifugal forces.

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[1] Distance equal to zero implies displacement=0; and Displacement=0 also implies distance = 0

[2] If the net external torque acting on a system is zero,the angular momentum L(vector) of the system remains constant,no matter what changes take place within the system.L(vector)=a constant (net external torque acting on system is zero)

[3] Consider a disc rotating about an axis perpendicular to its plane. On placing a smaller disc with its surface parallel to the surface of the rotating disc, the angular momentum of the system of two discs remains constant as there is no external torque.

[4] For the motion of earth around sun, the sum of angular momenta of the Sun and the Earth about the center of mass of the sun + earth system is conserved.

[5] The projection of angular momentum of a conical pendulum in the horizontal plane is a constant of motion when the origin is chosen to be at fixed at the point of suspension.

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[6] There is no case where LAW OF CONSERVATION OF ANGULAR MOMENTUM does'nt hold.But there are cases where conservation of angular momentum does not hold.A body in vertical circular motion is an example where angular momentum is not conserved. Here the law of conservation does not apply.

[7] Oscillating simple pendulum is a very good example where potential energy gets converted to kinetic energy and kinetic to potential energy. Some energy gets dissipated as heat if we consider air resistance. Energy as a whole is conserved if we consider universe as system, the energy has just changed its form.

[8] In order to apply the law of conservation of momentum we must first identify the system. Then even if there is no *net external forces* acting on the system, all the three conservation laws of momentum, angular momentum and energy may not hold due to presence of internal forces.

[9] Non conservative force is the force in which the work done by a particle in going from one point to another is path dependent.

For non conservative forces mechanical energy is not conserved,mostly lost in the form of heat and light.The work done by a non conservative force is equal to the change in mechanical energy.

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For non conservative force $E_{\text{initial}} > E_{\text{final}}$

[10] The motion of a bomb dropped from a plane does is not a uniform motion as it follows a parabolic path and not a straight line path.

[11] If two bodies starting from a point A reach a point B, following different paths, their displacement will be, in general different, but the distances covered will always be the same.

[12] Assume bullet train, moving with out any jerks, is going on a circular arc of radius R with constant speed. Then an experiment is to be performed entirely within the train without any measurement on objects outside the train. Such an experiment can tell only radius of the track.

[13] The law of conservation of momentum does not hold in relativistic situations, i.e., where the speeds of the masses involved are close to the speed of light.

[14] The kinetic energy of a body does not change if any one of the following is true
(i)force is always perpendicular to the velocity
(ii) the force is always perpendicular to the acceleration
(iii) the object remains stationary
(iv) the object moves in such a way that the point of application of the force remains fixed. SetId=590

[15] A psuedo force is an apparent force that acts on all masses whose motion is described with respect to a non-inertial frame of reference like a rotating frame of reference. This force is needed by an observer in an non-inertial frame to make all the Newtons second laws to write correct equation of motion..

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[1] If P and Q are the initial and the final points of a path of a particle, displacement is a vector whose direction is along PQ and has magnitude is equal to the length of line PQ

[2] The Law of conservation of angular momentum states that when no external torque acts on an object or a closed system of objects undergoing motion about a given axis, the change in angular momentum is zero. Therefore, considering an event where only internal torque or no torque is involved, the total angular momentum of the system before the event is equal to the total angular momentum after the event

[3] Consider a man standing on a spinning platform. Initially, the man spreads out his arms and he spins with a certain angular velocity. The next moment, he pulls his arms inwards keeping them close to his body. We will observe that the angular velocity with which he is spinning now increases. This phenomenon can be explained by the Law Of Conservation of Angular momentum. Initially, since his arms were spread wide, his moment of inertia was large. However, when he pulled them close to his body, his moment of inertia decreased.
In this example the angular velocity of the man increases and therefore the angular momentum also increases.The law of conservation of angular momentum does not apply because the torque of muscular forces is not zero.

[4] For the motion of the Earth around the sun, the total of angular momenta of the Earth and the Sun, about in a reference frame fixed in the pole star, is conserved.

[5] The law of angular momentum of a is not applicable for the conical pendulum conserved w.r.t. the origin fixed at the point of suspension. SetId=591

[6] A sphere rolling on a rough surface.Due to friction there is external torque so the angular momentum changes which results in the slowing of the sphere. The angular momentum keeps changing. Even in case like this one, it is wrong to say that the Law of Angular Momentum Conservation does not hold.

[7] Law of conservation of momentum does not hold whenever an external force or impulse acts on the system. For example,when a body collides with earth then it bounces back to a lesser height as it loses some velocity.

In this example the momentum of a ball is not conserved due to impulsive force by ground in the normal direction.

However, strictly speaking the system that should be considered here is the ball-earth system and the total momentum is conserved.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then check we should if the laws are applicable or not.

So if there is no *external force* acting on the system all the three quantities, total momentum, total angular momentum, and total kinetic energy will be conserved independent of the nature of forces.

[9] A force is said to be non-conservative, if the work done by the force is dependent on the path taken. It could also be defined as a force for which the work done during a cyclic process is non-zero.

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[10] A wagon sliding on a roller coaster designed in such a way that the wagon covers equal distances in equal times. As the motion of the wagon is uniform, there will be no net force acting on it.

[11] Distance is equal to the length of the path covered. Displacement is the shortest distance between initial and final points.

[12] Assume bullet train, moving with out any jerks, is going on a circular arc of radius R with constant speed. Then an experiment is to be performed entirely within the train without any measurement on objects outside the train. Such an experiment can tell both speed of the train and radius of the track.

[13] when we are in accelerating frame if we observe any collision between two bodies then the law of conservation of momentum does not hold in that frame of reference.

[14] The total work done on a particle is always equal to the change in kinetic energy. SetId=591

[15] One indication that pseudo forces are NON-NEWTONIAN is that they violate Newton's III law and violate the Newton's third law.

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SetId=592

[1] If P and Q are the initial and the final points of a path of a particle,the displacement is the vector $\overrightarrow{PQ}$.

[2] The law of conservation of angular momentum states that when no external torque acts on an object or a closed system of objects, no change of angular momentum can occur. Hence, the angular momentum before an event involving only internal torques or no torques is equal to the angular momentum after the event . Angular momentum can be calculated with the help of the formula $L = I\omega$ where L stands for Angular momentum, I stands for moment of inertia and ω stands for angular velocity

[3] In the Sun-Earth system, angular momentum of the earth is not conserved but the total angular momentum of the sun and the earth is constant of motion.

[4] For the motion of the Earth around the sun, the total of angular momenta of the Earth and the Sun, is conserved in every inertial frame of reference; but the angular momentum of the Earth (or of the sun)is not conserved in every inertial frame.

[5] The law of angular momentum of a is not applicable for the conical pendulum conserved when the origin is chosen to be at the pendulum bob itself. SetId=592

[6] Consider a rod of length l. Let us give an impulse to one end . Now the angular momentum about the oposite end is not zero since the impulse provides some torque . So the angular momentum is not conserved .

$$\text{torque} = \text{impulse} * \ell.$$

$d\ell/dt$ is not equal to zero and the law of conservation of angular momentum does not hold.

[7] If a bullet hits a wooden board and gets embedded in the board, the total energy and the total momentum of the bullet and the board are conserved.

[8] If we want to apply the conservation laws of momentum, energy and angular momentum, we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *external force* acting on the system, the momentum and angular momentum will be conserved, and depending on the nature of the forces but total energy may or may not be conserved.

[9] a force is said to be non conservative if work done is dependent on the path of the particle.potential cannot be defined in the case of non conservative forces.work done in closed loop is not equal to zero.

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[10] A simple pendulum moves along a circular arc and does not have constant speed and therefore its motion is not uniform.

[11] Distance is a scalar quantity where as the displacement is a vector quantity.

[12] Assume bullet train, moving with out any jerks, is going on a circular arc of radius R with constant speed. Then an experiment is to be performed entirely within the train without any measurement on objects outside the train. Such an experiment can tell only speed of the track.

[13] Give an example where law of conservation of momentum does not hold all cases when seen from non inertial frame of references for example when we see two cars collide from a moving bus there momentum is not conserved

[14] A particle is acted upon by a force of constant magnitude which is always perpendicular to the velocity of the particle and the motion of the particle takes place in a plane, Then its kinetic energy, speed, velocity acceleration will not change. SetId=592

[15] The apparent force which seems to act on an object in an accelerating frame of reference if we wish to describe the object's motion is called a pseudo force.Its a non-existent force used only to describe the motion completely using Newton's second law even though the agent causing the force is undefined.

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[1] If two bodies starting from a point A reach a point B, following different paths, their displacement will be, in general different, but the distances covered will always be the same.

[2] Newton's Second Law of Motion is defined by the expression $F = \frac{dp}{dT}$, where F gives the force vector acting on the system and p gives its momentum vector; in linear motion. A similar expression can be written to describe angular motion, i.e. : $\tau = \frac{dL}{dt}$, where τ is the external torque vector acting on the system, and L is the angular momentum.

If the external torque on the system is zero, then we get the expression as: dL/dt=0. This points out to the fact that, when no external torque is acting on the system, then its angular momentum is constant, no matter what changes occur in the system. This is the Law of Conservation Of Angular Momentum.

[3] Consider a disc and a man system. man is standing on center of the disc rotating with angular velocity.initially man folded his hand.when man stretches his hands then momentum of inertia of system increases.and angular velocity decreases.and total angular momentum remains constant.

[4] In the Sun Earth system the angular momentum of the Earth is conserved in every frame of reference

[5] The three components of angular momentum of a conical pendulum is conserved w.r.t. the origin at the position of the center of mass of the pendulum. SetId=593

[6] Let us consider a rotating skew rod. In the absence of friction or any other drag force, the rod should continuously spin without stopping. Here the net torque about the axis of rotation is 0 and hence angular momentum is conserved. It therefore follows from law of conservation of angular momentum that a spinning skew rod will keep rotating with constant angular velocity if there is no external torque. So law of conservation of angular momentum does not hold.

[7] If a bullet hits a wooden board and gets embedded in the board, the total energy of the bullet and the board system is conserved but the total momentum is not conserved.

[8] To apply the conservation laws of momentum, energy and angular momentum, we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *external force* acting on the system, the energy and momentum will be conserved. However, depending on the nature of the system and of the forces, the total angular momentum may not be conserved.

[9] Explain Nonconservative Forces:

The forces that depend on the path taken by the particle are called non-conservative forces.

Mechanical energy is not conserved during the action of a non conservative force, instead, it is lost as other forms of enery like heat, light, etc.

Potential energy is not defined for a non-conservative force.

The initial and final kinetic energy in a closed loop is not equal.

The work done by a non conservative force in a closed loop is non zero. In practice, the net work is invariably negative.

Work done by a non conservative force cannot be completely recovered.

For a non conservative force,

$$/text(KE)//_f//+(\text{PE})//_f// = (\text{KE})_i+(\text{PE})_i//+//\text{Work Done})//\text{non-conservative force}//$$

SetId=593

[10] A satellite goes around the earth in a circular orbit of 600km with a time period of $5.8 \times 10^3 s$. Its motion will be uniform as it will cover equal distances in equal times.

[11] Both displacement and distance tell us about the motion of a body but their study does not tell much about the forces on the body

[12] A particle is observed from two frames S_1 and S_2. The frame S_2 moves with respect to S_1 with an acceleration a. If F_1 and F_2 be the pseudoforces when seen from S_1 and S_2 respectively it is not possible to have $F_1 = F_2 = 0$

[13] When a tennis ball hits the ground at an oblique angle, the angle of reflection is equal to the angle of incidence. This is a simple consequence of conservation of horizontal component of momentum.

[14] The kinetic energy of a particle is continuously increasing with time, then the angle bewteen the net force and the velocity cannot be greater than or equal to 90^o at any time. SetId=593

[15] The physically apparent, but nonexistent, force needed by an observer in a noninertial frame to make Newton's laws of motion hold true is called pseudoforce.

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[1] Displacement is equal to the vector difference $\vec{r}_f - \vec{r}_i$ of the position vectors of initial and final points. The distance covered will be $|\vec{r}_f - \vec{r}_i|$

[2] If the net external torque acting on a system is zero, the angular momentum L of the system remains constant, no matter what changes take place within the system.

$$\sum(T_{\text{ext}}) = \frac{dL}{dt}$$

The law states that when there is no net external torque, $\frac{dL}{dt}$ is zero implying that the total angular momentum of system is constant.

i.e. $L = a$ constant (isolated system)

[3] The conservation of angular momentum of a system of bodies requires that the the sum of torque due to all forces be equal to zero. Now consider a situation where the forces are such that the sum of torques of external forces is zero w.r.t. some axes K. Since the value of torque depends of the choices of axes, the sum of torques due to all internal forces will depend on the choice of axes and in general it will be non zero. Therefore, for a system of several bodies, for a given choice of axes K, there will be situations when the total angular momentum may not be conserved.

[4] In the motion of earth around sun, the angular momentum of the earth about an axis passing through the sun and perpendicular to the plane of motion of earth is conserved.

[5] Only the z component of the angular momentum of a conical pendulum is conserved w.r.t. the origin fixed at the point of suspension. SetId=594

[6] In the example of skew rod the angular velocity does not change even though the torque applied is nonzero. However there is no contradiction as in this case the law of conservation of momentum is not applicable. conservation is violated.

[7] If a bullet hits a wooden board and gets embedded in the board, both total energy and the total momentum of the bullet and the board are not conserved.

[8] In order to apply the law of conservation of momentum we must first identify the system. If there is no *external forces* acting on the system then conservation laws of momentum always holds. And depending on the nature of the system and of the forces, the total kinetic energy and the total angular momentum may not be conserved.

[9] A non conservative force is one where the mechanical energy is not conserved.Here the work done is dependent on the path taken .Different amounts of work need to

be done in different paths.Here potential energy would have no meaning as it would keep changing with the path.Here some amount of mechanical energy is lost as sound energy or heat energy and hence is not conserved.

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[10] A uniform motion is defined to be the one in which a body covers equal distances in equal time intervals.

[11] Displacement is the shortest distance between initial and final points with direction specified.

[12] A particle is observed from two frames S_1 and S_2. The frame S_2 moves with respect to S_1 with an acceleration a. If F_1 and F_2 be the pseudoforces when seen from S_1 and S_2 respectively and if $F_1 = 0$ then we must have $F_2 \neq 0$

[13] when a ball is dropped from a height, it gains momentum down if we consider the ball as our system.This is because the force of gravity acts as an external force.

However, if we change our system and consider earth as a part of our system too, then the momentum remains conserved because the earth gains momentum up.

[14] A heavy body is attached from a spring and is held at point A and is such that the spring is not slack nor is it stretched. It is then released. It goes down upto a point B and then it rises upto point C and executes an oscillatory motion between B and C. During the motion from A to C is first positive (from A to B) and then it is negative from B to A and again remains negative from A to C.

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[15] Pseudo forces come into picture when Newton's laws of motion have to be applied to describe the motion of bodies in non-inertial frames. These forces have no real existence.

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[1] Distance is equal to the length of the path covered. Displacement is the shortest distance between initial and final points.

[2] When the net external torque acting on a body or a system of bodies is zero about a particular axis, then the angular momentum of each body is conserved about that axis.

[3] Example where law of conservation of angular momentum does not hold:
When there is external force like frictional force acting on a object when it is rotating we cannot use conservation of angular momentum as the friction force acting on the object produces an external torque.

[4] For the motion of earth around sun, the angular momentum of the earth about the center of mass of the sun + earth system and perpendicular to the plane of motion of earth is conserved.

[5] The z component of angular momentum of a conical pendulum is not conserved w.r.t. the origin fixed at the point of suspension; but the x and y components are conserved. SetId=595

[6] Example where law of conservation of angular momentum does not hold:If a particle undergoes conical motion and the only force acting on particle is central force like tension of the string.Then total external torque about fixed point A is zero,yet angular momentum is not conserved,as angular momentum keeps on changing direction.

[7] There are certain situations where it appears that the law of conservation of linear momentum does not hold. For example if we take some amount of a substance like construction putty, cement, cake batter, playing dough,etc and drop it on the ground, it does not bounce back like a rubber ball would and hence the momentum it had before striking the ground seems to have been lost. Hence it appears that the law of conservation of linear momentum does not hold.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then check if the laws is applicable or not.

So if there is no *net external force* acting on the system all the three conservation laws will hold.

[9] The force whose work depends on path taken is called a non conservative force.friction for example does less work on a book dragged across a table if the book is dragged straight across than if the book is dragged in a curved path.

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[10] A particle moves on a circular path. Then its speed, direction of force, velocity and acceleration must always change with time.

[11] Displacements, being vector quantity can not compared with, a scalar quantity such as distance.

[12] If K is an inertial frame, any frame that moves w.r.t. the frame K with uniform velocity is also an inertial frame.

[13] There is no known exception to the law of conservation of momentum in classical mechanics however when two bodies collide and their mass converts to energy, an exception in nuclear physics is observed. In real life this is observed in nuclear reactions at atomic level.

[14] The kinetic energy of a body does not change if any one of the following is true
(i)force is always perpendicular to the velocity
(ii) the force is always perpendicular to the acceleration
(iii) the object remains stationary
(iv) the object moves in such a way that the point of application of the force remains fixed. SetId=595

[15] In a non-inertial frame of reference the accelration of the body that we measure, is not the true acceleration, as the frame itself accelerates.Thus,force(F=ma) is also not the true force acting on the body.The extra force added to make it a true value is called pseudo force.Thus pseudo force does not really act on a body but just compensates the change produced by the non inertial frame, in true acceleration.

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[1] Distance is a scalar quantity where as the displacement is a vector quantity.

[2] The law of conservation of angular momentum states that in absence of an external torque on an object or a closed system of objects the total angular momentum of the system remains constant. Thus if $\vec{\tau} = 0 => \vec{L} =$ constant where τ is the torque and $\vec{L}$ is the angular momentum of the system.

[3] A bob attached to a ceiling by a string moving in a horizontal circular plane is an example where the total angular momentum of the bob about the point of suspension is not conserved. This is because the the torque due to the weight of the bob about the point of suspension does not vanish and has non zero horizontal component. Only the vertical component of the angular component is conserved.

[4] In the Sun Earth system the angular momentum of the Earth about the pole star is conserved

[5] Only the z component of angular momentum of a conical pendulum is conserved w.r.t. the origin fixed at the point of suspension. SetId=596

[6] A nonzero torque always causes the angular velocity to change, because a change in angular momentum means a change in angular velocity $L = I\omega$

[7] A tennis ball is dropped from height h and after hitting the ground and it bounces back and rises to the same height. In this case the momentum of the ball is conserved because (under ideal conditions) the momentum after it hits the ground will be equal to the momentum it had before hitting the ground.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then check we should if the laws are applicable or not.

So if there is no *external force* acting on the system all the three quantities, total momentum is conserved. The total angular momentum is also because the torque of internal forces will be zero. The conservation of energy depends on the nature of forces. will be conserved.

[9] ** Nonconservative force is a force in which the amount of work done by the force is dependent of the path taken to change a state of a system.

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[10] A particle moves on a circular path. Then its speed, direction offorce, can remain constant by velocity and acceleration must always change with time.

[11] Distance depends on the path where as the displacement depends on the end point only

[12] If K is an inertial frame, any frame that moves w.r.t. the frame K with uniform speed is also an inertial frame.

[13] When there is no external forces act on a system of many particles, and there are only internal forces acting on the particles. The third law gives that the internal forces are pairwise equal and opposite.Thus the sum of internal forces is zero and the momentum of each particle is conserved.

[14] The total work done on a particle is always equal to the change in kinetic energy. $\boxed{\text{SetId=596}}$

[15] A force is any interaction which tends to change the motion of an object. It is *equal to* the rate of change of momentum by Newton's second law.

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[1] The speed is rate of change of distance and the velocity is the rate of change of displacement.

[2] If no net external torque acts on a system, the total angular momentum of the system remains constant.

[3] Law of conservation of angular momentum holds in case of long jump. When a athlete takes off from the ground in a running long jump, the forces on the launching foot give the athlete an angular momentum with a forward rotation around a horizontal axis. Such rotation would not allow the jumper to land properly. In the landing, the legs should be together and extended forward at an angle so that the heels mark the sand at the greatest distance. Once airborne, the angular momentum cannot change (it is conserved) because no external torque acts to change it. However, the jumper can shift most of the angular momentum to the arms by rotating them in windmill fashion. Then the body remains upright in the proper orientation of landing.

[4] For the motion of earth around sun, the angular momentum of the sun about the center of mass of the sun + earth system and perpendicular to the orbital plane of earth is conserved.

For the motion of earth around sun, the angular momentum of the sun about and axis passing through the Earth and perpendicular to the orbital plane of motion of earth is conserved.

[5] The projection of angular momentum of a conical pendulum in the horizontal plane is a constant of motion when the origin is chosen to be at fixed at the point of suspension. SetId=597

[6] A nonzero torque always implies change in angular momentum and may not give rise to a change in magnitude of angular velocity. A non zero torque may mean change only the direction of the angular momentum and not the angular velocity.

[7] Law of conservation of momentum does not hold when Newton's laws are not valid, e.g. in a non-inertial frame of reference. For example, when we consider collision between two bodies in a non-inertial frame of reference, the law of conservation of momentum cannot be applied because there will be a pseudo force acting on the frame itself.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *net external force* acting on the system, the momentum is conserved. The definition of angular momentum and torque depends on the choice of axes, and

therefore it may not be be conserved. The conservation of total energy holds only for conservative forces.

When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *net external force* acting on the system, the energy and momentum will be conserved. However, the total angular momentum may not be conserved because the torque may not be zero.

[9] Nonconservative force is any force where the work done by the force on the object depends on the path of motion of the object.the work done by the frictional force results in to loss of the energy of the system in the form of heat or other form of energy.

SetId=597

[10] A particle moves on a circular path. Then under suitable conditions its speed may remain constant, but the force, velocity and acceleration must always change with time.

[11] Distance equal to zero $\Rightarrow$ displacement=0; but Displacement=0

[12] A frame rotating w.r.t K with uniform angular velocity is also an inertial frame.

[13] During collision of billiard balls momentum is conserved. During explosion of a bomb also momentum is conserved and the total momentum of the fragments of bomb will be zero. This is because all the forces are only internal forces.

[14] A particle is acted upon by a force of constant magnitude which is always perpendicular to the velocity of the particle and the motion of the particle takes place in a plane, Then its kinetic energy, speed, velocity acceleration will not change. SetId=597

[15] Newton's laws are not valid on non-inertial frame of reference. So to validate Newton's laws of motion pseudo force (fictious or virtual force) is introduced.
Pseudo force acts in non-inertial frame. Its magnitude is always mass of the body multiplied by acceleration of the frame. It is always in direction opposite to the acceleration of the frame of reference. The resultant of pseudo forces and real forces is always zero.

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[1] For any type of translational motion of a body, the displacement cannot be zero, where as the distance travelled can be zero.

[2] The law of conservation of angular momentum states that when no external torque is applied on an object or a closed system of objects about an axis, the angular momentum about that axis remains constant.

[3] The total angular momentum of a body remains constant of motion when the net torque of the external forces acting on the body is zero.
In general, we have a system of particles such that the net torque of the external forces on the system, w.r.t. some axes K, is zero, the total angular momentum may not remain conserved, because the torque due to the internal forces may not be zero.

[4] For the motion of earth around sun, the sum of angular momenta of the Sun and the Earth about the center of mass of the sun + earth system is conserved.

[5] The law of angular momentum of a is not applicable for the conical pendulum conserved w.r.t. the origin fixed at the point of suspension. SetId=598

[6] In the example of a rotating skew rod the torque due to the external gravitational forces is zero , but the angular momentum is not constant Therefore the law of conservation of angular momentum is violated.

[7] If I throw a ball upward, it's speed decreases as it rises upwards. There is an external force (gravity) acting on the ball, so the momentum conservation law does not apply. Momentum of the ball is not conserved, however the momentum of the Earth-ball system is conserved as gravity will become an internal force in this case.

[8] In order to apply the law of conservation of momentum we must first identify the system. If there is no *net external forces* acting on the system then conservation laws of momentum always holds. The total energy and the total angular momentum may not be conserved.

[9] nonconservative force is any force ,where the work done by the force depends on the path of motion of the body.The work done by such a force is equal to the change in mechanical energy of the system.Energy mostly observed to be lost in form of heat,
SetId=598
by the action of non conservative force.

[10] A particle moves on a circular path. Then under suitable conditions its speed and acceleration may remain constant, but the force, and velocity must always change with time.

[11] If P and Q are the initial and the final points of a path of a particle, displacement is a vector whose direction is along PQ and has magnitude is equal to the length of line PQ

[12] The Newton's Laws of motion will hold in all frames which are at rest w.r.t. K but do not remain valid in a frame that move with respect to K.

[13] Give an example where law of conservation of momentum holds: A mass exploding into several pieces in a conservative field like gravitational field(if air resistance is neglected), obeys law of conservation of momentum. If air resistance cannot be neglected then the law of conservation of momentum will not hold.

[14] The kinetic energy of a particle is continuously increasing with time, then the angle bewteen the net force and the velocity cannot be greater than or equal to 90° at any time. SetId=598

[15] These forces are non-real forces but must be taken into account while applying Newton's Law's of Motion in accelerating frame of reference as compared to an inertial frame of reference.

The centrifugal and centripetal forces are examples of pesudo-forces.

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[1] Displacements, being vector quantity can not compared with, a scalar quantity such as distance.

[2] The angular momentum of a given system of bodies shall remain conserved unless acted upon by an external unbalanced torque.

[3] An example where law of conservation of angular momentum holds:
The Law of conservation of angular momentum holds in the case of a ballet dancer performing a pirouette.

When the dancer extends her arms outward, the angular velocity of her rotation decreases whereas when she keeps her arms close to her body, the angular velocity increases. This is because her moment of inertia changes as she moves her arms outward and inward. It can be noted that she as a system has no external torque acting upon her.

[4] For the motion of the Earth around the sun, the total of angular momenta of the Earth and the Sun, about in a reference frame fixed in the pole star, is conserved.

[5] The law of angular momentum of a is not applicable for the conical pendulum conserved when the origin is chosen to be at the pendulum bob itself. SetId=599

[6] In the example of skew rod, the angular momentum changes with time and there is a non zero torque coming from action of forces other than gravitational forces. Hence the law of conservation of angular momentum dos not apply.

[7] A soldier accelerating away, after detonating a bomb, will find that the total momentum of the fragments of the bomb is zero. This is an example where the law of conservation of momentum holds as the forces on the fragments are internal forces only and sum of all such forces is zero.

[8] In order to apply the law of conservation of momentum we must first identify the system. Then even if there is no *net external forces* acting on the system, all the three conservation laws of momentum, angular momentum and energy may not hold due to presence of internal forces.

[9] The work done by a "non-conservative" force does depend on the path taken. Non-conservative forces cannot be associated with a potential energy. If some of the internal forces of a system are non-conservative, the mechanical energy of the system is not constant.Work-energy theorem is valid even in the presence of some non-conservative forces.

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[10] When the force is kept constant as function of time, it is possible for a particle to move on a circular path in such a way that its speed remains constant, but the velocity and acceleration must always change with time.

[11] If P and Q are the initial and the final points of a path of a particle,the displacement is the vector $\overrightarrow{PQ}$.

[12] Staying inside a bullet train moving with constant velocity (no jerks etc) an experiment can always be performed which will tell us the numerical velocity of the bullet train

[13] Also a good example of law of conservation momentum can be seen when a bullet from a rifle is fired.As the bullet is fired and gets out of the rifle, the rifle gives a backward jerk due to the phenomenon of conservation of momentum.

[14] A heavy body is attached from a spring and is held at point A and is such that the spring is not slack nor is it stretched. It is then released. It goes down upto a point B and then it rises upto point C and executes an oscillatory motion between B and C. During the motion from A to C is first positive (from A to B) and then it is negative from B to A and again remains negative from A to C. SetId=599

[15] When observing our system from a reference frame which is accelerating compared to an inertial frame,in order to make it easier to apply newtons laws, we can apply a pseudo force on all objects in the universe proportional to their mass capable of causing an acceleration equal and opposite to that of our reference frame. Hence serving to in a way "stop"(or make inertial) our reference frame, and making it easier for us to investigate the motion.

This application of pseudo force doesn't change the motion of the object because just as we can choose an arbitrary reference frame, we can choose an arbitrary force to cause the same acceleration in every object in the whole universe without changing the relative motions of objects. (as all motion is truly relative, we will still get correct answers for our investigations.

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[1] Distance depends on the path where as the displacement depends on the end point only.

[2] When the net external torque acting on a system about a given axis is zero, the total angular momentum of the system about that axis remains consant.

[3] In case of a skater, who can be considered an isolated system, so no torue will be acting on him/her. When the arms are extended, the moment of inertia is more. When his hands are closely held, the moment of inertia is lesser. Since the angular momentum is same, the angular acceleration changes accordingly.

[4] For the motion of the Earth around the sun, the total of angular momenta of the Earth and the Sun, is conserved in every inertial frame of reference; but the angular momentum of the Earth (or of the sun)is not conserved in every inertial frame.

[5] The three components of angular momentum of a conical pendulum is conserved w.r.t. the origin at the position of the center of mass of the pendulum. SetId=600

[6] In the example of conical pendulum, the z- component of angular momentum does not change. This follows from the angular momentum conservation as there is no external torque.

[7] There is no known exception to the law of conservation of momentum in classical mechanics However, an exception to conservation of energy in nuclear physics is observed. In nuclear reactions when two nuclei collide and their mass converts to energy and energy momentum are not conserved.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then check we should if the laws are applicable or not.

So if there is no *external force* acting on the system all the three quantities, total momentum, total angular momentum, and total kinetic energy will be conserved independent of the nature of forces.

[9] Non conservative forces are forces with the property that the work done by the force in moving a particle between two points is dependent on the path taken.Also the work done over a closed loop is not zero.Defining of scalar potential is not possible in case of non conservative forces because the change in potential energy between
SetId=600
two points will depend on path taken.

[10] It is not possible for a particle to move on a circular path in such a way that its speed and force remains constant, and only the velocity and acceleration may (or may not) always change with time.

[11] If two bodies starting from a point A reach a point B, following different paths, their displacement will be, in general different, but the distances covered will always be the same.

[12] Staying inside a bullet train moving with constant velocity (no jerks etc) an experiment can always be performed which will tell us the numerical value of the acceleration of the bullet train

[13] when a man walks on the ice slab where friction does not exist between the ice block and the floor but between the feet of the man and the slab the slab moves back as per the law of conservation of momentum

[14] The kinetic energy of a body does not change if any one of the following is true
(i)force is always perpendicular to the velocity
(ii) the force is always perpendicular to the acceleration
(iii) the object remains stationary
(iv) the object moves in such a way that the point of application of the force remains fixed. SetId=600

[15] Various types of forces in nature can be grouped in four categories:
(a)Gravitational; (b)Electromagnetic; (c)Nuclear; (d)Weak
There are also some non-fundamental forces such as:
(i)Normal reaction on bodies in contact with surfaces , (ii) Friction,(iii) Tension,(iv)Elastic force.

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[1] Distance equal to zero implies displacement=0; and Displacement=0 also implies distance = 0

[2] This law sates that when no net torque of all forces acts on a object or a system of objects then total angular momentum of system is conserved.The angular momentum before an event is equal to angular momentum after that event.mathematically explained by when, net torque=0 ;then, total angular momentum(L)=constant.

[3] Example where law of conservation of angular momentum holds:
Let us assume a student seated on a stool that can rotate freely about a vertical axis. The student has been set into rotation at a modest initial angular speed ω . He holds two dumbbells in his outstretched hands. His angular momentum vector L lies along the vertical rotation axis, pointing upwards. Now he pulls in his arms;this action reduces his rotational inertia from its value I_{initial} to a final value I_{final} because he moves the mass closer to the rotational axis. His rate of rotation increases markedly, from ω_{initial} to ω_{final}. The student can then slow down by extending his arms once more,moving the dumbbells outward. No external torque acts on the system consisting of the student, stool and the dumbbells. Thus the angular momentum of the system about the rotational axis remains constant. $I_{\text{initial}} * \omega_{\text{initial}} = I_{\text{final}} * \omega_{\text{final}}$.

[4] In the Sun Earth system the angular momentum of the Earth is conserved in every frame of reference

[5] Only the z component of the angular momentum of a conical pendulum is conserved w.r.t. the origin fixed at the point of suspension. SetId=601

[6] In the example of conical pendulum, the x and$y$ components of angular momentum change. This follows from the angular momentum conservation as the z components external torque is zero and horizontal components of torque are non zero.

[7] In a system of a canon and a canon ball, total momentum of the system is zero before canon ball is fired. After firing the canon ball, the momentum of the system seems to be conserved as the ball moves forward and the canon moves backward.

[8] If we want to apply the conservation laws of momentum, energy and angular momentum, we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *external force* acting on the system, the momentum and angular momentum will be conserved, and depending on the nature of the forces but total energy may or may not be conserved.

[9] A non conservative force is the force with the property that the work done in moving a particle between two points is dependent of the path taken.If a particle travels in a closed path, the net work done(the some of the forces acting along the path multiplied by the distance travelled) by a non conservative force is non zero. When an object moves from one location to another, the force changes the potential energy of the object by an amount that depends on the path taken.Non conservative force depends only on the path followed by the object.

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[10] For a particle moving on circle the acceleration is always constant in magnitude and directed towards the centre of the circle.

[11] Distance is equal to the length of the path covered. Displacement is the shortest distance between initial and final points.

[12] Assume bullet train, moving with out any jerks, is going on a circular arc of radius R with constant speed. Then an experiment is to be performed entirely within the train without any measurement on objects outside the train. Such an experiment can tell only radius of the track.

[13] When a freely falling rigid body collides another body in its path momentum the system of two particles is not conserved in the collision as there is external force mg acting on the system.

[14] The total work done on a particle is always equal to the change in kinetic energy.

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[15] A force is agency that which changes or tends to change the state of rest or motion of a body.

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[1] If P and Q are the initial and the final points of a path of a particle, displacement is a vector whose direction is along PQ and has magnitude is equal to the length of line PQ

[2] Statement of Law of Conservation of Angular Momentum:

Differentiating $\vec{L} = \vec{r} \times \vec{p}$ w.r.t, time,

$$\begin{aligned} \frac{dL}{dt} &= \frac{d\vec{r} \times \vec{p}}{dt} = \frac{d\vec{r}}{dt} \times \vec{p} + \vec{r} \times \frac{d\vec{p}}{dt} = \vec{v} \times (m\vec{v}) + \vec{r} \times \vec{F} \\ &= \vec{r} \times \vec{F} (\because v \times v = 0) \\ &= \vec{\tau} \end{aligned}$$

here $\vec{\tau}$ represents the net torque acting on a rigid body rotating about a fixed axis.This torque must take into account of all the forces, be it external or internal forces

[3] A bob is attached to ceiling by a string and moves in a horizontal circular plane is an example. In this case the law of conservation of angular momentum does not hold.

[4] In the motion of earth around sun, the angular momentum of the earth about an axis passing through the sun and perpendicular to the plane of motion of earth is conserved.

[5] The z component of angular momentum of a conical pendulum is not conserved w.r.t. the origin fixed at the point of suspension; but the x and y components are conserved. SetId=602

[6] Example where law of conservation of angular momentum does not hold: A disc rotating on a horizontal rough surface will not have a constant angular momentum because there will be a constant torque by frictional force. Hence, its angular momentum will decrease, and the law of conservation of angular momentum does not apply.

[7] When applying the conservation laws of momentum, energy and angular momentum we must define the system first.Only then check if the laws is applicable or not.

As an example: when a ball is dropped from a height, it gains momentum down if we consider the ball as our system.This is because the force of gravity acts as an external force.

However, if we change our system and consider earth as a part of our system too, then the momentum remains conserved because the earth gains momentum up.

[8] To apply the conservation laws of momentum, energy and angular momentum, we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *external force* acting on the system, the energy and momentum will be conserved. However, depending on the nature of the system and of the forces, the total angular momentum may not be conserved.

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[9] In this type of force the work done depends on the path taken by the body.Mechanical energy is not conserved in the system if non conservative force acts on it.

[10] The motion of a bomb dropped from a plane does is not a uniform motion as it follows a parabolic path and not a straight line path.

[11] Distance is a scalar quantity where as the displacement is a vector quantity.

[12] Assume bullet train, moving with out any jerks, is going on a circular arc of radius R with constant speed. Then an experiment is to be performed entirely within the train without any measurement on objects outside the train. Such an experiment can tell both speed of the train and radius of the track.

[13] If we take some amount of a substance like construction putty, cement, cake batter, playing dough,etc and drop it on the ground, it does not bounce back, like a rubber ball would bounce, and hence the momentum it had before striking the ground seems to have been lost. Hence it appears that the law of conservation of linear momentum does not hold.

[14] A particle is acted upon by a force of constant magnitude which is always perpendicular to the velocity of the particle and the motion of the particle takes place in a plane, Then its kinetic energy, speed, velocity acceleration will not change. SetId=602

[15] The forces may be of the following two types - *Contact forces* (those that act when bodies are in physical contact) eg. friction, normal reaction, bouyancy etc. and*Action-at-a-distance forces* (those that act when bodies are not in contact) eg. Gravity, electostatic forces, magnetic forces etc. There At the root level, forces are of the following fundamental types :- (a) *Gravitational forces* - weakest of all forces, always attractive
(b) *Electromagnetic forces* - stronger than gravitational forces, can be attractive or repulsive,
(c) *Nuclear forces* - exist at atomic level, have very short range,
(d) *Weak nuclear forces* associated with beta particle emission

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SetId=603

[1] If P and Q are the initial and the final points of a path of a particle,the displacement is the vector $\overrightarrow{PQ}$.

[2] Statement of Law of Conservation of Angular Momentum: For a system of many particles The net torque due all the forces, be it external or internal forces. But as the torque due to all the internal forces cancel out, it sufficient to consider the external forces acting on the system.

[3] Consider a disc rotating about an axis perpendicular to its plane. On placing a smaller disc with its surface parallel to the surface of the rotating disc, the angular momentum of the system of two discs remains constant as there is no external torque.

[4] For the motion of earth around sun, the angular momentum of the earth about the center of mass of the sun + earth system and perpendicular to the plane of motion of earth is conserved.

[5] Only the z component of angular momentum of a conical pendulum is conserved w.r.t. the origin fixed at the point of suspension.

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[6] Example where law of conservation of angular momentum does not hold:Consider a vertical stick on the ground falling to a horizontal position. During the fall, the conservation of angular momentum applied at the point of rotation on the ground and perpendicular to the plane of the stick is not applicable as, the gravitational force which acts vertically downwards assumed at the centre of mass produces an external torque about the axis of rotation

[7] Statement: Law of Conservation of energy states that "ENERGY CAN NEITHER BE CREATED NOR DESTROYED",but it can be changed from one form to other.

EXPLANATION: Statement implies that the total amount of energy in an isolated system remains constant although it may change forms. viz, kinetic energy may change to potential;chemical to electrical energies etc.

[8] In order to apply the law of conservation of momentum we must first identify the system. If there is no *external forces* acting on the system then conservation laws of momentum always holds. And depending on the nature of the system and of the forces, the total kinetic energy and the total angular momentum may not be conserved.

[9] A force is said to be a non-conservative force if the work done by the force in a closed path is non-zero;(i.e) the cyclic integral of the work done is non-zero.

Work done by a non-conservative force is equal to change in total energy of the system.Work-Energy theorem is not applicable in the case of a non-conservative

force.Work done by conservative force depends on the path.It differs with the paths taken by the partical even if the initial and final points are same.In case of non-conservative forces,the total mechanical energy is not constant as the energy is dissipated in various forms such as heat energy,sound energy,etc and cannot be recovered.

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[10] A wagon sliding on a roller coaster designed in such a way that the wagon covers equal distances in equal times. As the motion of the wagon is uniform, there will be no net force acting on it.

[11] Both displacement and distance tell us about the motion of a body but their study does not tell much about the forces on the body

[12] Assume bullet train, moving with out any jerks, is going on a circular arc of radius R with constant speed. Then an experiment is to be performed entirely within the train without any measurement on objects outside the train. Such an experiment can tell only speed of the track.

[13] When we consider collision between two bodies in a non-inertial frame of reference, the law of conservation of momentum cannot be applied because there will be a pseudo force acting on the frame itself.

[14] The kinetic energy of a particle is continuously increasing with time, then the angle bewteen the net force and the velocity cannot be greater than or equal to 90^{o} at any time.

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[15] The main differences between force and pseudo force are -
(1) Forces have a real presence while pseudo forces don't.
(2) Forces can be accounted for by Newton's laws.
(3) Pseudo forces are only taken into account when the reference frame is accelerated.

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[1] If two bodies starting from a point A reach a point B, following different paths, their displacement will be, in general different, but the distances covered will always be the same.

[2] Depending on the torques acting on a system, the angular momentum can be conserved only in one or two directions, but may not be conserved in all. For instance, if an isolated body has no torque acting on it only in the direction along the Z axis, then the angular momentum is conserved only in that direction.

[3] Consider a man standing on a spinning platform. Initially, the man spreads out his arms and he spins with a certain angular velocity. The next moment, he pulls his arms inwards keeping them close to his body. We will observe that the angular velocity with which he is spinning now increases. This phenomenon can be explained by the Law Of Conservation of Angular momentum. Initially, since his arms were spread wide, his moment of inertia was large. However, when he pulled them close to his body, his moment of inertia decreased.
In this example the angular velocity of the man increases and therefore the angular momentum also increases.The law of conservation of angular momentum does not apply because the torque of muscular forces is not zero.

[4] In the Sun Earth system the angular momentum of the Earth about the pole star is conserved

[5] The projection of angular momentum of a conical pendulum in the horizontal plane is a constant of motion when the origin is chosen to be at fixed at the point of suspension. SetId=604

[6] We have a conical pendulum .The forces acting on the bob are tension (along the direction of the string) and gravitational force acting in the vertically downward direction.we have an additional force called the drag force which is tangential to the motion of the bob and acts in the direction opposite to the motion of the bob.The axis of rotation passes through the hinge point and is vertical.The torque due to tension is 0 because the force passes through the axis of rotation.The torque due to mg is also zero since it is parallel to the axis of rotation.but the torque due to drag force is not zero.since the net external torque acting on the bob is not zero,therefore the law of conservation of angular momentum does not hold here

[7] Oscillating simple pendulum is a very good example where potential energy gets converted to kinetic energy and kinetic to potential energy. Some energy gets dissipated as heat if we consider air resistance. Energy as a whole is conserved if we consider universe as system, the energy has just changed its form.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then check if the laws is applicable or not.

So if there is no *net external force* acting on the system all the three conservation laws will hold.

[9] A non conservative force is a force where work done in moving a particle between two points depends on the path through which it is taken.Friction is an example of non conservative force.Mechanical energy is not conserved in case of a non conservative force

SetId=604

[10] A simple pendulum moves along a circular arc and does not have constant speed and therefore its motion is not uniform.

[11] Displacement is the shortest distance between initial and final points with direction specified.

[12] A particle is observed from two frames S_1 and S_2. The frame S_2 moves with respect to S_1 with an acceleration a. If F_1 and F_2 be the pseudoforces when seen from S_1 and S_2 respectively it is not possible to have $F_1 = F_2 = 0$

[13] When a system is acted upon by external forces like friction etc, the conservation principle does not hold good,there will be impulse imparted and so we cant conserve momentum. This is case when a collision between two elastic balls take place on a rough horizontal table. The total momentum just after the collision will be different from the total momentum just before the collision. Here momentum is not conserved as there is external force friction is present.

[14] A heavy body is attached from a spring and is held at point A and is such that the spring is not slack nor is it stretched. It is then released. It goes down upto a point B and then it rises upto point C and executes an oscillatory motion between B and C. During the motion from A to C is first positive (from A to B) and then it is negative from B to A and again remains negative from A to C. SetId=604

[15] A force is any interaction which tends to change the motion of an object. It is also *defined* as rate of change of momentum. It is a vector quantity.

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[1] Displacement is equal to the vector difference $\vec{r}_f - \vec{r}_i$ of the position vectors of initial and final points. The distance covered will be $|\vec{r}_f - \vec{r}_i|$

[2] According to Law of Conservation of Angular momentum,if no external torque acts on an object or system of objects,angular momentum of an object or system of objects remains CONSTANT or no change in angular momentum can occur.

Also it states that,only external torque can change angular momentm of the system where as the torque produced by internal forces can not change the angular momentum of the system

[3] In the Sun-Earth system, angular momentum of the earth is not conserved but the total angular momentum of the sun and the earth is constant of motion.

[4] For the motion of earth around sun, the angular momentum of the sun about the center of mass of the sun + earth system and perpendicular to the orbital plane of earth is conserved.

For the motion of earth around sun, the angular momentum of the sun about and axis passing through the Earth and perpendicular to the orbital plane of motion of earth is conserved.

[5] The law of angular momentum of a is not applicable for the conical pendulum conserved w.r.t. the origin fixed at the point of suspension. SetId=605

[6] When you release a toy gyroscope on its pedestal, it initially has no precessional rotation around that pedestal, i.e, the orientation of rotation is fixed. However, it instantaneously starts precessing around the pedestal. Both Kinetic Energy and Angular Momentum now exist where they did not exist a moment earlier. The Kinetic Energy is easy to explain, as appearing due to the body of the gyroscope dropping a tiny fraction of a millimeter in the Earth's gravitational field, giving up exactly the correct amount of Potential Energy. But the Angular Momentum of the Precession which just appeared, does not come from anywhere. This is therefore a Violation of the Conservation of Angular Momentum.

[7] Law of conservation of momentum does not hold whenever an external force or impulse acts on the system. For example,when a body collides with earth then it bounces back to a lesser height as it loses some velocity.

In this example the momentum of a ball is not conserved due to impulsive force by ground in the normal direction.

However, strictly speaking the system that should be considered here is the ball-earth system and the total momentum is conserved.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then check we should if the laws are applicable or not.

So if there is no *external force* acting on the system all the three quantities, total momentum is conserved. The total angular momentum is also because the torque of internal forces will be zero. The conservation of energy depends on the nature of forces. will be conserved.

SetId=605

[9] A force:A force is said to be a *non-//**conservative force* if the*/ work done by it in a closed path is/*/ non-zero./For such forces,potential energy cannot be defined.

[10] A satellite goes around the earth in a circular orbit of 600km with a time period of $5.8 \times 10^3 s$. Its motion will be uniform as it will cover equal distances in equal times.

[11] Displacements, being vector quantity can not compared with, a scalar quantity such as distance.

[12] A particle is observed from two frames S_1 and S_2. The frame S_2 moves with respect to S_1 with an acceleration a. If F_1 and F_2 be the pseudoforces when seen from S_1 and S_2 respectively and if $F_1 = 0$ then we must have $F_2 \neq 0$

[13] When we are in accelerating frame if we observe any collision between two bodies then the law of conservation of momentum does not hold in that frame of reference. On the other hand the law of conservation of momentum holds in all inertial frames.

[14] The kinetic energy of a body does not change if any one of the following is true
(i)force is always perpendicular to the velocity
(ii) the force is always perpendicular to the acceleration
(iii) the object remains stationary
(iv) the object moves in such a way that the point of application of the force remains fixed. SetId=605

[15] Explain Pseudo Force: While applying Newton's laws of motion in non-inertial frame of reference it gives answers which contradict observations. Thus, to account for this,using Newton's Laws, we introduce a "fake" or pseudo force which gives answers that match the observations in a non-inertial frame.

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SetId=606

[1] Distance is equal to the length of the path covered. Displacement is the shortest distance between initial and final points.

[2] The law of conservation of angular momentum states that when the net external torque acting on the system is zero, then the angular momentum of the system remains constant.both the initial and final momentum should be taken from a fixed inertial frame of reference provided.

[3] Consider a disc and a man system. man is standing on center of the disc rotating with angular velocity.initially man folded his hand.when man stretches his hands then momentum of inertia of system increases.and angular velocity decreases.and total angular momentum remains constant.

[4] For the motion of earth around sun, the sum of angular momenta of the Sun and the Earth about the center of mass of the sun + earth system is conserved.

[5] The law of angular momentum of a is not applicable for the conical pendulum conserved when the origin is chosen to be at the pendulum bob itself. SetId=606

[6] There is no case where LAW OF CONSERVATION OF ANGULAR MOMENTUM does'nt hold.But there are cases where conservation of angular momentum does not hold.A body in vertical circular motion is an example where angular momentum is not conserved. Here the law of conservation does not apply.

[7] If a bullet hits a wooden board and gets embedded in the board, the total energy and the total momentum of the bullet and the board are conserved.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *net external force* acting on the system, the momentum is conserved. The definition of angular momentum and torque depends on the choice of axes, and therefore it may not be be conserved. The conservation of total energy holds only for conservative forces.

When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *net external force* acting on the system, the energy and momentum will be conserved. However, the total angular momentum may not be conserved because the torque may not be zero.

[9] A force that is not conservative is nonconservative force. The work done by a noconservative force cannot be represented by a potential energy function. That is work done by a nonconservative force is dependent on the path through which the system is moved. Some nonconservative forces cause the mechanical energy to be lost or dissipiated. Such forces are called dissipiative forces. There is no way to get back the lost mechanical energy. Nonconservative forces can also increase the mechanical energy. This is arrived from the concept of irreversible process.

SetId=606

[10] A uniform motion is defined to be the one in which a body covers equal distances in equal time intervals.

[11] Distance depends on the path where as the displacement depends on the end point only

[12] If K is an inertial frame, any frame that moves w.r.t. the frame K with uniform velocity is also an inertial frame.

[13] When a freely falling body hits another rigid body in its path then momentum is not conserved as external force mg acts on both the bodies. The total momentum after the collision will be different from the total momentum before the hit.

[14] The total work done on a particle is always equal to the change in kinetic energy. SetId=606

[15] When a train is at rest and a ball is hung from the ceiling with a string, an observer in the train sees that the string is vertical. But when the train starts moving, the observer sees that the string makes an angle with the vertical and is tilted in forward direction . This means that some force other than gravity and tension must act on the ball. That force is the pseudo force.

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SetId=607 [1] Distance is a scalar quantity where as the displacement is a vector quantity.

[2] The law of conservation of angular momentum states that The total angular momentum of a system is constant in both magnitude and direction if the resultant torque, of the external forces acting on the system, is zero.

[3] The conservation of angular momentum of a system of bodies requires that the the sum of torque due to all forces be equal to zero. Now consider a situation where the forces are such that the sum of torques of external forces is zero w.r.t. some axes K. Since the value of torque depends of the choices of axes, the sum of torques due to all internal forces will depend on the choice of axes and in general it will be non zero. Therefore, for a system of several bodies, for a given choice of axes K, there will be situations when the total angular momentum may not be conserved.

[4] For the motion of the Earth around the sun, the total of angular momenta of the Earth and the Sun, about in a reference frame fixed in the pole star, is conserved.

[5] The three components of angular momentum of a conical pendulum is conserved w.r.t. the origin at the position of the center of mass of the pendulum. SetId=607

[6] A sphere rolling on a rough surface.Due to friction there is external torque so the angular momentum changes which results in the slowing of the sphere. The angular momentum keeps changing. Even in case like this one, it is wrong to say that the Law of Angular Momentum Conservation does not hold.

[7] If a bullet hits a wooden board and gets embedded in the board, the total energy of the bullet and the board system is conserved but the total momentum is not conserved.

[8] In order to apply the law of conservation of momentum we must first identify the system. If there is no *net external forces* acting on the system then conservation laws of momentum always holds. The total energy and the total angular momentum may not be conserved.

[9] Nonconservative forces are forces, such that the work done by these forces are path dependent. Work done by these forces around a close path is not necessarily equal to zero. Hence if a particle is acted on by a non-conservative force and that particle returns to its original position, that particle will experience a net loss of energy. Energy will thus not be conserved for particle. Potential Energy can not be defined
SetId=607 for these type of forces.

[10] A particle moves on a circular path. Then its speed, direction of force, velocity and acceleration must always change with time.

[11] Distance equal to zero $\Rightarrow$ displacement=0; but Displacement=0

[12] If K is an inertial frame, any frame that moves w.r.t. the frame K with uniform speed is also an inertial frame.

[13] .The law of conservation of momentum does not hold good when net external forces acting on the system is not zero.when two bodies collide law of conservation of momentum is applicable on system of two bodies but on not individual bodies because external impulse acts on them.

[14] A particle is acted upon by a force of constant magnitude which is always perpendicular to the velocity of the particle and the motion of the particle takes place in a plane, Then its kinetic energy, speed, velocity acceleration will not change. SetId=607

[15] Since newton's laws are not valid in non-inertial frames, pseudoforces (which do not exist in reality) are used to help us formualate and use Newton's laws of motion in non-inertial frames.

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SetId=608

[1] The speed is rate of change of distance and the velocity is the rate of change of displacement.

[2] If the net external torque acting on a system is zero,the angular momentum L(vector) of the system remains constant,no matter what changes take place within the system.L(vector)=a constant (net external torque acting on system is zero)

[3] Example where law of conservation of angular momentum does not hold:
When there is external force like frictional force acting on a object when it is rotating we cannot use conservation of angular momentum as the friction force acting on the object produces an external torque.

[4] For the motion of the Earth around the sun, the total of angular momenta of the Earth and the Sun, is conserved in every inertial frame of reference; but the angular momentum of the Earth (or of the sun)is not conserved in every inertial frame.

[5] Only the z component of the angular momentum of a conical pendulum is conserved w.r.t. the origin fixed at the point of suspension. SetId=608

[6] Consider a rod of length l. Let us give an impulse to one end . Now the angular momentum about the oposite end is not zero since the impulse provides some torque . So the angular momentum is not conserved .

$$\text{torque} = \text{impulse} * \ell.$$

$d\ell/dt$ is not equal to zero and the law of conservation of angular momentum does not hold.

[7] If a bullet hits a wooden board and gets embedded in the board, both total energy and the total momentum of the bullet and the board are not conserved.

[8] In order to apply the law of conservation of momentum we must first identify the system. Then even if there is no *net external forces* acting on the system, all the three conservation laws of momentum, angular momentum and energy may not hold due to presence of internal forces.

[9] Non Conservative force is a force with the property that workdone in moving an object from one point to another is dependent on the path taken .

Non Conservative Force can arise in classical physics due to neglected degrees of freedom or time dependent potentials.

SetId=608

Friction may be treated without resorting the use of non conservative forces by considering the motion of individual molecules.

[10] A particle moves on a circular path. Then its speed, direction offorce, can remain constant by velocity and acceleration must always change with time.

[11] If P and Q are the initial and the final points of a path of a particle, displacement is a vector whose direction is along PQ and has magnitude is equal to the length of line PQ

[12] A frame rotating w.r.t K with uniform angular velocity is also an inertial frame.

[13] A block moving in the air breaks up into two parts and the parts separate, then the total momentum must be the same before and after the break.

[14] The kinetic energy of a particle is continuously increasing with time, then the angle bewteen the net force and the velocity cannot be greater than or equal to 90^{o} at any time. SetId=608

[15] Force is defined as the rate of change of linear momentum. In other words it is the agency which changes or tends to change the (a) State of rest; (b)State of uniform motion (c) Direction of body's motion; (d) Shape of the body

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SetId=609

[1] For any type of translational motion of a body, the displacement cannot be zero, where as the distance travelled can be zero.

[2] The Law of conservation of angular momentum states that when no external torque acts on an object or a closed system of objects undergoing motion about a given axis, the change in angular momentum is zero. Therefore, considering an event where only internal torque or no torque is involved, the total angular momentum of the system before the event is equal to the total angular momentum after the event

[3] A bob attached to a ceiling by a string moving in a horizontal circular plane is an example where the total angular momentum of the bob about the point of suspension is not conserved. This is because the the torque due to the weight of the bob about the point of suspension does not vanish and has non zero horizontal component. Only the vertical component of the angular component is conserved.

[4] In the Sun Earth system the angular momentum of the Earth is conserved in every frame of reference

[5] The z component of angular momentum of a conical pendulum is not conserved w.r.t. the origin fixed at the point of suspension; but the x and y components are conserved.

SetId=609

[6] Let us consider a rotating skew rod. In the absence of friction or any other drag force, the rod should continuously spin without stopping. Here the net torque about the axis of rotation is 0 and hence angular momentum is conserved. It therefore follows from law of conservation of angular momentum that a spinning skew rod will keep rotating with constant angular velocity if there is no external torque. So law of conservation of angular momentum does not hold.

[7] There are certain situations where it appears that the law of conservation of linear momentum does not hold. For example if we take some amount of a substance like construction putty, cement, cake batter, playing dough,etc and drop it on the ground, it does not bounce back like a rubber ball would and hence the momentum it had before striking the ground seems to have been lost. Hence it appears that the law of conservation of linear momentum does not hold.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then check we should if the laws are applicable or not.

So if there is no *external force* acting on the system all the three quantities, total momentum, total angular momentum, and total kinetic energy will be conserved independent of the nature of forces.

[9] A non-conservative force is a force with the property that the work done in moving a particle between two points is dependent of the path taken . Mostly the enery of the particle in a non conservative force field dissipates in the form of heat or sound . Since the lost energy cannot be bought back ,conservation of mechanical energy does not hold true .

SetId=609

[10] A particle moves on a circular path. Then under suitable conditions its speed may remain constant, but the force, velocity and acceleration must always change with time.

[11] If P and Q are the initial and the final points of a path of a particle,the displacement is the vector $\overrightarrow{PQ}$.

[12] The Newton's Laws of motion will hold in all frames which are at rest w.r.t. K but do not remain valid in a frame that move with respect to K.

[13] A ball hits the floor and rebounds after an inelastic collision. In this case the total momentum of the ball before and after the collsion is conserved. Also the total enrgy of the ball and the earth remains the same

[14] A heavy body is attached from a spring and is held at point A and is such that the spring is not slack nor is it stretched. It is then released. It goes down upto a point B and then it rises upto point C and executes an oscillatory motion between B and C. During the motion from A to C is first positive (from A to B) and then it is negative from B to A and again remains negative from A to C. SetId=609

[15] Real forces have their origin in matter such as electricity, gravitation etc., while pseudo forces are caused by inertial motion.

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SetId=610

[1] Displacements, being vector quantity can not compared with, a scalar quantity such as distance.

[2] The law of conservation of angular momentum states that when no external torque acts on an object or a closed system of objects, no change of angular momentum can occur. Hence, the angular momentum before an event involving only internal torques or no torques is equal to the angular momentum after the event . Angular momentum can be calculated with the help of the formula $L = I\omega$ where L stands for Angular momentum, I stands for moment of inertia and ω stands for angular velocity

[3] Law of conservation of angular momentum holds in case of long jump. When a athlete takes off from the ground in a running long jump, the forces on the launching foot give the athlete an angular momentum with a forward rotation around a horizontal axis. Such rotation would not allow the jumper to land properly. In the landing, the legs should be together and extended forward at an angle so that the heels mark the sand at the greatest distance. Once airborne, the angular momentum cannot change (it is conserved) because no external torque acts to change it. However, the jumper can shift most of the angular momentum to the arms by rotating them in windmill fashion. Then the body remains upright in the proper orientation of landing.

[4] In the motion of earth around sun, the angular momentum of the earth about an axis passing through the sun and perpendicular to the plane of motion of earth is conserved.

[5] Only the z component of angular momentum of a conical pendulum is conserved w.r.t. the origin fixed at the point of suspension. SetId=610

[6] In the example of skew rod the angular velocity does not change even though the torque applied is nonzero. However there is no contradiction as in this case the law of conservation of momentum is not applicable. conservation is violated.

[7] A tennis ball is dropped from height h and after hitting the ground and it bounces back and rises to the same height. In this case the momentum of the ball is conserved because (under ideal conditions) the momentum after it hits the ground will be equal to the momentum it had before hitting the ground.

[8] If we want to apply the conservation laws of momentum, energy and angular momentum, we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *external force* acting on the system, the momentum and angular momentum will be conserved, and depending on the nature of the forces but total energy may or may not be conserved.

[9] If the work done by a force depends on the path followed by the particle, it is called a Non conservative force. Work done by a non conservative force is not zero in round trip.

SetId=610

[10] A particle moves on a circular path. Then under suitable conditions its speed and acceleration may remain constant, but the force, and velocity must always change with time.

[11] If two bodies starting from a point A reach a point B, following different paths, their displacement will be, in general different, but the distances covered will always be the same.

[12] Staying inside a bullet train moving with constant velocity (no jerks etc) an experiment can always be performed which will tell us the numerical velocity of the bullet train

[13] In a head on elastic collision of two identical bodies of equal masses the velocities, the speeds, the momenta and the kinetic energy are all exchanged.

[14] The kinetic energy of a body does not change if any one of the following is true
(i)force is always perpendicular to the velocity
(ii) the force is always perpendicular to the acceleration
(iii) the object remains stationary
(iv) the object moves in such a way that the point of application of the force remains fixed.

SetId=610

[15] 1)When we start rolling a body on a rough ground, it stops rolling after certain period because of frictional force.
2)When we leave a body from a certain height, it falls due to the act of gravitational force.

1)When a body is rotating in a circular path due to the centrifugal force which is the pseudo force. 2) When the lift is accelerating upwards, the upwards force felt by passengers a pseudo force.

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SetId=611

[1] Distance depends on the path where as the displacement depends on the end point only.

[2] Newton's Second Law of Motion is defined by the expression $F = \frac{dp}{dT}$, where F gives the force vector acting on the system and p gives its momentum vector; in linear motion. A similar expression can be written to describe angular motion, i.e. : $\tau = \frac{dL}{dt}$, where τ is the external torque vector acting on the system, and L is the angular momentum.

If the external torque on the system is zero, then we get the expression as: dL/dt=0. This points out to the fact that, when no external torque is acting on the system, then its angular momentum is constant, no matter what changes occur in the system. This is the Law of Conservation Of Angular Momentum.

[3] The total angular momentum of a body remains constant of motion when the net torque of the external forces acting on the body is zero.
In general, we have a system of particles such that the net torque of the external forces on the system, w.r.t. some axes K, is zero, the total angular momentum may not remain conserved, because the torque due to the internal forces may not be zero.

[4] For the motion of earth around sun, the angular momentum of the earth about the center of mass of the sun + earth system and perpendicular to the plane of motion of earth is conserved.

[5] The projection of angular momentum of a conical pendulum in the horizontal plane is a constant of motion when the origin is chosen to be at fixed at the point of suspension. SetId=611

[6] Example where law of conservation of angular momentum does not hold:If a particle undergoes conical motion and the only force acting on particle is central force like tension of the string.Then total external torque about fixed point A is zero,yet angular momentum is not conserved,as angular momentum keeps on changing direction.

[7] Law of conservation of momentum does not hold when Newton's laws are not valid, e.g. in a non-inertial frame of reference. For example, when we consider collision between two bodies in a non-inertial frame of reference, the law of conservation of momentum cannot be applied because there will be a pseudo force acting on the frame itself.

[8] To apply the conservation laws of momentum, energy and angular momentum, we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *external force* acting on the system, the energy and momentum will be conserved. However, depending on the nature of the system and of the forces, the total angular momentum may not be conserved.

SetId=611

[9] The workdone by a non conservative force is dependant on its path. the work varies as the path varies.

[10] When the force is kept constant as function of time, it is possible for a particle to move on a circular path in such a way that its speed remains constant, but the velocity and acceleration must always change with time.

[11] Distance is equal to the length of the path covered. Displacement is the shortest distance between initial and final points.

[12] Staying inside a bullet train moving with constant velocity (no jerks etc) an experiment can always be performed which will tell us the numerical value of the acceleration of the bullet train

[13] For a system of several particles the conservation of total linear momentum is equivalent to the statement that their centre of mass moves like a free particle.

[14] The total work done on a particle is always equal to the change in kinetic energy. SetId=611

[15] Newton's first law defines inertial frame. An inertial frame is a frame in which the first law hold. It also makes it possible to compare and tell two force being equal or not. The second law defines the force.

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SetId=612

[1] Distance equal to zero implies displacement=0; and Displacement=0 also implies distance = 0

[2] If the net external torque acting on a system is zero, the angular momentum L of the system remains constant, no matter what changes take place within the system.

$$\sum(T_{\text{ext}}) = \frac{dL}{dt}$$

The law states that when there is no net external torque, $\frac{dL}{dt}$ is zero implying that the total angular momentum of system is constant.

i.e. $L = a$ constant (isolated system)

[3] An example where law of conservation of angular momentum holds:
The Law of conservation of angular momentum holds in the case of a ballet dancer performing a pirouette.

When the dancer extends her arms outward, the angular velocity of her rotation decreases whereas when she keeps her arms close to her body, the angular velocity increases. This is because her moment of inertia changes as she moves her arms outward and inward. It can be noted that she as a system has no external torque acting upon her.

[4] In the Sun Earth system the angular momentum of the Earth about the pole star is conserved

[5] The law of angular momentum of a is not applicable for the conical pendulum conserved w.r.t. the origin fixed at the point of suspension. SetId=612

[6] A nonzero torque always causes the angular velocity to change, because a change in angular momentum means a change in angular velocity $L = I\omega$

[7] If I throw a ball upward, it's speed decreases as it rises upwards. There is an external force (gravity) acting on the ball, so the momentum conservation law does not apply. Momentum of the ball is not conserved, however the momentum of the Earth-ball system is conserved as gravity will become an internal force in this case.

[8] In order to apply the law of conservation of momentum we must first identify the system. If there is no *external forces* acting on the system then conservation laws of momentum always holds. And depending on the nature of the system and of the forces, the total kinetic energy and the total angular momentum may not be conserved.

SetId=612

[9] A non conservative force is a force with the property that the work done in moving a particle between two points is dependent on the path followed.

[10] It is not possible for a particle to move on a circular path in such a way that its speed and force remains constant, and only the velocity and acceleration may (or may not) always change with time.

[11] Distance is a scalar quantity where as the displacement is a vector quantity.

[12] Assume bullet train, moving with out any jerks, is going on a circular arc of radius R with constant speed. Then an experiment is to be performed entirely within the train without any measurement on objects outside the train. Such an experiment can tell only radius of the track.

[13] The total mechanical energy of a system may not be conserved if there are no external forces and the internal forces are conservative.

[14] A particle is acted upon by a force of constant magnitude which is always perpendicular to the velocity of the particle and the motion of the particle takes place in a plane, Then its kinetic energy, speed, velocity acceleration will not change. SetId=612

[15] The magnitude of the pseudo force arising in a non-inertial frame is always equal to the mass of the body under consideration multiplied by the acceleration of the frame of reference and the direction of pseudoforce is always opposite to the direction of acceleration of the frame.

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SetId=613

[1] If P and Q are the initial and the final points of a path of a particle, displacement is a vector whose direction is along PQ and has magnitude is equal to the length of line PQ

[2] When the net external torque acting on a body or a system of bodies is zero about a particular axis, then the angular momentum of each body is conserved about that axis.

[3] In case of a skater, who can be considered an isolated system, so no torue will be acting on him/her. When the arms are extended, the moment of inertia is more. When his hands are closely held, the moment of inertia is lesser. Since the angular momentum is same, the angular acceleration changes accordingly.

[4] For the motion of earth around sun, the angular momentum of the sun about the center of mass of the sun + earth system and perpendicular to the orbital plane of earth is conserved.

For the motion of earth around sun, the angular momentum of the sun about and axis passing through the Earth and perpendicular to the orbital plane of motion of earth is conserved.

[5] The law of angular momentum of a is not applicable for the conical pendulum conserved when the origin is chosen to be at the pendulum bob itself.

SetId=613

[6] A nonzero torque always implies change in angular momentum and may not give rise to a change in magnitude of angular velocity. A non zero torque may mean change only the direction of the angular momentum and not the angular velocity.

[7] A soldier accelerating away, after detonating a bomb, will find that the total momentum of the fragments of the bomb is zero. This is an example where the law of conservation of momentum holds as the forces on the fragments are internal forces only and sum of all such forces is zero.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then check if the laws is applicable or not.

So if there is no *net external force* acting on the system all the three conservation laws will hold.

[9] A non conservative force is a force with the property that the work done in moving a particle between two points is dependent of the taken path.

Friction, for example, does less work on a book dragged across a table if the book is dragged straight across than if the book is dragged in a curved path.

To write the equation for conservation of energy for non conservative forces we need to include the work done by the non conservative force also.This is because forces like friction liberate heat which are not included in the mechanical energy.

SetId=613

[10] For a particle moving on circle the acceleration is always constant in magnitude and directed towards the centre of the circle.

[11] Both displacement and distance tell us about the motion of a body but their study does not tell much about the forces on the body

[12] Assume bullet train, moving with out any jerks, is going on a circular arc of radius R with constant speed. Then an experiment is to be performed entirely within the train without any measurement on objects outside the train. Such an experiment can tell both speed of the train and radius of the track.

[13] When a bullet fired on a wooden block, some energy is transferred to the block and the total mechanical energy of the block and the bullet is conserved.

[14] The kinetic energy of a particle is continuously increasing with time, then the angle bewteen the net force and the velocity cannot be greater than or equal to 90^o at any time. SetId=613

[15] A force is any interaction which tends to change the motion of an object. It is also *defined* as rate of change of momentum.It is a vector quantity.
A physically apparent but nonexistent force felt by an observer in a noninertial frame (that is, a frame undergoing acceleration).

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SetId=614

[1] If P and Q are the initial and the final points of a path of a particle,the displacement is the vector $\overrightarrow{PQ}$.

[2] The law of conservation of angular momentum states that in absence of an external torque on an object or a closed system of objects the total angular momentum of the system remains constant. Thus if $\vec{\tau} = 0 => \vec{L} =$ constant where τ is the torque and $\vec{L}$ is the angular momentum of the system.

[3] Example where law of conservation of angular momentum holds:
Let us assume a student seated on a stool that can rotate freely about a vertical axis. The student has been set into rotation at a modest initial angular speed ω . He holds two dumbbells in his outstretched hands. His angular momentum vector L lies along the vertical rotation axis, pointing upwards. Now he pulls in his arms;this action reduces his rotational inertia from its value I_{initial} to a final value I_{final} because he moves the mass closer to the rotational axis. His rate of rotation increases markedly, from ω_{initial} to ω_{final}. The student can then slow down by extending his arms once more,moving the dumbbells outward. No external torque acts on the system consisting of the student, stool and the dumbbells. Thus the angular momentum of the system about the rotational axis remains constant. $I_{\text{initial}} * \omega_{\text{initial}} = I_{\text{final}} * \omega_{\text{final}}$.

[4] For the motion of earth around sun, the sum of angular momenta of the Sun and the Earth about the center of mass of the sun + earth system is conserved.

[5] The three components of angular momentum of a conical pendulum is conserved w.r.t. the origin at the position of the center of mass of the pendulum. SetId=614

[6] In the example of a rotating skew rod the torque due to the external gravitational forces is zero , but the angular momentum is not constant Therefore the law of conservation of angular momentum is violated.

[7] There is no known exception to the law of conservation of momentum in classical mechanics However, an exception to conservation of energy in nuclear physics is observed. In nuclear reactions when two nuclei collide and their mass converts to energy and energy momentum are not conserved.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then check we should if the laws are applicable or not.

So if there is no *external force* acting on the system all the three quantities, total momentum is conserved. The total angular momentum is also because the torque of internal forces will be zero. The conservation of energy depends on the nature of forces. will be conserved.

[9] A non conservative force is a force with the property that the work done in moving a particle between two points is dependent of the taken path.

Friction, for example, does less work on a book dragged across a table if the book is dragged straight across than if the book is dragged in a curved path.

To write the equation for conservation of energy for nonconservative forces we need toinclude the work done by the non conservative force also.This is because forces like friction liberate heat which are not included in the mechanical energy.

SetId=614

[10] The motion of a bomb dropped from a plane does is not a uniform motion as it follows a parabolic path and not a straight line path.

[11] Displacement is the shortest distance between initial and final points with direction specified.

[12] Assume bullet train, moving with out any jerks, is going on a circular arc of radius R with constant speed. Then an experiment is to be performed entirely within the train without any measurement on objects outside the train. Such an experiment can tell only speed of the track.

[13] When a moving car hits a parked lorry and causes the parked lorry to move ,energy is transferred from moving the car to the lorry and the total energy of the lorry and the car is conserved.

[14] A heavy body is attached from a spring and is held at point A and is such that the spring is not slack nor is it stretched. It is then released. It goes down upto a point B and then it rises upto point C and executes an oscillatory motion between B and C. During the motion from A to C is first positive (from A to B) and then it is negative from B to A and again remains negative from A to C.

SetId=614

[15] Psuedo Force is defined as an apparent force that acts in only non-inertial frames. Pseudo Forces are also called Fictitious Forces. It is an Imaginary force. It is independent of mass.

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[1] If two bodies starting from a point A reach a point B, following different paths, their displacement will be, in general different, but the distances covered will always be the same.

SetId=615

[2] If no net external torque acts on a system, the total angular momentum of the system remains constant.

[3] A bob is attached to ceiling by a string and moves in a horizontal circular plane is an example. In this case the law of conservation of angular momentum does not hold.

[4] For the motion of the Earth around the sun, the total of angular momenta of the Earth and the Sun, about in a reference frame fixed in the pole star, is conserved.

[5] Only the z component of the angular momentum of a conical pendulum is conserved w.r.t. the origin fixed at the point of suspension.

SetId=615

[6] In the example of skew rod, the angular momentum changes with time and there is a non zero torque coming from action of forces other than gravitational forces. Hence the law of conservation of angular momentum dos not apply.

[7] In a system of a canon and a canon ball, total momentum of the system is zero before canon ball is fired. After firing the canon ball, the momentum of the system seems to be conserved as the ball moves forward and the canon moves backward.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *net external force* acting on the system, the momentum is conserved. The definition of angular momentum and torque depends on the choice of axes, and therefore it may not be be conserved. The conservation of total energy holds only for conservative forces.

When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *net external force* acting on the system, the energy and momentum will be conserved. However, the total angular momentum may not be conserved because the torque may not be zero.

[9] The non conservative force is a force with a property thet the work done between two points depends on path taken. If a particle moves along a curve path, to know about the work done by a non conservative force we should have the equation of the path along which the particle had move.The work done would be

WORK = INTEGRAL (F.dx)

The equation of conservation of mechanical energy for a non conservative force would be

SetId=615

$KE_{\text{final}} + PE_{final} = KE_{initial} + PE_{initial} + W_{nc}$

[10] A wagon sliding on a roller coaster designed in such a way that the wagon covers equal distances in equal times. As the motion of the wagon is uniform, there will be no net force acting on it.

[11] Displacements, being vector quantity can not compared with, a scalar quantity such as distance.

[12] A particle is observed from two frames S_1 and S_2. The frame S_2 moves with respect to S_1 with an acceleration a. If F_1 and F_2 be the pseudoforces when seen from S_1 and S_2 respectively it is not possible to have $F_1 = F_2 = 0$

[13] When a bomb explodes the total mechanical energy is not conserved. But the total chemical energy and the mechanical energy is conserved.

[14] The kinetic energy of a body does not change if any one of the following is true
(i)force is always perpendicular to the velocity
(ii) the force is always perpendicular to the acceleration
(iii) the object remains stationary
(iv) the object moves in such a way that the point of application of the force remains fixed.

SetId=615

[15] Psuedo Force is defined as an apparent force that acts in only non-inertial frames. Pseudo Forces are also called Fictious Forces. It is an Imaginary force. It is always proportional to mass. It is sometimes dependent on speed.

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[1] Displacement is equal to the vector difference $\vec{r}_f - \vec{r}_i$ of the position vectors of initial and final points. The distance covered will be $|\vec{r}_f - \vec{r}_i|$

[2] The law of conservation of angular momentum states that when no external torque is applied on an object or a closed system of objects about an axis, the angular momentum about that axis remains constant.

[3] Consider a disc rotating about an axis perpendicular to its plane. On placing a smaller disc with its surface parallel to the surface of the rotating disc, the angular momentum of the system of two discs remains constant as there is no external torque.

[4] For the motion of the Earth around the sun, the total of angular momenta of the Earth and the Sun, is conserved in every inertial frame of reference; but the angular momentum of the Earth (or of the sun)is not conserved in every inertial frame.

[5] The z component of angular momentum of a conical pendulum is not conserved w.r.t. the origin fixed at the point of suspension; but the x and y components are conserved.

SetId=616

[6] In the example of conical pendulum, the z- component of angular momentum does not change. This follows from the angular momentum conservation as there is no external torque.

[7] When applying the conservation laws of momentum, energy and angular momentum we must define the system first.Only then check if the laws is applicable or not.

As an example: when a ball is dropped from a height, it gains momentum down if we consider the ball as our system.This is because the force of gravity acts as an external force.

However, if we change our system and consider earth as a part of our system too, then the momentum remains conserved because the earth gains momentum up.

[8] In order to apply the law of conservation of momentum we must first identify the system. If there is no *net external forces* acting on the system then conservation laws of momentum always holds. The total energy and the total angular momentum may not be conserved.

[9] Nonconservative forces arise due to neglected degrees of freedom or from time dependent potentials. The work done by a nonconservative force depends upon the path taken. It causes a change in the mechanical energy of the system. It adds or removes mechanical energy from a system.

SetId=616

[10] A simple pendulum moves along a circular arc and does not have constant speed and therefore its motion is not uniform.

[11] Distance depends on the path where as the displacement depends on the end point only

[12] A particle is observed from two frames S_1 and S_2. The frame S_2 moves with respect to S_1 with an acceleration a. If F_1 and F_2 be the pseudoforces when seen from S_1 and S_2 respectively and if $F_1 = 0$ then we must have $F_2 \neq 0$

[13] When a ball rolls over a rough surface, it comes to stop after some time. This is because transational and rotational kinetic energy initially present in the ball continuosly gets converted to heat due to friction. When all the kinetic energy changes to heat, the ball stops. The total mechanical energy of the ball is not conserved.

[14] The total work done on a particle is always equal to the change in kinetic energy. SetId=616

[15] Since pseudo forces are not real forces, they do not affect the conservation laws and all the three conservation laws hold in noninertial frames.

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SetId=617

[1] Distance is equal to the length of the path covered. Displacement is the shortest distance between initial and final points.

[2] The angular momentum of a given system of bodies shall remain conserved unless acted upon by an external unbalanced torque.

[3] Consider a man standing on a spinning platform. Initially, the man spreads out his arms and he spins with a certain angular velocity. The next moment, he pulls his arms inwards keeping them close to his body. We will observe that the angular velocity with which he is spinning now increases. This phenomenon can be explained by the Law Of Conservation of Angular momentum. Initially, since his arms were spread wide, his moment of inertia was large. However, when he pulled them close to his body, his moment of inertia decreased.
In this example the angular velocity of the man increases and therefore the angular momentum also increases.The law of conservation of angular momentum does not apply because the torque of muscular forces is not zero.

[4] In the Sun Earth system the angular momentum of the Earth is conserved in every frame of reference

[5] Only the z component of angular momentum of a conical pendulum is conserved w.r.t. the origin fixed at the point of suspension. SetId=617

[6] In the example of conical pendulum, the x and$y$ components of angular momentum change. This follows from the angular momentum conservation as the z components external torque is zero and horizontal components of torque are non zero.

[7] Statement: Law of Conservation of energy states that "ENERGY CAN NEITHER BE CREATED NOR DESTROYED",but it can be changed from one form to other.

EXPLANATION: Statement implies that the total amount of energy in an isolated system remains constant although it may change forms. viz, kinetic energy may change to potential;chemical to electrical energies etc.

[8] In order to apply the law of conservation of momentum we must first identify the system. Then even if there is no *net external forces* acting on the system, all the three conservation laws of momentum, angular momentum and energy may not hold due to presence of internal forces.

[9] The work done by a *Nonconservative Force *is not recoverable*.*The work done by a *Non Conservative force* is usually dissipated in the form of Heat and Sound.

SetId=617 Non conservative force *cannot* be expressed in the form of *Potential Energy*.

[10] A satellite goes around the earth in a circular orbit of 600km with a time period of $5.8 \times 10^3 s$. Its motion will be uniform as it will cover equal distances in equal times.

[11] Distance equal to zero $\Rightarrow$ displacement=0; but Displacement=0

[12] If K is an inertial frame, any frame that moves w.r.t. the frame K with uniform velocity is also an inertial frame.

[13] Let us consider that a pendulum is oscillating moving in a vertical plane. Mean while let another bob which is attached to a spring and is executing a simple harmonic motion in horizontal direction comes and hits the pendulum. Here conservation of momentum does not hold good as tension(external force) is acting on the system.(pendulum)

[14] A particle is acted upon by a force of constant magnitude which is always perpendicular to the velocity of the particle and the motion of the particle takes place in a plane, Then its kinetic energy, speed, velocity acceleration will not change. SetId=617

[15] A force is any interaction which tends to change the motion of an object. Newtons' second tell us that it is *equal* to the rate of change of momentum.It is a vector quantity. Real forces can be distinguished from pseudo forces because the pseudo forces always proportional to the mass of the body. All real forces, except the gravitational force, do not depend on the mass of the body.

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SetId=618

[1] Distance is a scalar quantity where as the displacement is a vector quantity.

[2] When the net external torque acting on a system about a given axis is zero, the total angular momentum of the system about that axis remains consant.

[3] In the Sun-Earth system, angular momentum of the earth is not conserved but the total angular momentum of the sun and the earth is constant of motion.

[4] In the motion of earth around sun, the angular momentum of the earth about an axis passing through the sun and perpendicular to the plane of motion of earth is conserved.

[5] The projection of angular momentum of a conical pendulum in the horizontal plane is a constant of motion when the origin is chosen to be at fixed at the point of suspension. SetId=618

[6] Example where law of conservation of angular momentum does not hold: A disc rotating on a horizontal rough surface will not have a constant angular momentum because there will be a constant torque by frictional force. Hence, its angular momentum will decrease, and the law of conservation of angular momentum does not apply.

[7] Oscillating simple pendulum is a very good example where potential energy gets converted to kinetic energy and kinetic to potential energy. Some energy gets dissipated as heat if we consider air resistance. Energy as a whole is conserved if we consider universe as system, the energy has just changed its form.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then check we should if the laws are applicable or not.

So if there is no *external force* acting on the system all the three quantities, total momentum, total angular momentum, and total kinetic energy will be conserved independent of the nature of forces.

[9] * A non conservative force is a force that acts on a particle(or point), such that the work done by this force in moving this particle from one point to another is */dependent of path taken/* that is the work done depends on the path itself. * For example frictional force is non conservative because the work done by friction always acts in the direction of travel and therefore depends on length L of the path taken.

SetId=618

[10] A uniform motion is defined to be the one in which a body covers equal distances in equal time intervals.

[11] If P and Q are the initial and the final points of a path of a particle, displacement is a vector whose direction is along PQ and has magnitude is equal to the length of line PQ

[12] If K is an inertial frame, any frame that moves w.r.t. the frame K with uniform speed is also an inertial frame.

[13] The law of conservation of momentum does not hold in relativistic situations, i.e., where the speeds of the masses involved are close to the speed of light.

[14] The kinetic energy of a particle is continuously increasing with time, then the angle bewteen the net force and the velocity cannot be greater than or equal to 90^{o} at any time. SetId=618

[15] Examples of pseudoforce are Coriolis Force, Centrifugal Force, and magnetic force on currents.
Psuedo force also called as fictitious force is an apparent force that are needed for masses whose their motion is described using a non inertial frame of reference.

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SetId=619

[1] The speed is rate of change of distance and the velocity is the rate of change of displacement.

[2] This law sates that when no net torque of all forces acts on a object or a system of objects then total angular momentum of system is conserved.The angular momentum before an event is equal to angular momentum after that event.mathematically explained by when, net torque=0 ;then, total angular momentum(L)=constant.

[3] Consider a disc and a man system. man is standing on center of the disc rotating with angular velocity.initially man folded his hand.when man stretches his hands then momentum of inertia of system increases.and angular velocity decreases.and total angular momentum remains constant.

[4] For the motion of earth around sun, the angular momentum of the earth about the center of mass of the sun + earth system and perpendicular to the plane of motion of earth is conserved.

[5] The law of angular momentum of a is not applicable for the conical pendulum conserved w.r.t. the origin fixed at the point of suspension.

SetId=619

[6] Example where law of conservation of angular momentum does not hold:Consider a vertical stick on the ground falling to a horizontal position. During the fall, the conservation of angular momentum applied at the point of rotation on the ground and perpendicular to the plane of the stick is not applicable as, the gravitational force which acts vertically downwards assumed at the centre of mass produces an external torque about the axis of rotation

[7] Law of conservation of momentum does not hold whenever an external force or impulse acts on the system. For example,when a body collides with earth then it bounces back to a lesser height as it loses some velocity.

In this example the momentum of a ball is not conserved due to impulsive force by ground in the normal direction.

However, strictly speaking the system that should be considered here is the ball-earth system and the total momentum is conserved.

[8] If we want to apply the conservation laws of momentum, energy and angular momentum, we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *external force* acting on the system, the momentum and angular momentum will be conserved, and depending on the nature of the forces but total energy may or may not be conserved.

[9] A force with the property that the work done in moving a particle is dependent on the path followed. The work done by a conservative force in moving a body from an initial location to a final location is dependent on the path taken between the two points

SetId=619

[10] A particle moves on a circular path. Then its speed, direction of force, velocity and acceleration must always change with time.

[11] If P and Q are the initial and the final points of a path of a particle,the displacement is the vector $\overrightarrow{PQ}$.

[12] A frame rotating w.r.t K with uniform angular velocity is also an inertial frame.

[13] when we are in accelerating frame if we observe any collision between two bodies then the law of conservation of momentum does not hold in that frame of reference.

[14] A heavy body is attached from a spring and is held at point A and is such that the spring is not slack nor is it stretched. It is then released. It goes down upto a point B and then it rises upto point C and executes an oscillatory motion between B and C. During the motion from A to C is first positive (from A to B) and then it is negative from B to A and again remains negative from A to C.

SetId=619

[15] Examples of pseudo-force are Coriolis Force, Centrifugal Force, Centripetal force and magnetic force on currents. The pseudo forces do not obey Newton's third law and therefore the total momentum does not appear to be conserved in a non-inertial frame.

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ASSIGNMENT-II **Due On : Nov 18, 2014**

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SetId=620

[1] For any type of translational motion of a body, the displacement cannot be zero, where as the distance travelled can be zero.

[2] Statement of Law of Conservation of Angular Momentum:
Differentiating $\vec{L} = \vec{r} \times \vec{p}$ w.r.t, time,

$$\begin{aligned}\frac{dL}{dt} &= \frac{d\vec{r} \times \vec{p}}{dt} = \frac{d\vec{r}}{dt} \times \vec{p} + \vec{r} \times \frac{d\vec{p}}{dt} = \vec{v} \times (m\vec{v}) + \vec{r} \times \vec{F} \\ &= \vec{r} \times \vec{F}(\because v \times v = 0) \\ &= \vec{\tau}\end{aligned}$$

here $\vec{\tau}$ represents the net torque acting on a rigid body rotating about a fixed axis.This torque must take into account of all the forces, be it external or internal forces

[3] The conservation of angular momentum of a system of bodies requires that the the sum of torque due to all forces be equal to zero. Now consider a situation where the forces are such that the sum of torques of external forces is zero w.r.t. some axes K. Since the value of torque depends of the choices of axes, the sum of torques due to all internal forces will depend on the choice of axes and in general it will be non zero. Therefore, for a system of several bodies, for a given choice of axes K, there will be situations when the total angular momentum may not be conserved.

[4] In the Sun Earth system the angular momentum of the Earth about the pole star is conserved

[5] The law of angular momentum of a is not applicable for the conical pendulum conserved when the origin is chosen to be at the pendulum bob itself. SetId=620

[6] We have a conical pendulum .The forces acting on the bob are tension (along the direction of the string) and gravitational force acting in the vertically downward direction.we have an additional force called the drag force which is tangential to the motion of the bob and acts in the direction opposite to the motion of the bob.The axis of rotation passes through the hinge point and is vertical.The torque due to tension is 0 because the force passes through the axis of rotation.The torque due to mg is also zero since it is parallel to the axis of rotation.but the torque due to drag force is not zero.since the net external torque acting on the bob is not zero,therefore the law of conservation of angular momentum does not hold here

[7] If a bullet hits a wooden board and gets embedded in the board, the total energy and the total momentum of the bullet and the board are conserved.

[8] To apply the conservation laws of momentum, energy and angular momentum, we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *external force* acting on the system, the energy and momentum will be conserved. However, depending on the nature of the system and of the forces, the total angular momentum may not be conserved.

[9] The work done by non conservative force is dependent on the path taken by the particle in reaching final position from initial position. Non conservative force depends on the distance travelled by the particle

SetId=620

[10] A particle moves on a circular path. Then its speed, direction offorce, can remain constant by velocity and acceleration must always change with time.

[11] If two bodies starting from a point A reach a point B, following different paths, their displacement will be, in general different, but the distances covered will always be the same.

[12] The Newton's Laws of motion will hold in all frames which are at rest w.r.t. K but do not remain valid in a frame that move with respect to K.

[13] Give an example where law of conservation of momentum does not hold all cases when seen from non inertial frame of references for example when we see two cars collide from a moving bus there momentum is not conserved

[14] The kinetic energy of a body does not change if any one of the following is true
(i)force is always perpendicular to the velocity
(ii) the force is always perpendicular to the acceleration
(iii) the object remains stationary
(iv) the object moves in such a way that the point of application of the force remains fixed.

SetId=620

[15] FORCE is any interaction which tends to change the motion of an object.It has both magnitude and direction,making it a vector quantity.

A psuedo force is an apparent force that acts on all masses whose motion is described with respect to a non-inertial frame of reference like a rotating frame of reference.This force is needed by an observer in an non-inertial frame to make all the Newtons Laws of motion hold true.

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SetId=621

[1] Displacements, being vector quantity can not compared with, a scalar quantity such as distance.

[2] Statement of Law of Conservation of Angular Momentum: For a system of many particles The net torque due all the forces, be it external or internal forces. But as the torque due to all the internal forces cancel out, it sufficient to consider the external forces acting on the system.

[3] Example where law of conservation of angular momentum does not hold:
When there is external force like frictional force acting on a object when it is rotating we cannot use conservation of angular momentum as the friction force acting on the object produces an external torque.

[4] For the motion of earth around sun, the angular momentum of the sun about the center of mass of the sun + earth system and perpendicular to the orbital plane of earth is conserved.

For the motion of earth around sun, the angular momentum of the sun about and axis passing through the Earth and perpendicular to the orbital plane of motion of earth is conserved.

[5] The three components of angular momentum of a conical pendulum is conserved w.r.t. the origin at the position of the center of mass of the pendulum. SetId=621

[6] When you release a toy gyroscope on its pedestal, it initially has no precessional rotation around that pedestal, i.e, the orientation of rotation is fixed. However, it instantaneously starts precessing around the pedestal. Both Kinetic Energy and Angular Momentum now exist where they did not exist a moment earlier. The Kinetic Energy is easy to explain, as appearing due to the body of the gyroscope dropping a tiny fraction of a millimeter in the Earth's gravitational field, giving up exactly the correct amount of Potential Energy. But the Angular Momentum of the Precession which just appeared, does not come from anywhere. This is therefore a Violation of the Conservation of Angular Momentum.

[7] If a bullet hits a wooden board and gets embedded in the board, the total energy of the bullet and the board system is conserved but the total momentum is not conserved.

[8] In order to apply the law of conservation of momentum we must first identify the system. If there is no *external forces* acting on the system then conservation laws of momentum always holds. And depending on the nature of the system and of the forces, the total kinetic energy and the total angular momentum may not be conserved.

[9] The work done by non conservative force is dependent on the path taken by the particle in reaching final position from initial position. Non conservative force depends on the distance travelled by the particle

SetId=621

[10] A particle moves on a circular path. Then under suitable conditions its speed may remain constant, but the force, velocity and acceleration must always change with time.

[11] Distance is equal to the length of the path covered. Displacement is the shortest distance between initial and final points.

[12] Staying inside a bullet train moving with constant velocity (no jerks etc) an experiment can always be performed which will tell us the numerical velocity of the bullet train

[13] When a tennis ball hits the ground at an oblique angle, the angle of reflection is equal to the angle of incidence. This is a simple consequence of conservation of horizontal component of momentum.

[14] The total work done on a particle is always equal to the change in kinetic energy. SetId=621

[15] FORCE is any interaction which tends to change the motion of an object.It has both magnitude and direction,making it a vector quantity. A pseudo-force F doesn't arise from any physical interaction between two objects, but rather from the acceleration 'a' of the non-inertial reference frame itself. These forces have no real existence but must be taken into account in an accelerating frame of reference to make all the three Newton's Laws of motion applicable to the system

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SetId=622

[1] Distance depends on the path where as the displacement depends on the end point only.

[2] Depending on the torques acting on a system, the angular momentum can be conserved only in one or two directions, but may not be conserved in all. For instance, if an isolated body has no torque acting on it only in the direction along the Z axis, then the angular momentum is conserved only in that direction.

[3] A bob attached to a ceiling by a string moving in a horizontal circular plane is an example where the total angular momentum of the bob about the point of suspension is not conserved. This is because the the torque due to the weight of the bob about the point of suspension does not vanish and has non zero horizontal component. Only the vertical component of the angular component is conserved.

[4] For the motion of earth around sun, the sum of angular momenta of the Sun and the Earth about the center of mass of the sun + earth system is conserved.

[5] Only the z component of the angular momentum of a conical pendulum is conserved w.r.t. the origin fixed at the point of suspension. SetId=622

[6] There is no case where LAW OF CONSERVATION OF ANGULAR MOMENTUM does'nt hold.But there are cases where conservation of angular momentum does not hold.A body in vertical circular motion is an example where angular momentum is not conserved. Here the law of conservation does not apply.

[7] If a bullet hits a wooden board and gets embedded in the board, both total energy and the total momentum of the bullet and the board are not conserved.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then check if the laws is applicable or not.

So if there is no *net external force* acting on the system all the three conservation laws will hold.

[9] Nonconservative forces are those forces in which the work done in moving a particle is dependant on the path taken to cover the distance. Some energy woul be lost to the environment in the form of heat, sound, etc. The energy in the final state is less than that in the initial state.

SetId=622

[10] A particle moves on a circular path. Then under suitable conditions its speed and acceleration may remain constant, but the force, and velocity must always change with time.

[11] Distance is a scalar quantity where as the displacement is a vector quantity.

[12] Staying inside a bullet train moving with constant velocity (no jerks etc) an experiment can always be performed which will tell us the numerical value of the acceleration of the bullet train

[13] when a ball is dropped from a height, it gains momentum down if we consider the ball as our system.This is because the force of gravity acts as an external force.

However, if we change our system and consider earth as a part of our system too, then the momentum remains conserved because the earth gains momentum up.

[14] A particle is acted upon by a force of constant magnitude which is always perpendicular to the velocity of the particle and the motion of the particle takes place in a plane, Then its kinetic energy, speed, velocity acceleration will not change. SetId=622

[15] FORCE is any interaction which tends to change the motion of an object.It has both magnitude and direction,making it a vector quantity.
A pseudo-force results from acceleration of the frame of reference in which the objects reside. It is taken into account so that Newton's second law isn't invalidated. The pseudo force acting on an object can always be mathematically expressed as the product of the mass of the object and the acceleration of the frame of reference.

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SetId=623

[1] Distance equal to zero implies displacement=0; and Displacement=0 also implies distance = 0

[2] According to Law of Conservation of Angular momentum,if no external torque acts on an object or system of objects,angular momentum of an object or system of objects remains CONSTANT or no change in angular momentum can occur.

Also it states that,only external torque can change angular momentm of the system where as the torque produced by internal forces can not change the angular momentum of the system

[3] Law of conservation of angular momentum holds in case of long jump. When a athlete takes off from the ground in a running long jump, the forces on the launching foot give the athlete an angular momentum with a forward rotation around a horizontal axis. Such rotation would not allow the jumper to land properly. In the landing, the legs should be together and extended forward at an angle so that the heels mark the sand at the greatest distance. Once airborne, the angular momentum cannot change (it is conserved) because no external torque acts to change it. However, the jumper can shift most of the angular momentum to the arms by rotating them in windmill fashion. Then the body remains upright in the proper orientation of landing.

[4] For the motion of the Earth around the sun, the total of angular momenta of the Earth and the Sun, about in a reference frame fixed in the pole star, is conserved.

[5] The z component of angular momentum of a conical pendulum is not conserved w.r.t. the origin fixed at the point of suspension; but the x and y components are conserved.

SetId=623

[6] A sphere rolling on a rough surface.Due to friction there is external torque so the angular momentum changes which results in the slowing of the sphere. The angular momentum keeps changing. Even in case like this one, it is wrong to say that the Law of Angular Momentum Conservation does not hold.

[7] There are certain situations where it appears that the law of conservation of linear momentum does not hold. For example if we take some amount of a substance like construction putty, cement, cake batter, playing dough,etc and drop it on the ground, it does not bounce back like a rubber ball would and hence the momentum it had before striking the ground seems to have been lost. Hence it appears that the law of conservation of linear momentum does not hold.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then check we should if the laws are applicable or not.

So if there is no *external force* acting on the system all the three quantities, total momentum is conserved. The total angular momentum is also because the torque of internal forces will be zero. The conservation of energy depends on the nature of forces. will be conserved.

[9] The work done by such forces depends on the path taken. The work done cannot be represented as a potential energy function.Work done by such forces is always negative.

SetId=623

[10] When the force is kept constant as function of time, it is possible for a particle to move on a circular path in such a way that its speed remains constant, but the velocity and acceleration must always change with time.

[11] Both displacement and distance tell us about the motion of a body but their study does not tell much about the forces on the body

[12] Assume bullet train, moving with out any jerks, is going on a circular arc of radius R with constant speed. Then an experiment is to be performed entirely within the train without any measurement on objects outside the train. Such an experiment can tell only radius of the track.

[13] There is no known exception to the law of conservation of momentum in classical mechanics however when two bodies collide and their mass converts to energy, an exception in nuclear physics is observed. In real life this is observed in nuclear reactions at atomic level.

[14] The kinetic energy of a particle is continuously increasing with time, then the angle bewteen the net force and the velocity cannot be greater than or equal to 90° at any time.

SetId=623

[15] Explain Force:FORCE is any interaction which tends to change the motion of an object.It has both magnitude and direction,making it a vector quantity.
In the case of a non inertial frame, we can use the second law of motion by adding a pseudo force to the system which makes it an inertial frame of reference.

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SetId=624

[1] If P and Q are the initial and the final points of a path of a particle, displacement is a vector whose direction is along PQ and has magnitude is equal to the length of line PQ

[2] The law of conservation of angular momentum states that when the net external torque acting on the system is zero, then the angular momentum of the system remains constant.both the initial and final momentum should be taken from a fixed inertial frame of reference provided.

[3] The total angular momentum of a body remains constant of motion when the net torque of the external forces acting on the body is zero.
In general, we have a system of particles such that the net torque of the external forces on the system, w.r.t. some axes K, is zero, the total angular momentum may not remain conserved, because the torque due to the internal forces may not be zero.

[4] For the motion of the Earth around the sun, the total of angular momenta of the Earth and the Sun, is conserved in every inertial frame of reference; but the angular momentum of the Earth (or of the sun)is not conserved in every inertial frame.

[5] Only the z component of angular momentum of a conical pendulum is conserved w.r.t. the origin fixed at the point of suspension. SetId=624

[6] Consider a rod of length l. Let us give an impulse to one end . Now the angular momentum about the oposite end is not zero since the impulse provides some torque . So the angular momentum is not conserved .

$$\text{torque} = \text{impulse} * \ell.$$

$d\ell/dt$ is not equal to zero and the law of conservation of angular momentum does not hold.

[7] A tennis ball is dropped from height h and after hitting the ground and it bounces back and rises to the same height. In this case the momentum of the ball is conserved because (under ideal conditions) the momentum after it hits the ground will be equal to the momentum it had before hitting the ground.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *net external force* acting on the system, the momentum is conserved. The definition of angular momentum and torque depends on the choice of axes, and therefore it may not be be conserved. The conservation of total energy holds only for conservative forces.

When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *net external force* acting on the system, the energy and momentum will be conserved. However, the total angular momentum may not be conserved because the torque may not be zero.

[9] A nonconservative force is a force with the property that the work done in moving a particle depends on the path taken.Also, the net work done in a closed loop is non zero.

SetId=624

[10] It is not possible for a particle to move on a circular path in such a way that its speed and force remains constant, and only the velocity and acceleration may (or may not) always change with time.

[11] Displacement is the shortest distance between initial and final points with direction specified.

[12] Assume bullet train, moving with out any jerks, is going on a circular arc of radius R with constant speed. Then an experiment is to be performed entirely within the train without any measurement on objects outside the train. Such an experiment can tell both speed of the train and radius of the track.

[13] When there is no external forces act on a system of many particles, and there are only internal forces acting on the particles. The third law gives that the internal forces are pairwise equal and opposite.Thus the sum of internal forces is zero and the momentum of each particle is conserved.

[14] A heavy body is attached from a spring and is held at point A and is such that the spring is not slack nor is it stretched. It is then released. It goes down upto a point B and then it rises upto point C and executes an oscillatory motion between B and C. During the motion from A to C is first positive (from A to B) and then it is negative from B to A and again remains negative from A to C. SetId=624

[15] For the Newton's Law of Motion to hold true,the physically apparent but nonexistent force needed by an observer in a non-inertial frame is called the pseudo force.
1) Caused by relative acceleration of the origin in a straight line
2) Centrifugal and Centripetal forces
3) Coriolis force
4) Euler force

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SetId=625

[1] If P and Q are the initial and the final points of a path of a particle,the displacement is the vector $\overrightarrow{PQ}$.

[2] The law of conservation of angular momentum states that The total angular momentum of a system is constant in both magnitude and direction if the resultant torque, of the external forces acting on the system, is zero.

[3] An example where law of conservation of angular momentum holds:
The Law of conservation of angular momentum holds in the case of a ballet dancer performing a pirouette.

When the dancer extends her arms outward, the angular velocity of her rotation decreases whereas when she keeps her arms close to her body, the angular velocity increases. This is because her moment of inertia changes as she moves her arms outward and inward. It can be noted that she as a system has no external torque acting upon her.

[4] In the Sun Earth system the angular momentum of the Earth is conserved in every frame of reference

[5] The projection of angular momentum of a conical pendulum in the horizontal plane is a constant of motion when the origin is chosen to be at fixed at the point of suspension.

SetId=625

[6] Let us consider a rotating skew rod. In the absence of friction or any other drag force, the rod should continuously spin without stopping. Here the net torque about the axis of rotation is 0 and hence angular momentum is conserved. It therefore follows from law of conservation of angular momentum that a spinning skew rod will keep rotating with constant angular velocity if there is no external torque. So law of conservation of angular momentum does not hold.

[7] Law of conservation of momentum does not hold when Newton's laws are not valid, e.g. in a non-inertial frame of reference. For example, when we consider collision between two bodies in a non-inertial frame of reference, the law of conservation of momentum cannot be applied because there will be a pseudo force acting on the frame itself.

[8] In order to apply the law of conservation of momentum we must first identify the system. If there is no *net external forces* acting on the system then conservation laws of momentum always holds. The total energy and the total angular momentum may not be conserved.

[9] A force whose work done is a path function is called a non-conservative force. All the forces which do not satisfy the definition of conservative forces are non-conservative

in nature. The work done by these forces dissipates into heat energy, sound energy, light energy, etc. Therefore, law of conservation of mechanical energy cannot be applied to a system on which a non-conservative force is acting. No potential function can be defined for these forces.

SetId=625

[10] For a particle moving on circle the acceleration is always constant in magnitude and directed towards the centre of the circle.

[11] Displacements, being vector quantity can not compared with, a scalar quantity such as distance.

[12] Assume bullet train, moving with out any jerks, is going on a circular arc of radius R with constant speed. Then an experiment is to be performed entirely within the train without any measurement on objects outside the train. Such an experiment can tell only speed of the track.

[13] During collision of billiard balls momentum is conserved. During explosion of a bomb also momentum is conserved and the total momentum of the fragments of bomb will be zero. This is because all the forces are only internal forces.

[14] The kinetic energy of a body does not change if any one of the following is true
(i)force is always perpendicular to the velocity
(ii) the force is always perpendicular to the acceleration
(iii) the object remains stationary
(iv) the object moves in such a way that the point of application of the force remains fixed.

SetId=625

[15] A force is any interaction which tends to change the motion of an object. It is also *defined* as rate of change of momentum.It is a vector quantity.

Pseudo-force is a fictitious force it is taken by an observer from non inertial frame of reference. This force arises from acceleration of reference frame that is a reference frame which is accelerating or rotating.

The equation of motion is then written by balancing all forces. As an example a particle moving in a circle is seen to be at rest by balancing the centripetal and centrifugal forces.

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SetId=626

[1] If two bodies starting from a point A reach a point B, following different paths, their displacement will be, in general different, but the distances covered will always be the same.

[2] If the net external torque acting on a system is zero,the angular momentum L(vector) of the system remains constant,no matter what changes take place within the system.L(vector)=a constant (net external torque acting on system is zero)

[3] In case of a skater, who can be considered an isolated system, so no torue will be acting on him/her. When the arms are extended, the moment of inertia is more. When his hands are closely held, the moment of inertia is lesser. Since the angular momentum is same, the angular acceleration changes accordingly.

[4] In the motion of earth around sun, the angular momentum of the earth about an axis passing through the sun and perpendicular to the plane of motion of earth is conserved.

[5] The law of angular momentum of a is not applicable for the conical pendulum conserved w.r.t. the origin fixed at the point of suspension. SetId=626

[6] In the example of skew rod the angular velocity does not change even though the torque applied is nonzero. However there is no contradiction as in this case the law of conservation of momentum is not applicable. conservation is violated.

[7] If I throw a ball upward, it's speed decreases as it rises upwards. There is an external force (gravity) acting on the ball, so the momentum conservation law does not apply. Momentum of the ball is not conserved, however the momentum of the Earth-ball system is conserved as gravity will become an internal force in this case.

[8] In order to apply the law of conservation of momentum we must first identify the system. Then even if there is no *net external forces* acting on the system, all the three conservation laws of momentum, angular momentum and energy may not hold due to presence of internal forces.

SetId=626

[9] *Non conservative forces* are the type of forces in which the work done by the forces is purely dependent on the path taken by the body.Thus the net work done by the forces in cyclic path is never equal to zero.

[10] The motion of a bomb dropped from a plane does is not a uniform motion as it follows a parabolic path and not a straight line path.

[11] Distance depends on the path where as the displacement depends on the end point only

[12] A particle is observed from two frames S_1 and S_2. The frame S_2 moves with respect to S_1 with an acceleration a. If F_1 and F_2 be the pseudoforces when seen from S_1 and S_2 respectively it is not possible to have $F_1 = F_2 = 0$

[13] Give an example where law of conservation of momentum holds: A mass exploding into several pieces in a conservative field like gravitational field(if air resistance is neglected), obeys law of conservation of momentum. If air resistance cannot be neglected then the law of conservation of momentum will not hold.

[14] The total work done on a particle is always equal to the change in kinetic energy. SetId=626

[15] A psuedo force is an apparent force that acts on all masses whose motion is described with respect to a non-inertial frame of reference like a rotating frame of reference. This force is needed by an observer in an non-inertial frame to make all the Newtons second laws to write correct equation of motion..

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SetId=627

[1] Displacement is equal to the vector difference $\vec{r}_f - \vec{r}_i$ of the position vectors of initial and final points. The distance covered will be $|\vec{r}_f - \vec{r}_i|$

[2] The Law of conservation of angular momentum states that when no external torque acts on an object or a closed system of objects undergoing motion about a given axis, the change in angular momentum is zero. Therefore, considering an event where only internal torque or no torque is involved, the total angular momentum of the system before the event is equal to the total angular momentum after the event

[3] Example where law of conservation of angular momentum holds:
Let us assume a student seated on a stool that can rotate freely about a vertical axis. The student has been set into rotation at a modest initial angular speed ω . He holds two dumbbells in his outstretched hands. His angular momentum vector L lies along the vertical rotation axis, pointing upwards. Now he pulls in his arms;this action reduces his rotational inertia from its value I_{initial} to a final value I_{final} because he moves the mass closer to the rotational axis. His rate of rotation increases markedly, from ω_{initial} to ω_{final}. The student can then slow down by extending his arms once more,moving the dumbbells outward. No external torque acts on the system consisting of the student, stool and the dumbbells. Thus the angular momentum of the system about the rotational axis remains constant. $I_{\text{initial}} * \omega_{\text{initial}} = I_{\text{final}} * \omega_{\text{final}}$.

[4] For the motion of earth around sun, the angular momentum of the earth about the center of mass of the sun + earth system and perpendicular to the plane of motion of earth is conserved.

[5] The law of angular momentum of a is not applicable for the conical pendulum conserved when the origin is chosen to be at the pendulum bob itself. SetId=627

[6] Example where law of conservation of angular momentum does not hold:If a particle undergoes conical motion and the only force acting on particle is central force like tension of the string.Then total external torque about fixed point A is zero,yet angular momentum is not conserved,as angular momentum keeps on changing direction.

[7] A soldier accelerating away, after detonating a bomb, will find that the total momentum of the fragments of the bomb is zero. This is an example where the law of conservation of momentum holds as the forces on the fragments are internal forces only and sum of all such forces is zero.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then check we should if the laws are applicable or not.

So if there is no *external force* acting on the system all the three quantities, total momentum, total angular momentum, and total kinetic energy will be conserved independent of the nature of forces.

[9] Non-conservative forces are path-dependent forces, i.e. the work done on a body by these forces depends on the path taken by the body. Mechanical energy of a system is not conserved when a conservative force acts on it but the total energy is conserved. Therefore, the mechanical energy lost by the system is liberated in some other form such as light energy, heat energy, etc.

For example, when a body is moving along a surface, frictional force acts on the body as well. Due to this frictional force, the body loses its mechanical energy, and this loss is generally released in the form of heat energy to the surroundings. Thus, the mechanical energy will not be conserved and frictional force can be classified as a non-conservative force. SetId=627

[10] A wagon sliding on a roller coaster designed in such a way that the wagon covers equal distances in equal times. As the motion of the wagon is uniform, there will be no net force acting on it.

[11] Distance equal to zero $\Rightarrow$ displacement=0; but Displacement=0

[12] A particle is observed from two frames S_1 and S_2. The frame S_2 moves with respect to S_1 with an acceleration a. If F_1 and F_2 be the pseudoforces when seen from S_1 and S_2 respectively and if $F_1 = 0$ then we must have $F_2 \neq 0$

[13] Also a good example of law of conservation momentum can be seen when a bullet from a rifle is fired.As the bullet is fired and gets out of the rifle, the rifle gives a backward jerk due to the phenomenon of conservation of momentum.

[14] A particle is acted upon by a force of constant magnitude which is always perpendicular to the velocity of the particle and the motion of the particle takes place in a plane, Then its kinetic energy, speed, velocity acceleration will not change. SetId=627

[15] One indication that pseudo forces are NON-NEWTONIAN is that they violate Newton's III law and violate the Newton's third law.

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SetId=628

[1] Distance is equal to the length of the path covered. Displacement is the shortest distance between initial and final points.

[2] The law of conservation of angular momentum states that when no external torque acts on an object or a closed system of objects, no change of angular momentum can occur. Hence, the angular momentum before an event involving only internal torques or no torques is equal to the angular momentum after the event . Angular momentum can be calculated with the help of the formula $L = I\omega$ where L stands for Angular momentum, I stands for moment of inertia and ω stands for angular velocity

[3] A bob is attached to ceiling by a string and moves in a horizontal circular plane is an example. In this case the law of conservation of angular momentum does not hold.

[4] In the Sun Earth system the angular momentum of the Earth about the pole star is conserved

[5] The three components of angular momentum of a conical pendulum is conserved w.r.t. the origin at the position of the center of mass of the pendulum. SetId=628

[6] A nonzero torque always causes the angular velocity to change, because a change in angular momentum means a change in angular velocity $L = I\omega$

[7] There is no known exception to the law of conservation of momentum in classical mechanics However, an exception to conservation of energy in nuclear physics is observed. In nuclear reactions when two nuclei collide and their mass converts to energy and energy momentum are not conserved.

[8] If we want to apply the conservation laws of momentum, energy and angular momentum, we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *external force* acting on the system, the momentum and angular momentum will be conserved, and depending on the nature of the forces but total energy may or may not be conserved.

[9] It is a force for which the work done by that force on an object or a particle in moving it between any two points depends on its path travelled.This force doesn't conserves the mechanical energy.The work done by a non-conservative force on an object in moving it in a circular path is not equal to zero.

SetId=628

[10] A simple pendulum moves along a circular arc and does not have constant speed and therefore its motion is not uniform.

[11] If P and Q are the initial and the final points of a path of a particle, displacement is a vector whose direction is along PQ and has magnitude is equal to the length of line PQ

[12] If K is an inertial frame, any frame that moves w.r.t. the frame K with uniform velocity is also an inertial frame.

[13] when a man walks on the ice slab where friction does not exist between the ice block and the floor but between the feet of the man and the slab the slab moves back as per the law of conservation of momentum

[14] The kinetic energy of a particle is continuously increasing with time, then the angle bewteen the net force and the velocity cannot be greater than or equal to 90^{o} at any time. SetId=628

[15] The apparent force which seems to act on an object in an accelerating frame of reference if we wish to describe the object's motion is called a pseudo force.Its a non-existent force used only to describe the motion completely using Newton's second law even though the agent causing the force is undefined.

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SetId=629

[1] Distance is a scalar quantity where as the displacement is a vector quantity.

[2] Newton's Second Law of Motion is defined by the expression $F = \frac{dp}{dT}$, where F gives the force vector acting on the system and p gives its momentum vector; in linear motion. A similar expression can be written to describe angular motion, i.e. : $\tau = \frac{dL}{dt}$, where τ is the external torque vector acting on the system, and L is the angular momentum.

If the external torque on the system is zero, then we get the expression as: dL/dt=0. This points out to the fact that, when no external torque is acting on the system, then its angular momentum is constant, no matter what changes occur in the system. This is the Law of Conservation Of Angular Momentum.

[3] Consider a disc rotating about an axis perpendicular to its plane. On placing a smaller disc with its surface parallel to the surface of the rotating disc, the angular momentum of the system of two discs remains constant as there is no external torque.

[4] For the motion of earth around sun, the angular momentum of the sun about the center of mass of the sun + earth system and perpendicular to the orbital plane of earth is conserved.

For the motion of earth around sun, the angular momentum of the sun about and axis passing through the Earth and perpendicular to the orbital plane of motion of earth is conserved.

[5] Only the z component of the angular momentum of a conical pendulum is conserved w.r.t. the origin fixed at the point of suspension. SetId=629

[6] A nonzero torque always implies change in angular momentum and may not give rise to a change in magnitude of angular velocity. A non zero torque may mean change only the direction of the angular momentum and not the angular velocity.

[7] In a system of a canon and a canon ball, total momentum of the system is zero before canon ball is fired. After firing the canon ball, the momentum of the system seems to be conserved as the ball moves forward and the canon moves backward.

[8] To apply the conservation laws of momentum, energy and angular momentum, we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *external force* acting on the system, the energy and momentum will be conserved. However, depending on the nature of the system and of the forces, the total angular momentum may not be conserved.

[9] Explain Nonconservative force: This force is just opposite to that of conservative force. The work done by this force depends on the path taken by the particle on which the force is applied.This force does not conserve mechanical energy.If a particle travels in a closed loop, the net work done by a non consevative force is non zero.

SetId=629

[10] A satellite goes around the earth in a circular orbit of 600km with a time period of $5.8 \times 10^3 s$. Its motion will be uniform as it will cover equal distances in equal times.

[11] If P and Q are the initial and the final points of a path of a particle,the displacement is the vector $\overrightarrow{PQ}$.

[12] If K is an inertial frame, any frame that moves w.r.t. the frame K with uniform speed is also an inertial frame.

[13] When a freely falling rigid body collides another body in its path momentum the system of two particles is not conserved in the collision as there is external force mg acting on the system.

[14] A heavy body is attached from a spring and is held at point A and is such that the spring is not slack nor is it stretched. It is then released. It goes down upto a point B and then it rises upto point C and executes an oscillatory motion between B and C. During the motion from A to C is first positive (from A to B) and then it is negative from B to A and again remains negative from A to C. SetId=629

[15] The physically apparent, but nonexistent, force needed by an observer in a noninertial frame to make Newton's laws of motion hold true is called pseudoforce.

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SetId=630

[1] The speed is rate of change of distance and the velocity is the rate of change of displacement.

[2] If the net external torque acting on a system is zero, the angular momentum L of the system remains constant, no matter what changes take place within the system.

$$\sum(T_{\text{ext}}) = \frac{dL}{dt}$$

The law states that when there is no net external torque, $\frac{dL}{dt}$ is zero implying that the total angular momentum of system is constant.

i.e. $L = a$ constant (isolated system)

[3] Consider a man standing on a spinning platform. Initially, the man spreads out his arms and he spins with a certain angular velocity. The next moment, he pulls his arms inwards keeping them close to his body. We will observe that the angular velocity with which he is spinning now increases. This phenomenon can be explained by the Law Of Conservation of Angular momentum. Initially, since his arms were spread wide, his moment of inertia was large. However, when he pulled them close to his body, his moment of inertia decreased.
In this example the angular velocity of the man increases and therefore the angular momentum also increases.The law of conservation of angular momentum does not apply because the torque of muscular forces is not zero.

[4] For the motion of earth around sun, the sum of angular momenta of the Sun and the Earth about the center of mass of the sun + earth system is conserved.

[5] The z component of angular momentum of a conical pendulum is not conserved w.r.t. the origin fixed at the point of suspension; but the x and y components are conserved. SetId=630

[6] In the example of a rotating skew rod the torque due to the external gravitational forces is zero , but the angular momentum is not constant Therefore the law of conservation of angular momentum is violated.

[7] When applying the conservation laws of momentum, energy and angular momentum we must define the system first.Only then check if the laws is applicable or not.

As an example: when a ball is dropped from a height, it gains momentum down if we consider the ball as our system.This is because the force of gravity acts as an external force.

However, if we change our system and consider earth as a part of our system too, then the momentum remains conserved because the earth gains momentum up.

[8] In order to apply the law of conservation of momentum we must first identify the system. If there is no *external forces* acting on the system then conservation laws of momentum always holds. And depending on the nature of the system and of the forces, the total kinetic energy and the total angular momentum may not be conserved.

[9] Non conservative force is the force in which the work done by a particle in going from one point to another is path dependent.

For non conservative forces mechanical energy is not conserved,mostly lost in the form of heat and light.The work done by a non conservative force is equal to the change in mechanical energy.

SetId=630 For non conservative force $E_{\text{initial}} > E_{\text{final}}$

[10] A uniform motion is defined to be the one in which a body covers equal distances in equal time intervals.

[11] If two bodies starting from a point A reach a point B, following different paths, their displacement will be, in general different, but the distances covered will always be the same.

[12] A frame rotating w.r.t K with uniform angular velocity is also an inertial frame.

[13] If we take some amount of a substance like construction putty, cement, cake batter, playing dough,etc and drop it on the ground, it does not bounce back, like a rubber ball would bounce, and hence the momentum it had before striking the ground seems to have been lost. Hence it appears that the law of conservation of linear momentum does not hold.

[14] The kinetic energy of a body does not change if any one of the following is true
(i)force is always perpendicular to the velocity
(ii) the force is always perpendicular to the acceleration
(iii) the object remains stationary
(iv) the object moves in such a way that the point of application of the force remains fixed. SetId=630

[15] Pseudo forces come into picture when Newton's laws of motion have to be applied to describe the motion of bodies in non-inertial frames. These forces have no real existence.

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[1] For any type of translational motion of a body, the displacement cannot be zero, where as the distance travelled can be zero.

[2] When the net external torque acting on a body or a system of bodies is zero about a particular axis, then the angular momentum of each body is conserved about that axis.

[3] In the Sun-Earth system, angular momentum of the earth is not conserved but the total angular momentum of the sun and the earth is constant of motion.

[4] For the motion of the Earth around the sun, the total of angular momenta of the Earth and the Sun, about in a reference frame fixed in the pole star, is conserved.

[5] Only the z component of angular momentum of a conical pendulum is conserved w.r.t. the origin fixed at the point of suspension. SetId=631

[6] In the example of skew rod, the angular momentum changes with time and there is a non zero torque coming from action of forces other than gravitational forces. Hence the law of conservation of angular momentum dos not apply.

[7] Statement: Law of Conservation of energy states that "ENERGY CAN NEITHER BE CREATED NOR DESTROYED",but it can be changed from one form to other.

EXPLANATION: Statement implies that the total amount of energy in an isolated system remains constant although it may change forms. viz, kinetic energy may change to potential;chemical to electrical energies etc.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then check if the laws is applicable or not.

So if there is no *net external force* acting on the system all the three conservation laws will hold.

[9] A force is said to be non-conservative, if the work done by the force is dependent on the path taken. It could also be defined as a force for which the work done during
SetId=631 a cyclic process is non-zero.

[10] A particle moves on a circular path. Then its speed, direction of force, velocity and acceleration must always change with time.

[11] Distance is equal to the length of the path covered. Displacement is the shortest distance between initial and final points.

[12] The Newton's Laws of motion will hold in all frames which are at rest w.r.t. K but do not remain valid in a frame that move with respect to K.

[13] When we consider collision between two bodies in a non-inertial frame of reference, the law of conservation of momentum cannot be applied because there will be a pseudo force acting on the frame itself.

[14] The total work done on a particle is always equal to the change in kinetic energy. SetId=631

[15] In a non-inertial frame of reference the accelration of the body that we measure, is not the true acceleration, as the frame itself accelerates.Thus,force(F=ma) is also not the true force acting on the body.The extra force added to make it a true value is called pseudo force.Thus pseudo force does not really act on a body but just compensates the change produced by the non inertial frame, in true acceleration.

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[1] Displacements, being vector quantity can not compared with, a scalar quantity such as distance.

[2] The law of conservation of angular momentum states that in absence of an external torque on an object or a closed system of objects the total angular momentum of the system remains constant. Thus if $\vec{\tau} = 0 => \vec{L} =$ constant where τ is the torque and $\vec{L}$ is the angular momentum of the system.

[3] Consider a disc and a man system. man is standing on center of the disc rotating with angular velocity.initially man folded his hand.when man stretches his hands then momentum of inertia of system increases.and angular velocity decreases.and total angular momentum remains constant.

[4] For the motion of the Earth around the sun, the total of angular momenta of the Earth and the Sun, is conserved in every inertial frame of reference; but the angular momentum of the Earth (or of the sun)is not conserved in every inertial frame.

[5] The projection of angular momentum of a conical pendulum in the horizontal plane is a constant of motion when the origin is chosen to be at fixed at the point of suspension. SetId=632

[6] In the example of conical pendulum, the z- component of angular momentum does not change. This follows from the angular momentum conservation as there is no external torque.

[7] Oscillating simple pendulum is a very good example where potential energy gets converted to kinetic energy and kinetic to potential energy. Some energy gets dissipated as heat if we consider air resistance. Energy as a whole is conserved if we consider universe as system, the energy has just changed its form.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then check we should if the laws are applicable or not.

So if there is no *external force* acting on the system all the three quantities, total momentum is conserved. The total angular momentum is also because the torque of internal forces will be zero. The conservation of energy depends on the nature of forces. will be conserved.

[9] a force is said to be non conservative if work done is dependent on the path of the particle.potential cannot be defined in the case of non conservative forces.work done in closed loop is not equal to zero.

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[10] A particle moves on a circular path. Then its speed, direction offorce, can remain constant by velocity and acceleration must always change with time.

[11] Distance is a scalar quantity where as the displacement is a vector quantity.

[12] Staying inside a bullet train moving with constant velocity (no jerks etc) an experiment can always be performed which will tell us the numerical velocity of the bullet train

[13] When a system is acted upon by external forces like friction etc, the conservation principle does not hold good,there will be impulse imparted and so we cant conserve momentum. This is case when a collision between two elastic balls take place on a rough horizontal table. The total momentum just after the collision will be different from the total momentum just before the collision. Here momentum is not conserved as there is external force friction is present.

[14] A particle is acted upon by a force of constant magnitude which is always perpendicular to the velocity of the particle and the motion of the particle takes place in a plane, Then its kinetic energy, speed, velocity acceleration will not change. SetId=632

[15] A force is any interaction which tends to change the motion of an object. It is *equal to* the rate of change of momentum by Newton's second law.

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[1] Distance depends on the path where as the displacement depends on the end point only.

[2] If no net external torque acts on a system, the total angular momentum of the system remains constant.

[3] The conservation of angular momentum of a system of bodies requires that the the sum of torque due to all forces be equal to zero. Now consider a situation where the forces are such that the sum of torques of external forces is zero w.r.t. some axes K. Since the value of torque depends of the choices of axes, the sum of torques due to all internal forces will depend on the choice of axes and in general it will be non zero. Therefore, for a system of several bodies, for a given choice of axes K, there will be situations when the total angular momentum may not be conserved.

[4] In the Sun Earth system the angular momentum of the Earth is conserved in every frame of reference

[5] The law of angular momentum of a is not applicable for the conical pendulum conserved w.r.t. the origin fixed at the point of suspension. SetId=633

[6] In the example of conical pendulum, the x and$y$ components of angular momentum change. This follows from the angular momentum conservation as the z components external torque is zero and horizontal components of torque are non zero.

[7] Law of conservation of momentum does not hold whenever an external force or impulse acts on the system. For example,when a body collides with earth then it bounces back to a lesser height as it loses some velocity.

In this example the momentum of a ball is not conserved due to impulsive force by ground in the normal direction.

However, strictly speaking the system that should be considered here is the ball-earth system and the total momentum is conserved.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *net external force* acting on the system, the momentum is conserved. The definition of angular momentum and torque depends on the choice of axes, and therefore it may not be be conserved. The conservation of total energy holds only for conservative forces.

When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *net external force* acting on the system, the energy and momentum will be conserved. However, the total angular momentum may not be conserved because the torque may not be zero.

[9] Explain Nonconservative Forces:

The forces that depend on the path taken by the particle are called non-conservative forces.

Mechanical energy is not conserved during the action of a non conservative force, instead, it is lost as other forms of enery like heat, light, etc.

Potential energy is not defined for a non-conservative force.

The initial and final kinetic energy in a closed loop is not equal.

The work done by a non conservative force in a closed loop is non zero. In practice, the net work is invariably negative.

Work done by a non conservative force cannot be completely recovered.

For a non conservative force,

$$/text(KE)//_f//+(\mathrm{PE})//_f// = (\mathrm{KE})_i+(\mathrm{PE})_i//+//\text{Work Done})//\text{non-conservative force}//$$

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[10] A particle moves on a circular path. Then under suitable conditions its speed may remain constant, but the force, velocity and acceleration must always change with time.

[11] Both displacement and distance tell us about the motion of a body but their study does not tell much about the forces on the body

[12] Staying inside a bullet train moving with constant velocity (no jerks etc) an experiment can always be performed which will tell us the numerical value of the acceleration of the bullet train

[13] When we are in accelerating frame if we observe any collision between two bodies then the law of conservation of momentum does not hold in that frame of reference. On the other hand the law of conservation of momentum holds in all inertial frames.

[14] The kinetic energy of a particle is continuously increasing with time, then the angle bewteen the net force and the velocity cannot be greater than or equal to 90^{o} at any time. SetId=633

[15] Newton's laws are not valid on non-inertial frame of reference. So to validate Newton's laws of motion pseudo force (fictious or virtual force) is introduced.
Pseudo force acts in non-inertial frame. Its magnitude is always mass of the body multiplied by acceleration of the frame. It is always in direction opposite to the acceleration of the frame of reference. The resultant of pseudo forces and real forces is always zero.

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[1] Distance equal to zero implies displacement=0; and Displacement=0 also implies distance = 0

[2] The law of conservation of angular momentum states that when no external torque is applied on an object or a closed system of objects about an axis, the angular momentum about that axis remains constant.

[3] Example where law of conservation of angular momentum does not hold:
When there is external force like frictional force acting on a object when it is rotating we cannot use conservation of angular momentum as the friction force acting on the object produces an external torque.

[4] In the motion of earth around sun, the angular momentum of the earth about an axis passing through the sun and perpendicular to the plane of motion of earth is conserved.

[5] The law of angular momentum of a is not applicable for the conical pendulum conserved when the origin is chosen to be at the pendulum bob itself. SetId=634

[6] Example where law of conservation of angular momentum does not hold: A disc rotating on a horizontal rough surface will not have a constant angular momentum because there will be a constant torque by frictional force. Hence, its angular momentum will decrease, and the law of conservation of angular momentum does not apply.

[7] If a bullet hits a wooden board and gets embedded in the board, the total energy and the total momentum of the bullet and the board are conserved.

[8] In order to apply the law of conservation of momentum we must first identify the system. If there is no *net external forces* acting on the system then conservation laws of momentum always holds. The total energy and the total angular momentum may not be conserved.

[9] A non conservative force is one where the mechanical energy is not conserved.Here the work done is dependent on the path taken .Different amounts of work need to be done in different paths.Here potential energy would have no meaning as it would keep changing with the path.Here some amount of mechanical energy is lost as sound energy or heat energy and hence is not conserved.

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[10] A particle moves on a circular path. Then under suitable conditions its speed and acceleration may remain constant, but the force, and velocity must always change with time.

[11] Displacement is the shortest distance between initial and final points with direction specified.

[12] Assume bullet train, moving with out any jerks, is going on a circular arc of radius R with constant speed. Then an experiment is to be performed entirely within the train without any measurement on objects outside the train. Such an experiment can tell only radius of the track.

[13] When a freely falling body hits another rigid body in its path then momentum is not conserved as external force mg acts on both the bodies. The total momentum after the collision will be different from the total momentum before the hit.

[14] A heavy body is attached from a spring and is held at point A and is such that the spring is not slack nor is it stretched. It is then released. It goes down upto a point B and then it rises upto point C and executes an oscillatory motion between B and C. During the motion from A to C is first positive (from A to B) and then it is negative from B to A and again remains negative from A to C. SetId=634

[15] These forces are non-real forces but must be taken into account while applying Newton's Law's of Motion in accelerating frame of reference as compared to an inertial frame of reference.

The centrifugal and centripetal forces are examples of pesudo-forces.

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[1] If P and Q are the initial and the final points of a path of a particle, displacement is a vector whose direction is along PQ and has magnitude is equal to the length of line PQ

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[2] The angular momentum of a given system of bodies shall remain conserved unless acted upon by an external unbalanced torque.

[3] A bob attached to a ceiling by a string moving in a horizontal circular plane is an example where the total angular momentum of the bob about the point of suspension is not conserved. This is because the the torque due to the weight of the bob about the point of suspension does not vanish and has non zero horizontal component. Only the vertical component of the angular component is conserved.

[4] For the motion of earth around sun, the angular momentum of the earth about the center of mass of the sun + earth system and perpendicular to the plane of motion of earth is conserved.

[5] The three components of angular momentum of a conical pendulum is conserved w.r.t. the origin at the position of the center of mass of the pendulum.

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[6] Example where law of conservation of angular momentum does not hold:Consider a vertical stick on the ground falling to a horizontal position. During the fall, the conservation of angular momentum applied at the point of rotation on the ground and perpendicular to the plane of the stick is not applicable as, the gravitational force which acts vertically downwards assumed at the centre of mass produces an external torque about the axis of rotation

[7] If a bullet hits a wooden board and gets embedded in the board, the total energy of the bullet and the board system is conserved but the total momentum is not conserved.

[8] In order to apply the law of conservation of momentum we must first identify the system. Then even if there is no *net external forces* acting on the system, all the three conservation laws of momentum, angular momentum and energy may not hold due to presence of internal forces.

[9] The force whose work depends on path taken is called a non conservative force.friction for example does less work on a book dragged across a table if the book is dragged straight across than if the book is dragged in a curved path.

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[10] When the force is kept constant as function of time, it is possible for a particle to move on a circular path in such a way that its speed remains constant, but the velocity and acceleration must always change with time.

[11] Displacements, being vector quantity can not compared with, a scalar quantity such as distance.

[12] Assume bullet train, moving with out any jerks, is going on a circular arc of radius R with constant speed. Then an experiment is to be performed entirely within the train without any measurement on objects outside the train. Such an experiment can tell both speed of the train and radius of the track.

[13] .The law of conservation of momentum does not hold good when net external forces acting on the system is not zero.when two bodies collide law of conservation of momentum is applicable on system of two bodies but on not individual bodies because external impulse acts on them.

[14] The kinetic energy of a body does not change if any one of the following is true
(i)force is always perpendicular to the velocity
(ii) the force is always perpendicular to the acceleration
(iii) the object remains stationary
(iv) the object moves in such a way that the point of application of the force remains fixed. SetId=635

[15] When observing our system from a reference frame which is accelerating compared to an inertial frame,in order to make it easier to apply newtons laws, we can apply a pseudo force on all objects in the universe proportional to their mass capable of causing an acceleration equal and opposite to that of our reference frame. Hence serving to in a way "stop"(or make inertial) our reference frame, and making it easier for us to investigate the motion.

This application of pseudo force doesn't change the motion of the object because just as we can choose an arbitrary reference frame, we can choose an arbitrary force to cause the same acceleration in every object in the whole universe without changing the relative motions of objects. (as all motion is truly relative, we will still get correct answers for our investigations.

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[1] If P and Q are the initial and the final points of a path of a particle,the displacement is the vector $\overrightarrow{PQ}$.

[2] When the net external torque acting on a system about a given axis is zero, the total angular momentum of the system about that axis remains consant.

[3] Law of conservation of angular momentum holds in case of long jump. When a athlete takes off from the ground in a running long jump, the forces on the launching foot give the athlete an angular momentum with a forward rotation around a horizontal axis. Such rotation would not allow the jumper to land properly. In the landing, the legs should be together and extended forward at an angle so that the heels mark the sand at the greatest distance. Once airborne, the angular momentum cannot change (it is conserved) because no external torque acts to change it. However, the jumper can shift most of the angular momentum to the arms by rotating them in windmill fashion. Then the body remains upright in the proper orientation of landing.

[4] In the Sun Earth system the angular momentum of the Earth about the pole star is conserved

[5] Only the z component of the angular momentum of a conical pendulum is conserved w.r.t. the origin fixed at the point of suspension.

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[6] We have a conical pendulum .The forces acting on the bob are tension (along the direction of the string) and gravitational force acting in the vertically downward direction.we have an additional force called the drag force which is tangential to the motion of the bob and acts in the direction opposite to the motion of the bob.The axis of rotation passes through the hinge point and is vertical.The torque due to tension is 0 because the force passes through the axis of rotation.The torque due to mg is also zero since it is parallel to the axis of rotation.but the torque due to drag force is not zero.since the net external torque acting on the bob is not zero,therefore the law of conservation of angular momentum does not hold here

[7] If a bullet hits a wooden board and gets embedded in the board, both total energy and the total momentum of the bullet and the board are not conserved.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then check we should if the laws are applicable or not.

So if there is no *external force* acting on the system all the three quantities, total momentum, total angular momentum, and total kinetic energy will be conserved independent of the nature of forces.

[9] ** Nonconservative force is a force in which the amount of work done by the force is dependent of the path taken to change a state of a system.

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[10] It is not possible for a particle to move on a circular path in such a way that its speed and force remains constant, and only the velocity and acceleration may (or may not) always change with time.

[11] Distance depends on the path where as the displacement depends on the end point only

[12] Assume bullet train, moving with out any jerks, is going on a circular arc of radius R with constant speed. Then an experiment is to be performed entirely within the train without any measurement on objects outside the train. Such an experiment can tell only speed of the track.

[13] A block moving in the air breaks up into two parts and the parts separate, then the total momentum must be the same before and after the break.

[14] The total work done on a particle is always equal to the change in kinetic energy.

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[15] Various types of forces in nature can be grouped in four categories:
(a)Gravitational; (b)Electromagnetic; (c)Nuclear; (d)Weak
There are also some non-fundamental forces such as:
(i)Normal reaction on bodies in contact with surfaces , (ii) Friction,(iii) Tension,(iv)Elastic force.

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[1] If two bodies starting from a point A reach a point B, following different paths, their displacement will be, in general different, but the distances covered will always be the same.

[2] This law sates that when no net torque of all forces acts on a object or a system of objects then total angular momentum of system is conserved.The angular momentum before an event is equal to angular momentum after that event.mathematically explained by when, net torque=0 ;then, total angular momentum(L)=constant.

[3] The total angular momentum of a body remains constant of motion when the net torque of the external forces acting on the body is zero.
In general, we have a system of particles such that the net torque of the external forces on the system, w.r.t. some axes K, is zero, the total angular momentum may not remain conserved, because the torque due to the internal forces may not be zero.

[4] For the motion of earth around sun, the angular momentum of the sun about the center of mass of the sun + earth system and perpendicular to the orbital plane of earth is conserved.

For the motion of earth around sun, the angular momentum of the sun about and axis passing through the Earth and perpendicular to the orbital plane of motion of earth is conserved.

[5] The z component of angular momentum of a conical pendulum is not conserved w.r.t. the origin fixed at the point of suspension; but the x and y components are conserved. SetId=637

[6] When you release a toy gyroscope on its pedestal, it initially has no precessional rotation around that pedestal, i.e, the orientation of rotation is fixed. However, it instantaneously starts precessing around the pedestal. Both Kinetic Energy and Angular Momentum now exist where they did not exist a moment earlier. The Kinetic Energy is easy to explain, as appearing due to the body of the gyroscope dropping a tiny fraction of a millimeter in the Earth's gravitational field, giving up exactly the correct amount of Potential Energy. But the Angular Momentum of the Precession which just appeared, does not come from anywhere. This is therefore a Violation of the Conservation of Angular Momentum.

[7] There are certain situations where it appears that the law of conservation of linear momentum does not hold. For example if we take some amount of a substance like construction putty, cement, cake batter, playing dough,etc and drop it on the ground, it does not bounce back like a rubber ball would and hence the momentum it had before striking the ground seems to have been lost. Hence it appears that the law of conservation of linear momentum does not hold.

[8] If we want to apply the conservation laws of momentum, energy and angular momentum, we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *external force* acting on the system, the momentum and angular momentum will be conserved, and depending on the nature of the forces but total energy may or may not be conserved.

[9] Nonconservative force is any force where the work done by the force on the object depends on the path of motion of the object.the work done by the frictional force results in to loss of the energy of the system in the form of heat or other form of energy.

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[10] For a particle moving on circle the acceleration is always constant in magnitude and directed towards the centre of the circle.

[11] Distance equal to zero $\Rightarrow$ displacement=0; but Displacement=0

[12] A particle is observed from two frames S_1 and S_2. The frame S_2 moves with respect to S_1 with an acceleration a. If F_1 and F_2 be the pseudoforces when seen from S_1 and S_2 respectively it is not possible to have $F_1 = F_2 = 0$

[13] A ball hits the floor and rebounds after an inelastic collision. In this case the total momentum of the ball before and after the collsion is conserved. Also the total enrgy of the ball and the earth remains the same

[14] A particle is acted upon by a force of constant magnitude which is always perpendicular to the velocity of the particle and the motion of the particle takes place in a plane, Then its kinetic energy, speed, velocity acceleration will not change.

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[15] A force is agency that which changes or tends to change the state of rest or motion of a body.

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[1] Displacement is equal to the vector difference $\vec{r}_f - \vec{r}_i$ of the position vectors of initial and final points. The distance covered will be $|\vec{r}_f - \vec{r}_i|$

[2] Statement of Law of Conservation of Angular Momentum:
Differentiating $\vec{L} = \vec{r} \times \vec{p}$ w.r.t, time,

$$\begin{aligned} \frac{dL}{dt} &= \frac{d\vec{r} \times \vec{p}}{dt} = \frac{d\vec{r}}{dt} \times \vec{p} + \vec{r} \times \frac{d\vec{p}}{dt} = \vec{v} \times (m\vec{v}) + \vec{r} \times \vec{F} \\ &= \vec{r} \times \vec{F} (\because v \times v = 0) \\ &= \vec{\tau} \end{aligned}$$

here $\vec{\tau}$ represents the net torque acting on a rigid body rotating about a fixed axis.This torque must take into account of all the forces, be it external or internal forces

[3] An example where law of conservation of angular momentum holds:
The Law of conservation of angular momentum holds in the case of a ballet dancer performing a pirouette.

When the dancer extends her arms outward, the angular velocity of her rotation decreases whereas when she keeps her arms close to her body, the angular velocity increases. This is because her moment of inertia changes as she moves her arms outward and inward. It can be noted that she as a system has no external torque acting upon her.

[4] For the motion of earth around sun, the sum of angular momenta of the Sun and the Earth about the center of mass of the sun + earth system is conserved.

[5] Only the z component of angular momentum of a conical pendulum is conserved w.r.t. the origin fixed at the point of suspension. SetId=638

[6] There is no case where LAW OF CONSERVATION OF ANGULAR MOMENTUM does'nt hold.But there are cases where conservation of angular momentum does not hold.A body in vertical circular motion is an example where angular momentum is not conserved. Here the law of conservation does not apply.

[7] A tennis ball is dropped from height h and after hitting the ground and it bounces back and rises to the same height. In this case the momentum of the ball is conserved because (under ideal conditions) the momentum after it hits the ground will be equal to the momentum it had before hitting the ground.

[8] To apply the conservation laws of momentum, energy and angular momentum, we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *external force* acting on the system, the energy and momentum will be conserved. However, depending on the nature of the system and of the forces, the total angular momentum may not be conserved.

[9] nonconservative force is any force ,where the work done by the force depends on the path of motion of the body.The work done by such a force is equal to the change in mechanical energy of the system.Energy mostly observed to be lost in form of heat, by the action of non conservative force.

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[10] The motion of a bomb dropped from a plane does is not a uniform motion as it follows a parabolic path and not a straight line path.

[11] If P and Q are the initial and the final points of a path of a particle, displacement is a vector whose direction is along PQ and has magnitude is equal to the length of line PQ

[12] A particle is observed from two frames S_1 and S_2. The frame S_2 moves with respect to S_1 with an acceleration a. If F_1 and F_2 be the pseudoforces when seen from S_1 and S_2 respectively and if $F_1 = 0$ then we must have $F_2 \neq 0$

[13] In a head on elastic collision of two identical bodies of equal masses the velocities, the speeds, the momenta and the kinetic energy are all exchanged.

[14] The kinetic energy of a particle is continuously increasing with time, then the angle bewteen the net force and the velocity cannot be greater than or equal to 90^o at any time. SetId=638

[15] The forces may be of the following two types - *Contact forces* (those that act when bodies are in physical contact) eg. friction, normal reaction, bouyancy etc. and*Action-at-a-distance forces* (those that act when bodies are not in contact) eg. Gravity, electostatic forces, magnetic forces etc. There At the root level, forces are of the following fundamental types :- (a) *Gravitational forces* - weakest of all forces, always attractive
(b) *Electromagnetic forces* - stronger than gravitational forces, can be attractive or repulsive,
(c) *Nuclear forces* - exist at atomic level, have very short range,
(d) *Weak nuclear forces* associated with beta particle emission

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[1] Distance is equal to the length of the path covered. Displacement is the shortest distance between initial and final points.

[2] Statement of Law of Conservation of Angular Momentum: For a system of many particles The net torque due all the forces, be it external or internal forces. But as the torque due to all the internal forces cancel out, it sufficient to consider the external forces acting on the system.

[3] In case of a skater, who can be considered an isolated system, so no torue will be acting on him/her. When the arms are extended, the moment of inertia is more. When his hands are closely held, the moment of inertia is lesser. Since the angular momentum is same, the angular acceleration changes accordingly.

[4] For the motion of the Earth around the sun, the total of angular momenta of the Earth and the Sun, about in a reference frame fixed in the pole star, is conserved.

[5] The projection of angular momentum of a conical pendulum in the horizontal plane is a constant of motion when the origin is chosen to be at fixed at the point of suspension.

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[6] A sphere rolling on a rough surface.Due to friction there is external torque so the angular momentum changes which results in the slowing of the sphere. The angular momentum keeps changing. Even in case like this one, it is wrong to say that the Law of Angular Momentum Conservation does not hold.

[7] Law of conservation of momentum does not hold when Newton's laws are not valid, e.g. in a non-inertial frame of reference. For example, when we consider collision between two bodies in a non-inertial frame of reference, the law of conservation of momentum cannot be applied because there will be a pseudo force acting on the frame itself.

[8] In order to apply the law of conservation of momentum we must first identify the system. If there is no *external forces* acting on the system then conservation laws of momentum always holds. And depending on the nature of the system and of the forces, the total kinetic energy and the total angular momentum may not be conserved.

[9] The work done by a "non-conservative" force does depend on the path taken. Non-conservative forces cannot be associated with a potential energy. If some of the internal forces of a system are non-conservative, the mechanical energy of the system is not constant.Work-energy theorem is valid even in the presence of some non-conservative forces.

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[10] A wagon sliding on a roller coaster designed in such a way that the wagon covers equal distances in equal times. As the motion of the wagon is uniform, there will be no net force acting on it.

[11] If P and Q are the initial and the final points of a path of a particle,the displacement is the vector $\overrightarrow{PQ}$.

[12] If K is an inertial frame, any frame that moves w.r.t. the frame K with uniform velocity is also an inertial frame.

[13] For a system of several particles the conservation of total linear momentum is equivalent to the statement that their centre of mass moves like a free particle.

[14] A heavy body is attached from a spring and is held at point A and is such that the spring is not slack nor is it stretched. It is then released. It goes down upto a point B and then it rises upto point C and executes an oscillatory motion between B and C. During the motion from A to C is first positive (from A to B) and then it is negative from B to A and again remains negative from A to C. SetId=639

[15] The main differences between force and pseudo force are -
(1) Forces have a real presence while pseudo forces don't.
(2) Forces can be accounted for by Newton's laws.
(3) Pseudo forces are only taken into account when the reference frame is accelerated.

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[1] Distance is a scalar quantity where as the displacement is a vector quantity.

[2] Depending on the torques acting on a system, the angular momentum can be conserved only in one or two directions, but may not be conserved in all. For instance, if an isolated body has no torque acting on it only in the direction along the Z axis, then the angular momentum is conserved only in that direction.

[3] Example where law of conservation of angular momentum holds:
Let us assume a student seated on a stool that can rotate freely about a vertical axis. The student has been set into rotation at a modest initial angular speed ω . He holds two dumbbells in his outstretched hands. His angular momentum vector L lies along the vertical rotation axis, pointing upwards. Now he pulls in his arms;this action reduces his rotational inertia from its value I_{initial} to a final value I_{final} because he moves the mass closer to the rotational axis. His rate of rotation increases markedly, from ω_{initial} to ω_{final}. The student can then slow down by extending his arms once more,moving the dumbbells outward. No external torque acts on the system consisting of the student, stool and the dumbbells. Thus the angular momentum of the system about the rotational axis remains constant. $I_{\text{initial}} * \omega_{\text{initial}} = I_{\text{final}} * \omega_{\text{final}}$.

[4] For the motion of the Earth around the sun, the total of angular momenta of the Earth and the Sun, is conserved in every inertial frame of reference; but the angular momentum of the Earth (or of the sun)is not conserved in every inertial frame.

[5] The law of angular momentum of a is not applicable for the conical pendulum conserved w.r.t. the origin fixed at the point of suspension. SetId=640

[6] Consider a rod of length l. Let us give an impulse to one end . Now the angular momentum about the oposite end is not zero since the impulse provides some torque . So the angular momentum is not conserved .

$$\text{torque} = \text{impulse} * \ell.$$

$d\ell/dt$ is not equal to zero and the law of conservation of angular momentum does not hold.

[7] If I throw a ball upward, it's speed decreases as it rises upwards. There is an external force (gravity) acting on the ball, so the momentum conservation law does not apply. Momentum of the ball is not conserved, however the momentum of the Earth-ball system is conserved as gravity will become an internal force in this case.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then check if the laws is applicable or not.

So if there is no *net external force* acting on the system all the three conservation laws will hold.

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[9] Non conservative forces are forces with the property that the work done by the force in moving a particle between two points is dependent on the path taken.Also the work done over a closed loop is not zero.Defining of scalar potential is not possible in case of non conservative forces because the change in potential energy between two points will depend on path taken.

[10] A simple pendulum moves along a circular arc and does not have constant speed and therefore its motion is not uniform.

[11] If two bodies starting from a point A reach a point B, following different paths, their displacement will be, in general different, but the distances covered will always be the same.

[12] If K is an inertial frame, any frame that moves w.r.t. the frame K with uniform speed is also an inertial frame.

[13] The total mechanical energy of a system may not be conserved if there are no external forces and the internal forces are conservative.

[14] The kinetic energy of a body does not change if any one of the following is true
(i)force is always perpendicular to the velocity
(ii) the force is always perpendicular to the acceleration
(iii) the object remains stationary
(iv) the object moves in such a way that the point of application of the force remains fixed.

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[15] A force is any interaction which tends to change the motion of an object. It is also *defined* as rate of change of momentum. It is a vector quantity.

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[1] The speed is rate of change of distance and the velocity is the rate of change of displacement.

[2] According to Law of Conservation of Angular momentum,if no external torque acts on an object or system of objects,angular momentum of an object or system of objects remains CONSTANT or no change in angular momentum can occur.

Also it states that,only external torque can change angular momentm of the system where as the torque produced by internal forces can not change the angular momentum of the system

[3] A bob is attached to ceiling by a string and moves in a horizontal circular plane is an example. In this case the law of conservation of angular momentum does not hold.

[4] In the Sun Earth system the angular momentum of the Earth is conserved in every frame of reference

[5] The law of angular momentum of a is not applicable for the conical pendulum conserved when the origin is chosen to be at the pendulum bob itself.

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[6] Let us consider a rotating skew rod. In the absence of friction or any other drag force, the rod should continuously spin without stopping. Here the net torque about the axis of rotation is 0 and hence angular momentum is conserved. It therefore follows from law of conservation of angular momentum that a spinning skew rod will keep rotating with constant angular velocity if there is no external torque. So law of conservation of angular momentum does not hold.

[7] A soldier accelerating away, after detonating a bomb, will find that the total momentum of the fragments of the bomb is zero. This is an example where the law of conservation of momentum holds as the forces on the fragments are internal forces only and sum of all such forces is zero.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then check we should if the laws are applicable or not.

So if there is no *external force* acting on the system all the three quantities, total momentum is conserved. The total angular momentum is also because the torque of internal forces will be zero. The conservation of energy depends on the nature of forces. will be conserved.

[9] A non conservative force is the force with the property that the work done in moving a particle between two points is dependent of the path taken.If a particle travels in a closed path, the net work done(the some of the forces acting along the path multiplied by the distance travelled) by a non conservative force is non zero. When an object

moves from one location to another, the force changes the potential energy of the object by an amount that depends on the path taken.Non conservative force depends only on the path followed by the object.

SetId=641

[10] A satellite goes around the earth in a circular orbit of 600km with a time period of $5.8 \times 10^3 s$. Its motion will be uniform as it will cover equal distances in equal times.

[11] Distance is equal to the length of the path covered. Displacement is the shortest distance between initial and final points.

[12] A frame rotating w.r.t K with uniform angular velocity is also an inertial frame.

[13] When a bullet fired on a wooden block, some energy is transferred to the block and the total mechanical energy of the block and the bullet is conserved.

[14] The total work done on a particle is always equal to the change in kinetic energy.

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[15] Explain Pseudo Force: While applying Newton's laws of motion in non-inertial frame of reference it gives answers which contradict observations. Thus, to account for this,using Newton's Laws, we introduce a "fake" or pseudo force which gives answers that match the observations in a non-inertial frame.

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[1] For any type of translational motion of a body, the displacement cannot be zero, where as the distance travelled can be zero.

[2] The law of conservation of angular momentum states that when the net external torque acting on the system is zero, then the angular momentum of the system remains constant.both the initial and final momentum should be taken from a fixed inertial frame of reference provided.

[3] Consider a disc rotating about an axis perpendicular to its plane. On placing a smaller disc with its surface parallel to the surface of the rotating disc, the angular momentum of the system of two discs remains constant as there is no external torque.

[4] In the motion of earth around sun, the angular momentum of the earth about an axis passing through the sun and perpendicular to the plane of motion of earth is conserved.

[5] The three components of angular momentum of a conical pendulum is conserved w.r.t. the origin at the position of the center of mass of the pendulum. SetId=642

[6] In the example of skew rod the angular velocity does not change even though the torque applied is nonzero. However there is no contradiction as in this case the law of conservation of momentum is not applicable. conservation is violated.

[7] There is no known exception to the law of conservation of momentum in classical mechanics However, an exception to conservation of energy in nuclear physics is observed. In nuclear reactions when two nuclei collide and their mass converts to energy and energy momentum are not conserved.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *net external force* acting on the system, the momentum is conserved. The definition of angular momentum and torque depends on the choice of axes, and therefore it may not be be conserved. The conservation of total energy holds only for conservative forces.

When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *net external force* acting on the system, the energy and momentum will be conserved. However, the total angular momentum may not be conserved because the torque may not be zero.

[9] In this type of force the work done depends on the path taken by the body.Mechanical energy is not conserved in the system if non conservative force acts on it.

SetId=642

[10] A uniform motion is defined to be the one in which a body covers equal distances in equal time intervals.

[11] Distance is a scalar quantity where as the displacement is a vector quantity.

[12] The Newton's Laws of motion will hold in all frames which are at rest w.r.t. K but do not remain valid in a frame that move with respect to K.

[13] When a moving car hits a parked lorry and causes the parked lorry to move ,energy is transferred from moving the car to the lorry and the total energy of the lorry and the car is conserved.

[14] A particle is acted upon by a force of constant magnitude which is always perpendicular to the velocity of the particle and the motion of the particle takes place in a plane, Then its kinetic energy, speed, velocity acceleration will not change.

SetId=642

[15] When a train is at rest and a ball is hung from the ceiling with a string, an observer in the train sees that the string is vertical. But when the train starts moving, the observer sees that the string makes an angle with the vertical and is tilted in forward direction . This means that some force other than gravity and tension must act on the ball. That force is the pseudo force.

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[1] Displacements, being vector quantity can not compared with, a scalar quantity such as distance.

[2] The law of conservation of angular momentum states that The total angular momentum of a system is constant in both magnitude and direction if the resultant torque, of the external forces acting on the system, is zero.

[3] Consider a man standing on a spinning platform. Initially, the man spreads out his arms and he spins with a certain angular velocity. The next moment, he pulls his arms inwards keeping them close to his body. We will observe that the angular velocity with which he is spinning now increases. This phenomenon can be explained by the Law Of Conservation of Angular momentum. Initially, since his arms were spread wide, his moment of inertia was large. However, when he pulled them close to his body, his moment of inertia decreased.
In this example the angular velocity of the man increases and therefore the angular momentum also increases.The law of conservation of angular momentum does not apply because the torque of muscular forces is not zero.

[4] For the motion of earth around sun, the angular momentum of the earth about the center of mass of the sun + earth system and perpendicular to the plane of motion of earth is conserved.

[5] Only the z component of the angular momentum of a conical pendulum is conserved w.r.t. the origin fixed at the point of suspension.

SetId=643

[6] Example where law of conservation of angular momentum does not hold:If a particle undergoes conical motion and the only force acting on particle is central force like tension of the string.Then total external torque about fixed point A is zero,yet angular momentum is not conserved,as angular momentum keeps on changing direction.

[7] In a system of a canon and a canon ball, total momentum of the system is zero before canon ball is fired. After firing the canon ball, the momentum of the system seems to be conserved as the ball moves forward and the canon moves backward.

[8] In order to apply the law of conservation of momentum we must first identify the system. If there is no *net external forces* acting on the system then conservation laws of momentum always holds. The total energy and the total angular momentum may not be conserved.

[9] A force is said to be a non-conservative force if the work done by the force in a closed path is non-zero;(i.e) the cyclic integral of the work done is non-zero.

Work done by a non-conservative force is equal to change in total energy of the system.Work-Energy theorem is not applicable in the case of a non-conservative

force.Work done by conservative force depends on the path.It differs with the paths taken by the partical even if the initial and final points are same.In case of non-conservative forces,the total mechanical energy is not constant as the energy is dissipated in various forms such as heat energy,sound energy,etc and cannot be recovered.

SetId=643

[10] A particle moves on a circular path. Then its speed, direction of force, velocity and acceleration must always change with time.

[11] Both displacement and distance tell us about the motion of a body but their study does not tell much about the forces on the body

[12] Staying inside a bullet train moving with constant velocity (no jerks etc) an experiment can always be performed which will tell us the numerical velocity of the bullet train

[13] When a bomb explodes the total mechanical energy is not conserved. But the total chemical energy and the mechanical energy is conserved.

[14] The kinetic energy of a particle is continuously increasing with time, then the angle bewteen the net force and the velocity cannot be greater than or equal to 90^{o} at any time.

SetId=643

[15] Since newton's laws are not valid in non-inertial frames, pseudoforces (which do not exist in reality) are used to help us formualate and use Newton's laws of motion in non-inertial frames.

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[1] Distance depends on the path where as the displacement depends on the end point only.

[2] If the net external torque acting on a system is zero,the angular momentum L(vector) of the system remains constant,no matter what changes take place within the system.L(vector)=a constant (net external torque acting on system is zero)

[3] In the Sun-Earth system, angular momentum of the earth is not conserved but the total angular momentum of the sun and the earth is constant of motion.

[4] In the Sun Earth system the angular momentum of the Earth about the pole star is conserved

[5] The z component of angular momentum of a conical pendulum is not conserved w.r.t. the origin fixed at the point of suspension; but the x and y components are conserved.

SetId=644

[6] A nonzero torque always causes the angular velocity to change, because a change in angular momentum means a change in angular velocity $L = I\omega$

[7] When applying the conservation laws of momentum, energy and angular momentum we must define the system first.Only then check if the laws is applicable or not.

As an example: when a ball is dropped from a height, it gains momentum down if we consider the ball as our system.This is because the force of gravity acts as an external force.

However, if we change our system and consider earth as a part of our system too, then the momentum remains conserved because the earth gains momentum up.

[8] In order to apply the law of conservation of momentum we must first identify the system. Then even if there is no *net external forces* acting on the system, all the three conservation laws of momentum, angular momentum and energy may not hold due to presence of internal forces.

[9] A non conservative force is a force where work done in moving a particle between two points depends on the path through which it is taken.Friction is an example of non conservative force.Mechanical energy is not conserved in case of a non conservative force

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[10] A particle moves on a circular path. Then its speed, direction offorce, can remain constant by velocity and acceleration must always change with time.

[11] Displacement is the shortest distance between initial and final points with direction specified.

[12] Staying inside a bullet train moving with constant velocity (no jerks etc) an experiment can always be performed which will tell us the numerical value of the acceleration of the bullet train

[13] When a ball rolls over a rough surface, it comes to stop after some time. This is because transational and rotational kinetic energy initially present in the ball continuosly gets converted to heat due to friction. When all the kinetic energy changes to heat, the ball stops. The total mechanical energy of the ball is not conserved.

[14] A heavy body is attached from a spring and is held at point A and is such that the spring is not slack nor is it stretched. It is then released. It goes down upto a point B and then it rises upto point C and executes an oscillatory motion between B and C. During the motion from A to C is first positive (from A to B) and then it is negative from B to A and again remains negative from A to C. SetId=644

[15] Force is defined as the rate of change of linear momentum. In other words it is the agency which changes or tends to change the (a) State of rest; (b)State of uniform motion (c) Direction of body's motion; (d) Shape of the body

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[1] Distance equal to zero implies displacement=0; and Displacement=0 also implies distance = 0

[2] The Law of conservation of angular momentum states that when no external torque acts on an object or a closed system of objects undergoing motion about a given axis, the change in angular momentum is zero. Therefore, considering an event where only internal torque or no torque is involved, the total angular momentum of the system before the event is equal to the total angular momentum after the event

[3] Consider a disc and a man system. man is standing on center of the disc rotating with angular velocity.initially man folded his hand.when man stretches his hands then momentum of inertia of system increases.and angular velocity decreases.and total angular momentum remains constant.

[4] For the motion of earth around sun, the angular momentum of the sun about the center of mass of the sun + earth system and perpendicular to the orbital plane of earth is conserved.

For the motion of earth around sun, the angular momentum of the sun about and axis passing through the Earth and perpendicular to the orbital plane of motion of earth is conserved.

[5] Only the z component of angular momentum of a conical pendulum is conserved w.r.t. the origin fixed at the point of suspension. SetId=645

[6] A nonzero torque always implies change in angular momentum and may not give rise to a change in magnitude of angular velocity. A non zero torque may mean change only the direction of the angular momentum and not the angular velocity.

[7] Statement: Law of Conservation of energy states that "ENERGY CAN NEITHER BE CREATED NOR DESTROYED",but it can be changed from one form to other.

EXPLANATION: Statement implies that the total amount of energy in an isolated system remains constant although it may change forms. viz, kinetic energy may change to potential;chemical to electrical energies etc.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then check we should if the laws are applicable or not.

So if there is no *external force* acting on the system all the three quantities, total momentum, total angular momentum, and total kinetic energy will be conserved independent of the nature of forces.

SetId=645

[9] A force:A force is said to be a *non-//**conservative force* if the*/ work done by it in a closed path is/*/ non-zero./For such forces,potential energy cannot be defined.

[10] A particle moves on a circular path. Then under suitable conditions its speed may remain constant, but the force, velocity and acceleration must always change with time.

[11] Displacements, being vector quantity can not compared with, a scalar quantity such as distance.

[12] Assume bullet train, moving with out any jerks, is going on a circular arc of radius R with constant speed. Then an experiment is to be performed entirely within the train without any measurement on objects outside the train. Such an experiment can tell only radius of the track.

[13] Let us consider that a pendulum is oscillating moving in a vertical plane. Mean while let another bob which is attached to a spring and is executing a simple harmonic motion in horizontal direction comes and hits the pendulum. Here conservation of momentum does not hold good as tension(external force) is acting on the system.(pendulum)

[14] The kinetic energy of a body does not change if any one of the following is true
(i)force is always perpendicular to the velocity
(ii) the force is always perpendicular to the acceleration
(iii) the object remains stationary
(iv) the object moves in such a way that the point of application of the force remains fixed. SetId=645

[15] Real forces have their origin in matter such as electricity, gravitation etc., while pseudo forces are caused by inertial motion.

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[1] If P and Q are the initial and the final points of a path of a particle, displacement is a vector whose direction is along PQ and has magnitude is equal to the length of line PQ

[2] The law of conservation of angular momentum states that when no external torque acts on an object or a closed system of objects, no change of angular momentum can occur. Hence, the angular momentum before an event involving only internal torques or no torques is equal to the angular momentum after the event . Angular momentum can be calculated with the help of the formula $L = I\omega$ where L stands for Angular momentum, I stands for moment of inertia and ω stands for angular velocity

[3] The conservation of angular momentum of a system of bodies requires that the the sum of torque due to all forces be equal to zero. Now consider a situation where the forces are such that the sum of torques of external forces is zero w.r.t. some axes K. Since the value of torque depends of the choices of axes, the sum of torques due to all internal forces will depend on the choice of axes and in general it will be non zero. Therefore, for a system of several bodies, for a given choice of axes K, there will be situations when the total angular momentum may not be conserved.

[4] For the motion of earth around sun, the sum of angular momenta of the Sun and the Earth about the center of mass of the sun + earth system is conserved.

[5] The projection of angular momentum of a conical pendulum in the horizontal plane is a constant of motion when the origin is chosen to be at fixed at the point of suspension. SetId=646

[6] In the example of a rotating skew rod the torque due to the external gravitational forces is zero , but the angular momentum is not constant Therefore the law of conservation of angular momentum is violated.

[7] Oscillating simple pendulum is a very good example where potential energy gets converted to kinetic energy and kinetic to potential energy. Some energy gets dissipated as heat if we consider air resistance. Energy as a whole is conserved if we consider universe as system, the energy has just changed its form.

[8] If we want to apply the conservation laws of momentum, energy and angular momentum, we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *external force* acting on the system, the momentum and angular momentum will be conserved, and depending on the nature of the forces but total energy may or may not be conserved.

[9] A force that is not conservative is nonconservative force. The work done by a noconservative force cannot be represented by a potential energy function. That is work done by a nonconservative force is dependent on the path through which the system is moved. Some nonconservative forces cause the mechanical energy to be lost or dissipiated. Such forces are called dissipiative forces. There is no way to get back the lost mechanical energy. Nonconservative forces can also increase the mechanical energy. This is arrived from the concept of irreversible process.

SetId=646

[10] A particle moves on a circular path. Then under suitable conditions its speed and acceleration may remain constant, but the force, and velocity must always change with time.

[11] Distance depends on the path where as the displacement depends on the end point only

[12] Assume bullet train, moving with out any jerks, is going on a circular arc of radius R with constant speed. Then an experiment is to be performed entirely within the train without any measurement on objects outside the train. Such an experiment can tell both speed of the train and radius of the track.

[13] The law of conservation of momentum does not hold in relativistic situations, i.e., where the speeds of the masses involved are close to the speed of light.

[14] The total work done on a particle is always equal to the change in kinetic energy.

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[15] 1)When we start rolling a body on a rough ground, it stops rolling after certain period because of frictional force.
2)When we leave a body from a certain height, it falls due to the act of gravitational force.

1)When a body is rotating in a circular path due to the centrifugal force which is the pseudo force. 2) When the lift is accelerating upwards, the upwards force felt by passengers a pseudo force.

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[1] If P and Q are the initial and the final points of a path of a particle,the displacement is the vector $\overrightarrow{PQ}$.

[2] Newton's Second Law of Motion is defined by the expression $F = \frac{dp}{dT}$, where F gives the force vector acting on the system and p gives its momentum vector; in linear motion. A similar expression can be written to describe angular motion, i.e. : $\tau = \frac{dL}{dt}$, where τ is the external torque vector acting on the system, and L is the angular momentum.

If the external torque on the system is zero, then we get the expression as: dL/dt=0. This points out to the fact that, when no external torque is acting on the system, then its angular momentum is constant, no matter what changes occur in the system. This is the Law of Conservation Of Angular Momentum.

[3] Example where law of conservation of angular momentum does not hold:
When there is external force like frictional force acting on a object when it is rotating we cannot use conservation of angular momentum as the friction force acting on the object produces an external torque.

[4] For the motion of the Earth around the sun, the total of angular momenta of the Earth and the Sun, about in a reference frame fixed in the pole star, is conserved.

[5] The law of angular momentum of a is not applicable for the conical pendulum conserved w.r.t. the origin fixed at the point of suspension. SetId=647

[6] In the example of skew rod, the angular momentum changes with time and there is a non zero torque coming from action of forces other than gravitational forces. Hence the law of conservation of angular momentum dos not apply.

[7] Law of conservation of momentum does not hold whenever an external force or impulse acts on the system. For example,when a body collides with earth then it bounces back to a lesser height as it loses some velocity.

In this example the momentum of a ball is not conserved due to impulsive force by ground in the normal direction.

However, strictly speaking the system that should be considered here is the ball-earth system and the total momentum is conserved.

[8] To apply the conservation laws of momentum, energy and angular momentum, we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *external force* acting on the system, the energy and momentum will be conserved. However, depending on the nature of the system and of the forces, the total angular momentum may not be conserved.

[9] Nonconservative forces are forces, such that the work done by these forces are path dependent. Work done by these forces around a close path is not necessarily equal to zero. Hence if a particle is acted on by a non-conservative force and that particle returns to its original position, that particle will experience a net loss of energy. Energy will thus not be conserved for particle. Potential Energy can not be defined for these type of forces.

SetId=647

[10] When the force is kept constant as function of time, it is possible for a particle to move on a circular path in such a way that its speed remains constant, but the velocity and acceleration must always change with time.

[11] Distance equal to zero $\Rightarrow$ displacement=0; but Displacement=0

[12] Assume bullet train, moving with out any jerks, is going on a circular arc of radius R with constant speed. Then an experiment is to be performed entirely within the train without any measurement on objects outside the train. Such an experiment can tell only speed of the track.

[13] when we are in accelerating frame if we observe any collision between two bodies then the law of conservation of momentum does not hold in that frame of reference.

[14] A particle is acted upon by a force of constant magnitude which is always perpendicular to the velocity of the particle and the motion of the particle takes place in a plane, Then its kinetic energy, speed, velocity acceleration will not change.

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[15] Newton's first law defines inertial frame. An inertial frame is a frame in which the first law hold. It also makes it possible to compare and tell two force being equal or not. The second law defines the force.

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[1] If two bodies starting from a point A reach a point B, following different paths, their displacement will be, in general different, but the distances covered will always be the same.

[2] If the net external torque acting on a system is zero, the angular momentum L of the system remains constant, no matter what changes take place within the system.

$$\sum(T_{\text{ext}}) = \frac{dL}{dt}$$

The law states that when there is no net external torque, $\frac{dL}{dt}$ is zero implying that the total angular momentum of system is constant.

i.e. $L = a$ constant (isolated system)

[3] A bob attached to a ceiling by a string moving in a horizontal circular plane is an example where the total angular momentum of the bob about the point of suspension is not conserved. This is because the the torque due to the weight of the bob about the point of suspension does not vanish and has non zero horizontal component. Only the vertical component of the angular component is conserved.

[4] For the motion of the Earth around the sun, the total of angular momenta of the Earth and the Sun, is conserved in every inertial frame of reference; but the angular momentum of the Earth (or of the sun)is not conserved in every inertial frame.

[5] The law of angular momentum of a is not applicable for the conical pendulum conserved when the origin is chosen to be at the pendulum bob itself. SetId=648

[6] In the example of conical pendulum, the z- component of angular momentum does not change. This follows from the angular momentum conservation as there is no external torque.

[7] If a bullet hits a wooden board and gets embedded in the board, the total energy and the total momentum of the bullet and the board are conserved.

[8] In order to apply the law of conservation of momentum we must first identify the system. If there is no *external forces* acting on the system then conservation laws of momentum always holds. And depending on the nature of the system and of the forces, the total kinetic energy and the total angular momentum may not be conserved.

[9] Non Conservative force is a force with the property that workdone in moving an object from one point to another is dependent on the path taken .

Non Conservative Force can arise in classical physics due to neglected degrees of freedom or time dependent potentials.

Friction may be treated without resorting the use of non conservative forces by considering the motion of individual molecules.

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[10] It is not possible for a particle to move on a circular path in such a way that its speed and force remains constant, and only the velocity and acceleration may (or may not) always change with time.

[11] If P and Q are the initial and the final points of a path of a particle, displacement is a vector whose direction is along PQ and has magnitude is equal to the length of line PQ

[12] A particle is observed from two frames S_1 and S_2. The frame S_2 moves with respect to S_1 with an acceleration a. If F_1 and F_2 be the pseudoforces when seen from S_1 and S_2 respectively it is not possible to have $F_1 = F_2 = 0$

[13] Give an example where law of conservation of momentum does not hold all cases when seen from non inertial frame of references for example when we see two cars collide from a moving bus there momentum is not conserved

[14] The kinetic energy of a particle is continuously increasing with time, then the angle bewteen the net force and the velocity cannot be greater than or equal to 90^{o} at any time.

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[15] The magnitude of the pseudo force arising in a non-inertial frame is always equal to the mass of the body under consideration multiplied by the acceleration of the frame of reference and the direction of pseudoforce is always opposite to the direction of acceleration of the frame.

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[1] Displacement is equal to the vector difference $\vec{r}_f - \vec{r}_i$ of the position vectors of initial and final points. The distance covered will be $|\vec{r}_f - \vec{r}_i|$

[2] When the net external torque acting on a body or a system of bodies is zero about a particular axis, then the angular momentum of each body is conserved about that axis.

[3] Law of conservation of angular momentum holds in case of long jump. When a athlete takes off from the ground in a running long jump, the forces on the launching foot give the athlete an angular momentum with a forward rotation around a horizontal axis. Such rotation would not allow the jumper to land properly. In the landing, the legs should be together and extended forward at an angle so that the heels mark the sand at the greatest distance. Once airborne, the angular momentum cannot change (it is conserved) because no external torque acts to change it. However, the jumper can shift most of the angular momentum to the arms by rotating them in windmill fashion. Then the body remains upright in the proper orientation of landing.

[4] In the Sun Earth system the angular momentum of the Earth is conserved in every frame of reference

[5] The three components of angular momentum of a conical pendulum is conserved w.r.t. the origin at the position of the center of mass of the pendulum. SetId=649

[6] In the example of conical pendulum, the x and$y$ components of angular momentum change. This follows from the angular momentum conservation as the z components external torque is zero and horizontal components of torque are non zero.

[7] If a bullet hits a wooden board and gets embedded in the board, the total energy of the bullet and the board system is conserved but the total momentum is not conserved.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then check if the laws is applicable or not.

So if there is no *net external force* acting on the system all the three conservation laws will hold.

[9] A non-conservative force is a force with the property that the work done in moving a particle between two points is dependent of the path taken . Mostly the enery of the particle in a non conservative force field dissipates in the form of heat or sound . Since the lost energy cannot be bought back ,conservation of mechanical energy does not hold true .

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[10] For a particle moving on circle the acceleration is always constant in magnitude and directed towards the centre of the circle.

[11] If P and Q are the initial and the final points of a path of a particle,the displacement is the vector $\overrightarrow{PQ}$.

[12] A particle is observed from two frames S_1 and S_2. The frame S_2 moves with respect to S_1 with an acceleration a. If F_1 and F_2 be the pseudoforces when seen from S_1 and S_2 respectively and if $F_1 = 0$ then we must have $F_2 \neq 0$

[13] When a tennis ball hits the ground at an oblique angle, the angle of reflection is equal to the angle of incidence. This is a simple consequence of conservation of horizontal component of momentum.

[14] A heavy body is attached from a spring and is held at point A and is such that the spring is not slack nor is it stretched. It is then released. It goes down upto a point B and then it rises upto point C and executes an oscillatory motion between B and C. During the motion from A to C is first positive (from A to B) and then it is negative from B to A and again remains negative from A to C. SetId=649

[15] A force is any interaction which tends to change the motion of an object. It is also *defined* as rate of change of momentum.It is a vector quantity.
A physically apparent but nonexistent force felt by an observer in a noninertial frame (that is, a frame undergoing acceleration).

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[1] Distance is equal to the length of the path covered. Displacement is the shortest distance between initial and final points.

[2] The law of conservation of angular momentum states that in absence of an external torque on an object or a closed system of objects the total angular momentum of the system remains constant. Thus if $\vec{\tau} = 0 => \vec{L} =$ constant where τ is the torque and $\vec{L}$ is the angular momentum of the system.

[3] The total angular momentum of a body remains constant of motion when the net torque of the external forces acting on the body is zero.
In general, we have a system of particles such that the net torque of the external forces on the system, w.r.t. some axes K, is zero, the total angular momentum may not remain conserved, because the torque due to the internal forces may not be zero.

[4] In the motion of earth around sun, the angular momentum of the earth about an axis passing through the sun and perpendicular to the plane of motion of earth is conserved.

[5] Only the z component of the angular momentum of a conical pendulum is conserved w.r.t. the origin fixed at the point of suspension. SetId=650

[6] Example where law of conservation of angular momentum does not hold: A disc rotating on a horizontal rough surface will not have a constant angular momentum because there will be a constant torque by frictional force. Hence, its angular momentum will decrease, and the law of conservation of angular momentum does not apply.

[7] If a bullet hits a wooden board and gets embedded in the board, both total energy and the total momentum of the bullet and the board are not conserved.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then check we should if the laws are applicable or not.

So if there is no *external force* acting on the system all the three quantities, total momentum is conserved. The total angular momentum is also because the torque of internal forces will be zero. The conservation of energy depends on the nature of forces. will be conserved.

[9] If the work done by a force depends on the path followed by the particle, it is called a Non conservative force. Work done by a non conservative force is not zero in round trip.

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[10] The motion of a bomb dropped from a plane does is not a uniform motion as it follows a parabolic path and not a straight line path.

[11] If two bodies starting from a point A reach a point B, following different paths, their displacement will be, in general different, but the distances covered will always be the same.

[12] If K is an inertial frame, any frame that moves w.r.t. the frame K with uniform velocity is also an inertial frame.

[13] when a ball is dropped from a height, it gains momentum down if we consider the ball as our system.This is because the force of gravity acts as an external force.

However, if we change our system and consider earth as a part of our system too, then the momentum remains conserved because the earth gains momentum up.

[14] The kinetic energy of a body does not change if any one of the following is true
(i)force is always perpendicular to the velocity
(ii) the force is always perpendicular to the acceleration
(iii) the object remains stationary
(iv) the object moves in such a way that the point of application of the force remains fixed. SetId=650

[15] Psuedo Force is defined as an apparent force that acts in only non-inertial frames. Pseudo Forces are also called Fictitious Forces. It is an Imaginary force. It is independent of mass.

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[1] Distance is a scalar quantity where as the displacement is a vector quantity.

[2] If no net external torque acts on a system, the total angular momentum of the system remains constant.

[3] An example where law of conservation of angular momentum holds:
The Law of conservation of angular momentum holds in the case of a ballet dancer performing a pirouette.

When the dancer extends her arms outward, the angular velocity of her rotation decreases whereas when she keeps her arms close to her body, the angular velocity increases. This is because her moment of inertia changes as she moves her arms outward and inward. It can be noted that she as a system has no external torque acting upon her.

[4] For the motion of earth around sun, the angular momentum of the earth about the center of mass of the sun + earth system and perpendicular to the plane of motion of earth is conserved.

[5] The z component of angular momentum of a conical pendulum is not conserved w.r.t. the origin fixed at the point of suspension; but the x and y components are conserved.

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[6] Example where law of conservation of angular momentum does not hold:Consider a vertical stick on the ground falling to a horizontal position. During the fall, the conservation of angular momentum applied at the point of rotation on the ground and perpendicular to the plane of the stick is not applicable as, the gravitational force which acts vertically downwards assumed at the centre of mass produces an external torque about the axis of rotation

[7] There are certain situations where it appears that the law of conservation of linear momentum does not hold. For example if we take some amount of a substance like construction putty, cement, cake batter, playing dough,etc and drop it on the ground, it does not bounce back like a rubber ball would and hence the momentum it had before striking the ground seems to have been lost. Hence it appears that the law of conservation of linear momentum does not hold.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *net external force* acting on the system, the momentum is conserved. The definition of angular momentum and torque depends on the choice of axes, and therefore it may not be be conserved. The conservation of total energy holds only for conservative forces.

When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *net external force* acting on the system, the energy and momentum will be conserved. However, the total angular momentum may not be conserved because the torque may not be zero.

[9] The workdone by a non conservative force is dependant on its path. the work varies as the path varies.

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[10] A wagon sliding on a roller coaster designed in such a way that the wagon covers equal distances in equal times. As the motion of the wagon is uniform, there will be no net force acting on it.

[11] Distance is equal to the length of the path covered. Displacement is the shortest distance between initial and final points.

[12] If K is an inertial frame, any frame that moves w.r.t. the frame K with uniform speed is also an inertial frame.

[13] There is no known exception to the law of conservation of momentum in classical mechanics however when two bodies collide and their mass converts to energy, an exception in nuclear physics is observed. In real life this is observed in nuclear reactions at atomic level.

[14] The total work done on a particle is always equal to the change in kinetic energy. SetId=651

[15] Psuedo Force is defined as an apparent force that acts in only non-inertial frames. Pseudo Forces are also called Fictious Forces. It is an Imaginary force. It is always proportional to mass. It is sometimes dependent on speed.

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[1] The speed is rate of change of distance and the velocity is the rate of change of displacement.

[2] The law of conservation of angular momentum states that when no external torque is applied on an object or a closed system of objects about an axis, the angular momentum about that axis remains constant.

[3] In case of a skater, who can be considered an isolated system, so no torue will be acting on him/her. When the arms are extended, the moment of inertia is more. When his hands are closely held, the moment of inertia is lesser. Since the angular momentum is same, the angular acceleration changes accordingly.

[4] In the Sun Earth system the angular momentum of the Earth about the pole star is conserved

[5] Only the z component of angular momentum of a conical pendulum is conserved w.r.t. the origin fixed at the point of suspension. SetId=652

[6] We have a conical pendulum .The forces acting on the bob are tension (along the direction of the string) and gravitational force acting in the vertically downward direction.we have an additional force called the drag force which is tangential to the motion of the bob and acts in the direction opposite to the motion of the bob.The axis of rotation passes through the hinge point and is vertical.The torque due to tension is 0 because the force passes through the axis of rotation.The torque due to mg is also zero since it is parallel to the axis of rotation.but the torque due to drag force is not zero.since the net external torque acting on the bob is not zero,therefore the law of conservation of angular momentum does not hold here

[7] A tennis ball is dropped from height h and after hitting the ground and it bounces back and rises to the same height. In this case the momentum of the ball is conserved because (under ideal conditions) the momentum after it hits the ground will be equal to the momentum it had before hitting the ground.

[8] In order to apply the law of conservation of momentum we must first identify the system. If there is no *net external forces* acting on the system then conservation laws of momentum always holds. The total energy and the total angular momentum may not be conserved.

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[9] A non conservative force is a force with the property that the work done in moving a particle between two points is dependent on the path followed.

[10] A simple pendulum moves along a circular arc and does not have constant speed and therefore its motion is not uniform.

[11] Distance is a scalar quantity where as the displacement is a vector quantity.

[12] A frame rotating w.r.t K with uniform angular velocity is also an inertial frame.

[13] When there is no external forces act on a system of many particles, and there are only internal forces acting on the particles. The third law gives that the internal forces are pairwise equal and opposite.Thus the sum of internal forces is zero and the momentum of each particle is conserved.

[14] A particle is acted upon by a force of constant magnitude which is always perpendicular to the velocity of the particle and the motion of the particle takes place in a plane, Then its kinetic energy, speed, velocity acceleration will not change. SetId=652

[15] Since pseudo forces are not real forces, they do not affect the conservation laws and all the three conservation laws hold in noninertial frames.

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[1] For any type of translational motion of a body, the displacement cannot be zero, where as the distance travelled can be zero.

[2] The angular momentum of a given system of bodies shall remain conserved unless acted upon by an external unbalanced torque.

[3] Example where law of conservation of angular momentum holds:
Let us assume a student seated on a stool that can rotate freely about a vertical axis. The student has been set into rotation at a modest initial angular speed ω . He holds two dumbbells in his outstretched hands. His angular momentum vector L lies along the vertical rotation axis, pointing upwards. Now he pulls in his arms;this action reduces his rotational inertia from its value I_{initial} to a final value I_{final} because he moves the mass closer to the rotational axis. His rate of rotation increases markedly, from ω_{initial} to ω_{final}. The student can then slow down by extending his arms once more,moving the dumbbells outward. No external torque acts on the system consisting of the student, stool and the dumbbells. Thus the angular momentum of the system about the rotational axis remains constant. $I_{\text{initial}} * \omega_{\text{initial}} = I_{\text{final}} * \omega_{\text{final}}$.

[4] For the motion of earth around sun, the angular momentum of the sun about the center of mass of the sun + earth system and perpendicular to the orbital plane of earth is conserved.

For the motion of earth around sun, the angular momentum of the sun about and axis passing through the Earth and perpendicular to the orbital plane of motion of earth is conserved.

[5] The projection of angular momentum of a conical pendulum in the horizontal plane is a constant of motion when the origin is chosen to be at fixed at the point of suspension.

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[6] When you release a toy gyroscope on its pedestal, it initially has no precessional rotation around that pedestal, i.e, the orientation of rotation is fixed. However, it instantaneously starts precessing around the pedestal. Both Kinetic Energy and Angular Momentum now exist where they did not exist a moment earlier. The Kinetic Energy is easy to explain, as appearing due to the body of the gyroscope dropping a tiny fraction of a millimeter in the Earth's gravitational field, giving up exactly the correct amount of Potential Energy. But the Angular Momentum of the Precession which just appeared, does not come from anywhere. This is therefore a Violation of the Conservation of Angular Momentum.

[7] Law of conservation of momentum does not hold when Newton's laws are not valid, e.g. in a non-inertial frame of reference. For example, when we consider collision

between two bodies in a non-inertial frame of reference, the law of conservation of momentum cannot be applied because there will be a pseudo force acting on the frame itself.

[8] In order to apply the law of conservation of momentum we must first identify the system. Then even if there is no *net external forces* acting on the system, all the three conservation laws of momentum, angular momentum and energy may not hold due to presence of internal forces.

[9] A non conservative force is a force with the property that the work done in moving a particle between two points is dependent of the taken path.

Friction, for example, does less work on a book dragged across a table if the book is dragged straight across than if the book is dragged in a curved path.

To write the equation for conservation of energy for non conservative forces we need to include the work done by the non conservative force also.This is because forces like friction liberate heat which are not included in the mechanical energy.

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[10] A satellite goes around the earth in a circular orbit of 600km with a time period of $5.8 \times 10^3 s$. Its motion will be uniform as it will cover equal distances in equal times.

[11] Both displacement and distance tell us about the motion of a body but their study does not tell much about the forces on the body

[12] The Newton's Laws of motion will hold in all frames which are at rest w.r.t. K but do not remain valid in a frame that move with respect to K.

[13] During collision of billiard balls momentum is conserved. During explosion of a bomb also momentum is conserved and the total momentum of the fragments of bomb will be zero. This is because all the forces are only internal forces.

[14] The kinetic energy of a particle is continuously increasing with time, then the angle bewteen the net force and the velocity cannot be greater than or equal to 90^{o} at any time.

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[15] A force is any interaction which tends to change the motion of an object. Newtons' second tell us that it is *equal* to the rate of change of momentum.It is a vector quantity. Real forces can be distinguished from pseudo forces because the pseudo forces always proportional to the mass of the body. All real forces, except the gravitational force, do not depend on the mass of the body.

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[1] Displacements, being vector quantity can not compared with, a scalar quantity such as distance.

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[2] When the net external torque acting on a system about a given axis is zero, the total angular momentum of the system about that axis remains consant.

[3] A bob is attached to ceiling by a string and moves in a horizontal circular plane is an example. In this case the law of conservation of angular momentum does not hold.

[4] For the motion of earth around sun, the sum of angular momenta of the Sun and the Earth about the center of mass of the sun + earth system is conserved.

[5] The law of angular momentum of a is not applicable for the conical pendulum conserved w.r.t. the origin fixed at the point of suspension.

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[6] There is no case where LAW OF CONSERVATION OF ANGULAR MOMENTUM does'nt hold.But there are cases where conservation of angular momentum does not hold.A body in vertical circular motion is an example where angular momentum is not conserved. Here the law of conservation does not apply.

[7] If I throw a ball upward, it's speed decreases as it rises upwards. There is an external force (gravity) acting on the ball, so the momentum conservation law does not apply. Momentum of the ball is not conserved, however the momentum of the Earth-ball system is conserved as gravity will become an internal force in this case.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then check we should if the laws are applicable or not.

So if there is no *external force* acting on the system all the three quantities, total momentum, total angular momentum, and total kinetic energy will be conserved independent of the nature of forces.

[9] A non conservative force is a force with the property that the work done in moving a particle between two points is dependent of the taken path.

Friction, for example, does less work on a book dragged across a table if the book is dragged straight across than if the book is dragged in a curved path.

To write the equation for conservation of energy for nonconservative forces we need toinclude the work done by the non conservative force also.This is because forces like friction liberate heat which are not included in the mechanical energy.

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[10] A uniform motion is defined to be the one in which a body covers equal distances in equal time intervals.

[11] Displacement is the shortest distance between initial and final points with direction specified.

[12] Staying inside a bullet train moving with constant velocity (no jerks etc) an experiment can always be performed which will tell us the numerical velocity of the bullet train

[13] Give an example where law of conservation of momentum holds: A mass exploding into several pieces in a conservative field like gravitational field(if air resistance is neglected), obeys law of conservation of momentum. If air resistance cannot be neglected then the law of conservation of momentum will not hold.

[14] A heavy body is attached from a spring and is held at point A and is such that the spring is not slack nor is it stretched. It is then released. It goes down upto a point B and then it rises upto point C and executes an oscillatory motion between B and C. During the motion from A to C is first positive (from A to B) and then it is negative from B to A and again remains negative from A to C. SetId=654

[15] Examples of pseudoforce are Coriolis Force, Centrifugal Force, and magnetic force on currents.
Psuedo force also called as fictitious force is an apparent force that are needed for masses whose their motion is described using a non inertial frame of reference.

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[1] Distance depends on the path where as the displacement depends on the end point only.

[2] This law sates that when no net torque of all forces acts on a object or a system of objects then total angular momentum of system is conserved.The angular momentum before an event is equal to angular momentum after that event.mathematically explained by when, net torque=0 ;then, total angular momentum(L)=constant.

[3] Consider a disc rotating about an axis perpendicular to its plane. On placing a smaller disc with its surface parallel to the surface of the rotating disc, the angular momentum of the system of two discs remains constant as there is no external torque.

[4] For the motion of the Earth around the sun, the total of angular momenta of the Earth and the Sun, about in a reference frame fixed in the pole star, is conserved.

[5] The law of angular momentum of a is not applicable for the conical pendulum conserved when the origin is chosen to be at the pendulum bob itself. SetId=655

[6] A sphere rolling on a rough surface.Due to friction there is external torque so the angular momentum changes which results in the slowing of the sphere. The angular momentum keeps changing. Even in case like this one, it is wrong to say that the Law of Angular Momentum Conservation does not hold.

[7] A soldier accelerating away, after detonating a bomb, will find that the total momentum of the fragments of the bomb is zero. This is an example where the law of conservation of momentum holds as the forces on the fragments are internal forces only and sum of all such forces is zero.

[8] If we want to apply the conservation laws of momentum, energy and angular momentum, we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *external force* acting on the system, the momentum and angular momentum will be conserved, and depending on the nature of the forces but total energy may or may not be conserved.

[9] The non conservative force is a force with a property thet the work done between two points depends on path taken. If a particle moves along a curve path, to know about the work done by a non conservative force we should have the equation of the path along which the particle had move.The work done would be

WORK = INTEGRAL (F.dx)

The equation of conservation of mechanical energy for a non conservative force would be

SetId=655 $KE_{\text{final}} + PE_{final} = KE_{initial} + PE_{initial} + W_{nc}$

[10] A particle moves on a circular path. Then its speed, direction of force, velocity and acceleration must always change with time.

[11] Displacements, being vector quantity can not compared with, a scalar quantity such as distance.

[12] Staying inside a bullet train moving with constant velocity (no jerks etc) an experiment can always be performed which will tell us the numerical value of the acceleration of the bullet train

[13] Also a good example of law of conservation momentum can be seen when a bullet from a rifle is fired.As the bullet is fired and gets out of the rifle, the rifle gives a backward jerk due to the phenomenon of conservation of momentum.

[14] The kinetic energy of a body does not change if any one of the following is true
(i)force is always perpendicular to the velocity
(ii) the force is always perpendicular to the acceleration
(iii) the object remains stationary
(iv) the object moves in such a way that the point of application of the force remains fixed. SetId=655

[15] Examples of pseudo-force are Coriolis Force, Centrifugal Force, Centripetal force and magnetic force on currents. The pseudo forces do not obey Newton's third law and therefore the total momentum does not appear to be conserved in a non-inertial frame.

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[1] Distance equal to zero implies displacement=0; and Displacement=0 also implies distance = 0

[2] Statement of Law of Conservation of Angular Momentum:
Differentiating $\vec{L} = \vec{r} \times \vec{p}$ w.r.t, time,

$$\begin{aligned} \frac{dL}{dt} &= \frac{d\vec{r} \times \vec{p}}{dt} = \frac{d\vec{r}}{dt} \times \vec{p} + \vec{r} \times \frac{d\vec{p}}{dt} = \vec{v} \times (m\vec{v}) + \vec{r} \times \vec{F} \\ &= \vec{r} \times \vec{F} (\because v \times v = 0) \\ &= \vec{\tau} \end{aligned}$$

here $\vec{\tau}$ represents the net torque acting on a rigid body rotating about a fixed axis.This torque must take into account of all the forces, be it external or internal forces

[3] Consider a man standing on a spinning platform. Initially, the man spreads out his arms and he spins with a certain angular velocity. The next moment, he pulls his arms inwards keeping them close to his body. We will observe that the angular velocity with which he is spinning now increases. This phenomenon can be explained by the Law Of Conservation of Angular momentum. Initially, since his arms were spread wide, his moment of inertia was large. However, when he pulled them close to his body, his moment of inertia decreased.
In this example the angular velocity of the man increases and therefore the angular momentum also increases.The law of conservation of angular momentum does not apply because the torque of muscular forces is not zero.

[4] For the motion of the Earth around the sun, the total of angular momenta of the Earth and the Sun, is conserved in every inertial frame of reference; but the angular momentum of the Earth (or of the sun)is not conserved in every inertial frame.

[5] The three components of angular momentum of a conical pendulum is conserved w.r.t. the origin at the position of the center of mass of the pendulum. SetId=656

[6] Consider a rod of length l. Let us give an impulse to one end . Now the angular momentum about the oposite end is not zero since the impulse provides some torque . So the angular momentum is not conserved .

$$\text{torque} = \text{impulse} * \ell.$$

$d\ell/dt$ is not equal to zero and the law of conservation of angular momentum does not hold.

[7] There is no known exception to the law of conservation of momentum in classical mechanics However, an exception to conservation of energy in nuclear physics is observed. In nuclear reactions when two nuclei collide and their mass converts to energy and energy momentum are not conserved.

[8] To apply the conservation laws of momentum, energy and angular momentum, we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *external force* acting on the system, the energy and momentum will be conserved. However, depending on the nature of the system and of the forces, the total angular momentum may not be conserved.

[9] Nonconservative forces arise due to neglected degrees of freedom or from time dependent potentials. The work done by a nonconservative force depends upon the path taken. It causes a change in the mechanical energy of the system. It adds or removes mechanical energy from a system.

SetId=656

[10] A particle moves on a circular path. Then its speed, direction offorce, can remain constant by velocity and acceleration must always change with time.

[11] Distance depends on the path where as the displacement depends on the end point only

[12] Assume bullet train, moving with out any jerks, is going on a circular arc of radius R with constant speed. Then an experiment is to be performed entirely within the train without any measurement on objects outside the train. Such an experiment can tell only radius of the track.

[13] when a man walks on the ice slab where friction does not exist between the ice block and the floor but between the feet of the man and the slab the slab moves back as per the law of conservation of momentum

[14] The total work done on a particle is always equal to the change in kinetic energy. SetId=656

[15] FORCE is any interaction which tends to change the motion of an object.It has both magnitude and direction,making it a vector quantity.

A psuedo force is an apparent force that acts on all masses whose motion is described with respect to a non-inertial frame of reference like a rotating frame of reference.This force is needed by an observer in an non-inertial frame to make all the Newtons Laws of motion hold true.

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[1] If P and Q are the initial and the final points of a path of a particle, displacement is a vector whose direction is along PQ and has magnitude is equal to the length of line PQ

SetId=657

[2] Statement of Law of Conservation of Angular Momentum: For a system of many particles The net torque due all the forces, be it external or internal forces. But as the torque due to all the internal forces cancel out, it sufficient to consider the external forces acting on the system.

[3] In the Sun-Earth system, angular momentum of the earth is not conserved but the total angular momentum of the sun and the earth is constant of motion.

[4] In the Sun Earth system the angular momentum of the Earth is conserved in every frame of reference

[5] Only the z component of the angular momentum of a conical pendulum is conserved w.r.t. the origin fixed at the point of suspension.

SetId=657

[6] Let us consider a rotating skew rod. In the absence of friction or any other drag force, the rod should continuously spin without stopping. Here the net torque about the axis of rotation is 0 and hence angular momentum is conserved. It therefore follows from law of conservation of angular momentum that a spinning skew rod will keep rotating with constant angular velocity if there is no external torque. So law of conservation of angular momentum does not hold.

[7] In a system of a canon and a canon ball, total momentum of the system is zero before canon ball is fired. After firing the canon ball, the momentum of the system seems to be conserved as the ball moves forward and the canon moves backward.

[8] In order to apply the law of conservation of momentum we must first identify the system. If there is no *external forces* acting on the system then conservation laws of momentum always holds. And depending on the nature of the system and of the forces, the total kinetic energy and the total angular momentum may not be conserved.

[9] The work done by a *Nonconservative Force *is not recoverable*.*The work done by a *Non Conservative force* is usually dissipated in the form of Heat and Sound.

SetId=657

Non conservative force *cannot* be expressed in the form of *Potential Energy*.

[10] A particle moves on a circular path. Then under suitable conditions its speed may remain constant, but the force, velocity and acceleration must always change with time.

[11] Distance equal to zero $\Rightarrow$ displacement=0; but Displacement=0

[12] Assume bullet train, moving with out any jerks, is going on a circular arc of radius R with constant speed. Then an experiment is to be performed entirely within the train without any measurement on objects outside the train. Such an experiment can tell both speed of the train and radius of the track.

[13] When a freely falling rigid body collides another body in its path momentum the system of two particles is not conserved in the collision as there is external force mg acting on the system.

[14] A particle is acted upon by a force of constant magnitude which is always perpendicular to the velocity of the particle and the motion of the particle takes place in a plane, Then its kinetic energy, speed, velocity acceleration will not change. SetId=657

[15] FORCE is any interaction which tends to change the motion of an object.It has both magnitude and direction,making it a vector quantity. A pseudo-force F doesn't arise from any physical interaction between two objects, but rather from the acceleration 'a' of the non-inertial reference frame itself. These forces have no real existence but must be taken into account in an accelerating frame of reference to make all the three Newton's Laws of motion applicable to the system

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SetId=658

[1] If P and Q are the initial and the final points of a path of a particle,the displacement is the vector $\overrightarrow{PQ}$.

[2] Depending on the torques acting on a system, the angular momentum can be conserved only in one or two directions, but may not be conserved in all. For instance, if an isolated body has no torque acting on it only in the direction along the Z axis, then the angular momentum is conserved only in that direction.

[3] Consider a disc and a man system. man is standing on center of the disc rotating with angular velocity.initially man folded his hand.when man stretches his hands then momentum of inertia of system increases.and angular velocity decreases.and total angular momentum remains constant.

[4] In the motion of earth around sun, the angular momentum of the earth about an axis passing through the sun and perpendicular to the plane of motion of earth is conserved.

[5] The z component of angular momentum of a conical pendulum is not conserved w.r.t. the origin fixed at the point of suspension; but the x and y components are conserved.

SetId=658

[6] In the example of skew rod the angular velocity does not change even though the torque applied is nonzero. However there is no contradiction as in this case the law of conservation of momentum is not applicable. conservation is violated.

[7] When applying the conservation laws of momentum, energy and angular momentum we must define the system first.Only then check if the laws is applicable or not.

As an example: when a ball is dropped from a height, it gains momentum down if we consider the ball as our system.This is because the force of gravity acts as an external force.

However, if we change our system and consider earth as a part of our system too, then the momentum remains conserved because the earth gains momentum up.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then check if the laws is applicable or not.

So if there is no *net external force* acting on the system all the three conservation laws will hold.

[9] * A non conservative force is a force that acts on a particle(or point), such that the work done by this force in moving this particle from one point to another is */dependent of path taken/* that is the work done depends on the path itself. * For example frictional force is non conservative because the work done by friction

always acts in the direction of travel and therefore depends on length L of the path taken.

SetId=658

[10] A particle moves on a circular path. Then under suitable conditions its speed and acceleration may remain constant, but the force, and velocity must always change with time.

[11] If P and Q are the initial and the final points of a path of a particle, displacement is a vector whose direction is along PQ and has magnitude is equal to the length of line PQ

[12] Assume bullet train, moving with out any jerks, is going on a circular arc of radius R with constant speed. Then an experiment is to be performed entirely within the train without any measurement on objects outside the train. Such an experiment can tell only speed of the track.

[13] If we take some amount of a substance like construction putty, cement, cake batter, playing dough,etc and drop it on the ground, it does not bounce back, like a rubber ball would bounce, and hence the momentum it had before striking the ground seems to have been lost. Hence it appears that the law of conservation of linear momentum does not hold.

[14] The kinetic energy of a particle is continuously increasing with time, then the angle bewteen the net force and the velocity cannot be greater than or equal to 90^o at any time.

SetId=658

[15] FORCE is any interaction which tends to change the motion of an object.It has both magnitude and direction,making it a vector quantity.
A pseudo-force results from acceleration of the frame of reference in which the objects reside. It is taken into account so that Newton's second law isn't invalidated. The pseudo force acting on an object can always be mathematically expressed as the product of the mass of the object and the acceleration of the frame of reference.

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[1] If two bodies starting from a point A reach a point B, following different paths, their displacement will be, in general different, but the distances covered will always be the same.

[2] According to Law of Conservation of Angular momentum,if no external torque acts on an object or system of objects,angular momentum of an object or system of objects remains CONSTANT or no change in angular momentum can occur.

Also it states that,only external torque can change angular momentm of the system where as the torque produced by internal forces can not change the angular momentum of the system

[3] The conservation of angular momentum of a system of bodies requires that the the sum of torque due to all forces be equal to zero. Now consider a situation where the forces are such that the sum of torques of external forces is zero w.r.t. some axes K. Since the value of torque depends of the choices of axes, the sum of torques due to all internal forces will depend on the choice of axes and in general it will be non zero. Therefore, for a system of several bodies, for a given choice of axes K, there will be situations when the total angular momentum may not be conserved.

[4] For the motion of earth around sun, the angular momentum of the earth about the center of mass of the sun + earth system and perpendicular to the plane of motion of earth is conserved.

[5] Only the z component of angular momentum of a conical pendulum is conserved w.r.t. the origin fixed at the point of suspension. SetId=659

[6] Example where law of conservation of angular momentum does not hold:If a particle undergoes conical motion and the only force acting on particle is central force like tension of the string.Then total external torque about fixed point A is zero,yet angular momentum is not conserved,as angular momentum keeps on changing direction.

[7] Statement: Law of Conservation of energy states that ”ENERGY CAN NEITHER BE CREATED NOR DESTROYED”,but it can be changed from one form to other.

EXPLANATION: Statement implies that the total amount of energy in an isolated system remains constant although it may change forms. viz, kinetic energy may change to potential;chemical to electrical energies etc.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then check we should if the laws are applicable or not.

So if there is no *external force* acting on the system all the three quantities, total momentum is conserved. The total angular momentum is also because the torque

of internal forces will be zero. The conservation of energy depends on the nature of forces. will be conserved.

[9] A force with the property that the work done in moving a particle is dependent on the path followed. The work done by a conservative force in moving a body from an initial location to a final location is dependent on the path taken between the two points

SetId=659

[10] When the force is kept constant as function of time, it is possible for a particle to move on a circular path in such a way that its speed remains constant, but the velocity and acceleration must always change with time.

[11] If P and Q are the initial and the final points of a path of a particle,the displacement is the vector $\overrightarrow{PQ}$.

[12] A particle is observed from two frames S_1 and S_2. The frame S_2 moves with respect to S_1 with an acceleration a. If F_1 and F_2 be the pseudoforces when seen from S_1 and S_2 respectively it is not possible to have $F_1 = F_2 = 0$

[13] When we consider collision between two bodies in a non-inertial frame of reference, the law of conservation of momentum cannot be applied because there will be a pseudo force acting on the frame itself.

[14] A heavy body is attached from a spring and is held at point A and is such that the spring is not slack nor is it stretched. It is then released. It goes down upto a point B and then it rises upto point C and executes an oscillatory motion between B and C. During the motion from A to C is first positive (from A to B) and then it is negative from B to A and again remains negative from A to C.

SetId=659

[15] Explain Force:FORCE is any interaction which tends to change the motion of an object.It has both magnitude and direction,making it a vector quantity.
In the case of a non inertial frame, we can use the second law of motion by adding a pseudo force to the system which makes it an inertial frame of reference.

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[1] Displacement is equal to the vector difference $\vec{r}_f - \vec{r}_i$ of the position vectors of initial and final points. The distance covered will be $|\vec{r}_f - \vec{r}_i|$

[2] The law of conservation of angular momentum states that when the net external torque acting on the system is zero, then the angular momentum of the system remains constant.both the initial and final momentum should be taken from a fixed inertial frame of reference provided.

[3] Example where law of conservation of angular momentum does not hold:
When there is external force like frictional force acting on a object when it is rotating we cannot use conservation of angular momentum as the friction force acting on the object produces an external torque.

[4] In the Sun Earth system the angular momentum of the Earth about the pole star is conserved

[5] The projection of angular momentum of a conical pendulum in the horizontal plane is a constant of motion when the origin is chosen to be at fixed at the point of suspension.

SetId=660

[6] A nonzero torque always causes the angular velocity to change, because a change in angular momentum means a change in angular velocity $L = I\omega$

[7] Oscillating simple pendulum is a very good example where potential energy gets converted to kinetic energy and kinetic to potential energy. Some energy gets dissipated as heat if we consider air resistance. Energy as a whole is conserved if we consider universe as system, the energy has just changed its form.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *net external force* acting on the system, the momentum is conserved. The definition of angular momentum and torque depends on the choice of axes, and therefore it may not be be conserved. The conservation of total energy holds only for conservative forces.

When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *net external force* acting on the system, the energy and momentum will be conserved. However, the total angular momentum may not be conserved because the torque may not be zero.

[9] The work done by non conservative force is dependent on the path taken by the particle in reaching final position from initial position. Non conservative force depends on the distance travelled by the particle

SetId=660

[10] It is not possible for a particle to move on a circular path in such a way that its speed and force remains constant, and only the velocity and acceleration may (or may not) always change with time.

[11] If two bodies starting from a point A reach a point B, following different paths, their displacement will be, in general different, but the distances covered will always be the same.

[12] A particle is observed from two frames S_1 and S_2. The frame S_2 moves with respect to S_1 with an acceleration a. If F_1 and F_2 be the pseudoforces when seen from S_1 and S_2 respectively and if $F_1 = 0$ then we must have $F_2 \neq 0$

[13] When a system is acted upon by external forces like friction etc, the conservation principle does not hold good,there will be impulse imparted and so we cant conserve momentum. This is case when a collision between two elastic balls take place on a rough horizontal table. The total momentum just after the collision will be different from the total momentum just before the collision. Here momentum is not conserved as there is external force friction is present.

[14] The kinetic energy of a body does not change if any one of the following is true
(i)force is always perpendicular to the velocity
(ii) the force is always perpendicular to the acceleration
(iii) the object remains stationary
(iv) the object moves in such a way that the point of application of the force remains fixed.

SetId=660

[15] For the Newton's Law of Motion to hold true,the physically apparent but nonexistent force needed by an observer in a non-inertial frame is called the pseudo force.
1) Caused by relative acceleration of the origin in a straight line
2) Centrifugal and Centripetal forces
3) Coriolis force
4) Euler force

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[1] Distance is equal to the length of the path covered. Displacement is the shortest distance between initial and final points.

[2] The law of conservation of angular momentum states that The total angular momentum of a system is constant in both magnitude and direction if the resultant torque, of the external forces acting on the system, is zero.

[3] A bob attached to a ceiling by a string moving in a horizontal circular plane is an example where the total angular momentum of the bob about the point of suspension is not conserved. This is because the the torque due to the weight of the bob about the point of suspension does not vanish and has non zero horizontal component. Only the vertical component of the angular component is conserved.

[4] For the motion of earth around sun, the angular momentum of the sun about the center of mass of the sun + earth system and perpendicular to the orbital plane of earth is conserved.

For the motion of earth around sun, the angular momentum of the sun about and axis passing through the Earth and perpendicular to the orbital plane of motion of earth is conserved.

[5] The law of angular momentum of a is not applicable for the conical pendulum conserved w.r.t. the origin fixed at the point of suspension. SetId=661

[6] A nonzero torque always implies change in angular momentum and may not give rise to a change in magnitude of angular velocity. A non zero torque may mean change only the direction of the angular momentum and not the angular velocity.

[7] Law of conservation of momentum does not hold whenever an external force or impulse acts on the system. For example,when a body collides with earth then it bounces back to a lesser height as it loses some velocity.

In this example the momentum of a ball is not conserved due to impulsive force by ground in the normal direction.

However, strictly speaking the system that should be considered here is the ball-earth system and the total momentum is conserved.

[8] In order to apply the law of conservation of momentum we must first identify the system. If there is no *net external forces* acting on the system then conservation laws of momentum always holds. The total energy and the total angular momentum may not be conserved.

[9] The work done by non conservative force is dependent on the path taken by the particle in reaching final position from initial position. Non conservative force depends on the distance travelled by the particle

SetId=661

[10] For a particle moving on circle the acceleration is always constant in magnitude and directed towards the centre of the circle.

[11] Distance is equal to the length of the path covered. Displacement is the shortest distance between initial and final points.

[12] If K is an inertial frame, any frame that moves w.r.t. the frame K with uniform velocity is also an inertial frame.

[13] When we are in accelerating frame if we observe any collision between two bodies then the law of conservation of momentum does not hold in that frame of reference. On the other hand the law of conservation of momentum holds in all inertial frames.

[14] The total work done on a particle is always equal to the change in kinetic energy. $\boxed{\text{SetId=661}}$

[15] A force is any interaction which tends to change the motion of an object. It is also *defined* as rate of change of momentum.It is a vector quantity.

Pseudo-force is a fictitious force it is taken by an observer from non inertial frame of reference. This force arises from acceleration of reference frame that is a reference frame which is accelerating or rotating.

The equation of motion is then written by balancing all forces. As an example a particle moving in a circle is seen to be at rest by balancing the centripetal and centrifugal forces.

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[1] Distance is a scalar quantity where as the displacement is a vector quantity.

[2] If the net external torque acting on a system is zero,the angular momentum L(vector) of the system remains constant,no matter what changes take place within the system.L(vector)=a constant (net external torque acting on system is zero)

[3] Law of conservation of angular momentum holds in case of long jump. When a athlete takes off from the ground in a running long jump, the forces on the launching foot give the athlete an angular momentum with a forward rotation around a horizontal axis. Such rotation would not allow the jumper to land properly. In the landing, the legs should be together and extended forward at an angle so that the heels mark the sand at the greatest distance. Once airborne, the angular momentum cannot change (it is conserved) because no external torque acts to change it. However, the jumper can shift most of the angular momentum to the arms by rotating them in windmill fashion. Then the body remains upright in the proper orientation of landing.

[4] For the motion of earth around sun, the sum of angular momenta of the Sun and the Earth about the center of mass of the sun + earth system is conserved.

[5] The law of angular momentum of a is not applicable for the conical pendulum conserved when the origin is chosen to be at the pendulum bob itself. SetId=662

[6] In the example of a rotating skew rod the torque due to the external gravitational forces is zero , but the angular momentum is not constant Therefore the law of conservation of angular momentum is violated.

[7] If a bullet hits a wooden board and gets embedded in the board, the total energy and the total momentum of the bullet and the board are conserved.

[8] In order to apply the law of conservation of momentum we must first identify the system. Then even if there is no *net external forces* acting on the system, all the three conservation laws of momentum, angular momentum and energy may not hold due to presence of internal forces.

[9] Nonconservative forces are those forces in which the work done in moving a particle is dependant on the path taken to cover the distance. Some energy woul be lost to the environment in the form of heat, sound, etc. The energy in the final state is less than that in the initial state.

SetId=662

[10] The motion of a bomb dropped from a plane does is not a uniform motion as it follows a parabolic path and not a straight line path.

[11] Distance is a scalar quantity where as the displacement is a vector quantity.

[12] If K is an inertial frame, any frame that moves w.r.t. the frame K with uniform speed is also an inertial frame.

[13] When a freely falling body hits another rigid body in its path then momentum is not conserved as external force mg acts on both the bodies. The total momentum after the collision will be different from the total momentum before the hit.

[14] A particle is acted upon by a force of constant magnitude which is always perpendicular to the velocity of the particle and the motion of the particle takes place in a plane, Then its kinetic energy, speed, velocity acceleration will not change. SetId=662

[15] A psuedo force is an apparent force that acts on all masses whose motion is described with respect to a non-inertial frame of reference like a rotating frame of reference. This force is needed by an observer in an non-inertial frame to make all the Newtons second laws to write correct equation of motion..

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[1] The speed is rate of change of distance and the velocity is the rate of change of displacement.

[2] The Law of conservation of angular momentum states that when no external torque acts on an object or a closed system of objects undergoing motion about a given axis, the change in angular momentum is zero. Therefore, considering an event where only internal torque or no torque is involved, the total angular momentum of the system before the event is equal to the total angular momentum after the event

[3] The total angular momentum of a body remains constant of motion when the net torque of the external forces acting on the body is zero.
In general, we have a system of particles such that the net torque of the external forces on the system, w.r.t. some axes K, is zero, the total angular momentum may not remain conserved, because the torque due to the internal forces may not be zero.

[4] For the motion of the Earth around the sun, the total of angular momenta of the Earth and the Sun, about in a reference frame fixed in the pole star, is conserved.

[5] The three components of angular momentum of a conical pendulum is conserved w.r.t. the origin at the position of the center of mass of the pendulum. SetId=663

[6] In the example of skew rod, the angular momentum changes with time and there is a non zero torque coming from action of forces other than gravitational forces. Hence the law of conservation of angular momentum dos not apply.

[7] If a bullet hits a wooden board and gets embedded in the board, the total energy of the bullet and the board system is conserved but the total momentum is not conserved.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then check we should if the laws are applicable or not.

So if there is no *external force* acting on the system all the three quantities, total momentum, total angular momentum, and total kinetic energy will be conserved independent of the nature of forces.

[9] The work done by such forces depends on the path taken. The work done cannot be represented as a potential energy function.Work done by such forces is always negative.

SetId=663

[10] A wagon sliding on a roller coaster designed in such a way that the wagon covers equal distances in equal times. As the motion of the wagon is uniform, there will be no net force acting on it.

[11] Both displacement and distance tell us about the motion of a body but their study does not tell much about the forces on the body

[12] A frame rotating w.r.t K with uniform angular velocity is also an inertial frame.

[13] .The law of conservation of momentum does not hold good when net external forces acting on the system is not zero.when two bodies collide law of conservation of momentum is applicable on system of two bodies but on not individual bodies because external impulse acts on them.

[14] The kinetic energy of a particle is continuously increasing with time, then the angle bewteen the net force and the velocity cannot be greater than or equal to 90^o at any time. SetId=663

[15] One indication that pseudo forces are NON-NEWTONIAN is that they violate Newton's III law and violate the Newton's third law.

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[1] For any type of translational motion of a body, the displacement cannot be zero, where as the distance travelled can be zero.

[2] The law of conservation of angular momentum states that when no external torque acts on an object or a closed system of objects, no change of angular momentum can occur. Hence, the angular momentum before an event involving only internal torques or no torques is equal to the angular momentum after the event . Angular momentum can be calculated with the help of the formula $L = I\omega$ where L stands for Angular momentum, I stands for moment of inertia and ω stands for angular velocity

[3] An example where law of conservation of angular momentum holds:
The Law of conservation of angular momentum holds in the case of a ballet dancer performing a pirouette.

When the dancer extends her arms outward, the angular velocity of her rotation decreases whereas when she keeps her arms close to her body, the angular velocity increases. This is because her moment of inertia changes as she moves her arms outward and inward. It can be noted that she as a system has no external torque acting upon her.

[4] For the motion of the Earth around the sun, the total of angular momenta of the Earth and the Sun, is conserved in every inertial frame of reference; but the angular momentum of the Earth (or of the sun)is not conserved in every inertial frame.

[5] Only the z component of the angular momentum of a conical pendulum is conserved w.r.t. the origin fixed at the point of suspension. SetId=664

[6] In the example of conical pendulum, the z- component of angular momentum does not change. This follows from the angular momentum conservation as there is no external torque.

[7] If a bullet hits a wooden board and gets embedded in the board, both total energy and the total momentum of the bullet and the board are not conserved.

[8] If we want to apply the conservation laws of momentum, energy and angular momentum, we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *external force* acting on the system, the momentum and angular momentum will be conserved, and depending on the nature of the forces but total energy may or may not be conserved.

[9] A nonconservative force is a force with the property that the work done in moving a particle depends on the path taken.Also, the net work done in a closed loop is non zero.

SetId=664

[10] A simple pendulum moves along a circular arc and does not have constant speed and therefore its motion is not uniform.

[11] Displacement is the shortest distance between initial and final points with direction specified.

[12] The Newton's Laws of motion will hold in all frames which are at rest w.r.t. K but do not remain valid in a frame that move with respect to K.

[13] A block moving in the air breaks up into two parts and the parts separate, then the total momentum must be the same before and after the break.

[14] A heavy body is attached from a spring and is held at point A and is such that the spring is not slack nor is it stretched. It is then released. It goes down upto a point B and then it rises upto point C and executes an oscillatory motion between B and C. During the motion from A to C is first positive (from A to B) and then it is negative from B to A and again remains negative from A to C. SetId=664

[15] The apparent force which seems to act on an object in an accelerating frame of reference if we wish to describe the object's motion is called a pseudo force.Its a non-existent force used only to describe the motion completely using Newton's second law even though the agent causing the force is undefined.

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SetId=665

[1] Displacements, being vector quantity can not compared with, a scalar quantity such as distance.

[2] Newton's Second Law of Motion is defined by the expression $F = \frac{dp}{dT}$, where F gives the force vector acting on the system and p gives its momentum vector; in linear motion. A similar expression can be written to describe angular motion, i.e. : $\tau = \frac{dL}{dt}$, where τ is the external torque vector acting on the system, and L is the angular momentum.

If the external torque on the system is zero, then we get the expression as: dL/dt=0. This points out to the fact that, when no external torque is acting on the system, then its angular momentum is constant, no matter what changes occur in the system. This is the Law of Conservation Of Angular Momentum.

[3] In case of a skater, who can be considered an isolated system, so no torue will be acting on him/her. When the arms are extended, the moment of inertia is more. When his hands are closely held, the moment of inertia is lesser. Since the angular momentum is same, the angular acceleration changes accordingly.

[4] In the Sun Earth system the angular momentum of the Earth is conserved in every frame of reference

[5] The z component of angular momentum of a conical pendulum is not conserved w.r.t. the origin fixed at the point of suspension; but the x and y components are conserved.

SetId=665

[6] In the example of conical pendulum, the x and$y$ components of angular momentum change. This follows from the angular momentum conservation as the z components external torque is zero and horizontal components of torque are non zero.

[7] There are certain situations where it appears that the law of conservation of linear momentum does not hold. For example if we take some amount of a substance like construction putty, cement, cake batter, playing dough,etc and drop it on the ground, it does not bounce back like a rubber ball would and hence the momentum it had before striking the ground seems to have been lost. Hence it appears that the law of conservation of linear momentum does not hold.

[8] To apply the conservation laws of momentum, energy and angular momentum, we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *external force* acting on the system, the energy and momentum will be conserved. However, depending on the nature of the system and of the forces, the total angular momentum may not be conserved.

[9] A force whose work done is a path function is called a non-conservative force. All the forces which do not satisfy the definition of conservative forces are non-conservative in nature. The work done by these forces dissipates into heat energy, sound energy, light energy, etc. Therefore, law of conservation of mechanical energy cannot be applied to a system on which a non-conservative force is acting. No potential function can be defined for these forces.

SetId=665

[10] A satellite goes around the earth in a circular orbit of 600km with a time period of $5.8 \times 10^3 s$. Its motion will be uniform as it will cover equal distances in equal times.

[11] Displacements, being vector quantity can not compared with, a scalar quantity such as distance.

[12] Staying inside a bullet train moving with constant velocity (no jerks etc) an experiment can always be performed which will tell us the numerical velocity of the bullet train

[13] A ball hits the floor and rebounds after an inelastic collision. In this case the total momentum of the ball before and after the collsion is conserved. Also the total enrgy of the ball and the earth remains the same

[14] The kinetic energy of a body does not change if any one of the following is true
(i)force is always perpendicular to the velocity
(ii) the force is always perpendicular to the acceleration
(iii) the object remains stationary
(iv) the object moves in such a way that the point of application of the force remains fixed.

SetId=665

[15] The physically apparent, but nonexistent, force needed by an observer in a noninertial frame to make Newton's laws of motion hold true is called pseudoforce.

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[1] Distance depends on the path where as the displacement depends on the end point only.

[2] If the net external torque acting on a system is zero, the angular momentum L of the system remains constant, no matter what changes take place within the system.

$$\sum(T_{\text{ext}}) = \frac{dL}{dt}$$

The law states that when there is no net external torque, $\frac{dL}{dt}$ is zero implying that the total angular momentum of system is constant.

i.e. $L = a$ constant (isolated system)

[3] Example where law of conservation of angular momentum holds:
Let us assume a student seated on a stool that can rotate freely about a vertical axis. The student has been set into rotation at a modest initial angular speed ω . He holds two dumbbells in his outstretched hands. His angular momentum vector L lies along the vertical rotation axis, pointing upwards. Now he pulls in his arms;this action reduces his rotational inertia from its value I_{initial} to a final value I_{final} because he moves the mass closer to the rotational axis. His rate of rotation increases markedly, from ω_{initial} to ω_{final}. The student can then slow down by extending his arms once more,moving the dumbbells outward. No external torque acts on the system consisting of the student, stool and the dumbbells. Thus the angular momentum of the system about the rotational axis remains constant. $I_{\text{initial}} * \omega_{\text{initial}} = I_{\text{final}} * \omega_{\text{final}}$.

[4] In the motion of earth around sun, the angular momentum of the earth about an axis passing through the sun and perpendicular to the plane of motion of earth is conserved.

[5] Only the z component of angular momentum of a conical pendulum is conserved w.r.t. the origin fixed at the point of suspension. SetId=666

[6] Example where law of conservation of angular momentum does not hold: A disc rotating on a horizontal rough surface will not have a constant angular momentum because there will be a constant torque by frictional force. Hence, its angular momentum will decrease, and the law of conservation of angular momentum does not apply.

[7] A tennis ball is dropped from height h and after hitting the ground and it bounces back and rises to the same height. In this case the momentum of the ball is conserved because (under ideal conditions) the momentum after it hits the ground will be equal to the momentum it had before hitting the ground.

[8] In order to apply the law of conservation of momentum we must first identify the system. If there is no *external forces* acting on the system then conservation laws of momentum always holds. And depending on the nature of the system and of the forces, the total kinetic energy and the total angular momentum may not be conserved.

[9] *Non conservative forces* are the type of forces in which the work done by the forces is purely dependent on the path taken by the body.Thus the net work done by the forces in cyclic path is never equal to zero.

SetId=666

[10] A uniform motion is defined to be the one in which a body covers equal distances in equal time intervals.

[11] Distance depends on the path where as the displacement depends on the end point only

[12] Staying inside a bullet train moving with constant velocity (no jerks etc) an experiment can always be performed which will tell us the numerical value of the acceleration of the bullet train

[13] In a head on elastic collision of two identical bodies of equal masses the velocities, the speeds, the momenta and the kinetic energy are all exchanged.

[14] The total work done on a particle is always equal to the change in kinetic energy. SetId=666

[15] Pseudo forces come into picture when Newton's laws of motion have to be applied to describe the motion of bodies in non-inertial frames. These forces have no real existence.

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[1] Distance equal to zero implies displacement=0; and Displacement=0 also implies distance = 0

[2] When the net external torque acting on a body or a system of bodies is zero about a particular axis, then the angular momentum of each body is conserved about that axis.

[3] A bob is attached to ceiling by a string and moves in a horizontal circular plane is an example. In this case the law of conservation of angular momentum does not hold.

[4] For the motion of earth around sun, the angular momentum of the earth about the center of mass of the sun + earth system and perpendicular to the plane of motion of earth is conserved.

[5] The projection of angular momentum of a conical pendulum in the horizontal plane is a constant of motion when the origin is chosen to be at fixed at the point of suspension. SetId=667

[6] Example where law of conservation of angular momentum does not hold:Consider a vertical stick on the ground falling to a horizontal position. During the fall, the conservation of angular momentum applied at the point of rotation on the ground and perpendicular to the plane of the stick is not applicable as, the gravitational force which acts vertically downwards assumed at the centre of mass produces an external torque about the axis of rotation

[7] Law of conservation of momentum does not hold when Newton's laws are not valid, e.g. in a non-inertial frame of reference. For example, when we consider collision between two bodies in a non-inertial frame of reference, the law of conservation of momentum cannot be applied because there will be a pseudo force acting on the frame itself.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then check if the laws is applicable or not.

So if there is no *net external force* acting on the system all the three conservation laws will hold.

[9] Non-conservative forces are path-dependent forces, i.e. the work done on a body by these forces depends on the path taken by the body. Mechanical energy of a system is not conserved when a conservative force acts on it but the total energy is conserved. Therefore, the mechanical energy lost by the system is liberated in some other form such as light energy, heat energy, etc.

For example, when a body is moving along a surface, frictional force acts on the body as well. Due to this frictional force, the body loses its mechanical energy, and

this loss is generally released in the form of heat energy to the surroundings. Thus, the mechanical energy will not be conserved and frictional force can be classified as a non-conservative force. SetId=667

[10] A particle moves on a circular path. Then its speed, direction of force, velocity and acceleration must always change with time.

[11] Distance equal to zero $\Rightarrow$ displacement=0; but Displacement=0

[12] Assume bullet train, moving with out any jerks, is going on a circular arc of radius R with constant speed. Then an experiment is to be performed entirely within the train without any measurement on objects outside the train. Such an experiment can tell only radius of the track.

[13] For a system of several particles the conservation of total linear momentum is equivalent to the statement that their centre of mass moves like a free particle.

[14] A particle is acted upon by a force of constant magnitude which is always perpendicular to the velocity of the particle and the motion of the particle takes place in a plane, Then its kinetic energy, speed, velocity acceleration will not change. SetId=667

[15] In a non-inertial frame of reference the accelration of the body that we measure, is not the true acceleration, as the frame itself accelerates.Thus,force(F=ma) is also not the true force acting on the body.The extra force added to make it a true value is called pseudo force.Thus pseudo force does not really act on a body but just compensates the change produced by the non inertial frame, in true acceleration.

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[1] If P and Q are the initial and the final points of a path of a particle, displacement is a vector whose direction is along PQ and has magnitude is equal to the length of line PQ

SetId=668

[2] The law of conservation of angular momentum states that in absence of an external torque on an object or a closed system of objects the total angular momentum of the system remains constant. Thus if $\vec{\tau} = 0 => \vec{L} =$ constant where τ is the torque and $\vec{L}$ is the angular momentum of the system.

[3] Consider a disc rotating about an axis perpendicular to its plane. On placing a smaller disc with its surface parallel to the surface of the rotating disc, the angular momentum of the system of two discs remains constant as there is no external torque.

[4] In the Sun Earth system the angular momentum of the Earth about the pole star is conserved

[5] The law of angular momentum of a is not applicable for the conical pendulum conserved w.r.t. the origin fixed at the point of suspension. SetId=668

[6] We have a conical pendulum .The forces acting on the bob are tension (along the direction of the string) and gravitational force acting in the vertically downward direction.we have an additional force called the drag force which is tangential to the motion of the bob and acts in the direction opposite to the motion of the bob.The axis of rotation passes through the hinge point and is vertical.The torque due to tension is 0 because the force passes through the axis of rotation.The torque due to mg is also zero since it is parallel to the axis of rotation.but the torque due to drag force is not zero.since the net external torque acting on the bob is not zero,therefore the law of conservation of angular momentum does not hold here

[7] If I throw a ball upward, it's speed decreases as it rises upwards. There is an external force (gravity) acting on the ball, so the momentum conservation law does not apply. Momentum of the ball is not conserved, however the momentum of the Earth-ball system is conserved as gravity will become an internal force in this case.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then check we should if the laws are applicable or not.

So if there is no *external force* acting on the system all the three quantities, total momentum is conserved. The total angular momentum is also because the torque of internal forces will be zero. The conservation of energy depends on the nature of forces. will be conserved.

[9] It is a force for which the work done by that force on an object or a particle in moving it between any two points depends on its path travelled.This force doesn't conserves the mechanical energy.The work done by a non-conservative force on an object in moving it in a circular path is not equal to zero.

SetId=668

[10] A particle moves on a circular path. Then its speed, direction offorce, can remain constant by velocity and acceleration must always change with time.

[11] If P and Q are the initial and the final points of a path of a particle, displacement is a vector whose direction is along PQ and has magnitude is equal to the length of line PQ

[12] Assume bullet train, moving with out any jerks, is going on a circular arc of radius R with constant speed. Then an experiment is to be performed entirely within the train without any measurement on objects outside the train. Such an experiment can tell both speed of the train and radius of the track.

[13] The total mechanical energy of a system may not be conserved if there are no external forces and the internal forces are conservative.

[14] The kinetic energy of a particle is continuously increasing with time, then the angle bewteen the net force and the velocity cannot be greater than or equal to 90^o at any time.

SetId=668

[15] A force is any interaction which tends to change the motion of an object. It is *equal to* the rate of change of momentum by Newton's second law.

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SetId=669

[1] If P and Q are the initial and the final points of a path of a particle,the displacement is the vector $\overrightarrow{PQ}$.

[2] If no net external torque acts on a system, the total angular momentum of the system remains constant.

[3] Consider a man standing on a spinning platform. Initially, the man spreads out his arms and he spins with a certain angular velocity. The next moment, he pulls his arms inwards keeping them close to his body. We will observe that the angular velocity with which he is spinning now increases. This phenomenon can be explained by the Law Of Conservation of Angular momentum. Initially, since his arms were spread wide, his moment of inertia was large. However, when he pulled them close to his body, his moment of inertia decreased.
In this example the angular velocity of the man increases and therefore the angular momentum also increases.The law of conservation of angular momentum does not apply because the torque of muscular forces is not zero.

[4] For the motion of earth around sun, the angular momentum of the sun about the center of mass of the sun + earth system and perpendicular to the orbital plane of earth is conserved.

For the motion of earth around sun, the angular momentum of the sun about and axis passing through the Earth and perpendicular to the orbital plane of motion of earth is conserved.

[5] The law of angular momentum of a is not applicable for the conical pendulum conserved when the origin is chosen to be at the pendulum bob itself. SetId=669

[6] When you release a toy gyroscope on its pedestal, it initially has no precessional rotation around that pedestal, i.e, the orientation of rotation is fixed. However, it instantaneously starts precessing around the pedestal. Both Kinetic Energy and Angular Momentum now exist where they did not exist a moment earlier. The Kinetic Energy is easy to explain, as appearing due to the body of the gyroscope dropping a tiny fraction of a millimeter in the Earth's gravitational field, giving up exactly the correct amount of Potential Energy. But the Angular Momentum of the Precession which just appeared, does not come from anywhere. This is therefore a Violation of the Conservation of Angular Momentum.

[7] A soldier accelerating away, after detonating a bomb, will find that the total momentum of the fragments of the bomb is zero. This is an example where the law of conservation of momentum holds as the forces on the fragments are internal forces only and sum of all such forces is zero.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *net external force* acting on the system, the momentum is conserved. The definition of angular momentum and torque depends on the choice of axes, and therefore it may not be be conserved. The conservation of total energy holds only for conservative forces.

When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *net external force* acting on the system, the energy and momentum will be conserved. However, the total angular momentum may not be conserved because the torque may not be zero.

[9] Explain Nonconservative force: This force is just opposite to that of conservative force. The work done by this force depends on the path taken by the particle on which the force is applied.This force does not conserve mechanical energy.If a particle travels in a closed loop, the net work done by a non consevative force is non zero.

SetId=669

[10] A particle moves on a circular path. Then under suitable conditions its speed may remain constant, but the force, velocity and acceleration must always change with time.

[11] If P and Q are the initial and the final points of a path of a particle,the displacement is the vector $\overrightarrow{PQ}$.

[12] Assume bullet train, moving with out any jerks, is going on a circular arc of radius R with constant speed. Then an experiment is to be performed entirely within the train without any measurement on objects outside the train. Such an experiment can tell only speed of the track.

[13] When a bullet fired on a wooden block, some energy is transferred to the block and the total mechanical energy of the block and the bullet is conserved.

[14] A heavy body is attached from a spring and is held at point A and is such that the spring is not slack nor is it stretched. It is then released. It goes down upto a point B and then it rises upto point C and executes an oscillatory motion between B and C. During the motion from A to C is first positive (from A to B) and then it is negative from B to A and again remains negative from A to C. SetId=669

[15] Newton's laws are not valid on non-inertial frame of reference. So to validate Newton's laws of motion pseudo force (fictious or virtual force) is introduced.
Pseudo force acts in non-inertial frame. Its magnitude is always mass of the body multiplied by acceleration of the frame. It is always in direction opposite to the acceleration of the frame of reference. The resultant of pseudo forces and real forces is always zero.

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[1] If two bodies starting from a point A reach a point B, following different paths, their displacement will be, in general different, but the distances covered will always be the same.

SetId=670

[2] The law of conservation of angular momentum states that when no external torque is applied on an object or a closed system of objects about an axis, the angular momentum about that axis remains constant.

[3] In the Sun-Earth system, angular momentum of the earth is not conserved but the total angular momentum of the sun and the earth is constant of motion.

[4] For the motion of earth around sun, the sum of angular momenta of the Sun and the Earth about the center of mass of the sun + earth system is conserved.

[5] The three components of angular momentum of a conical pendulum is conserved w.r.t. the origin at the position of the center of mass of the pendulum. SetId=670

[6] There is no case where LAW OF CONSERVATION OF ANGULAR MOMENTUM does'nt hold.But there are cases where conservation of angular momentum does not hold.A body in vertical circular motion is an example where angular momentum is not conserved. Here the law of conservation does not apply.

[7] There is no known exception to the law of conservation of momentum in classical mechanics However, an exception to conservation of energy in nuclear physics is observed. In nuclear reactions when two nuclei collide and their mass converts to energy and energy momentum are not conserved.

[8] In order to apply the law of conservation of momentum we must first identify the system. If there is no *net external forces* acting on the system then conservation laws of momentum always holds. The total energy and the total angular momentum may not be conserved.

[9] Non conservative force is the force in which the work done by a particle in going from one point to another is path dependent.

For non conservative forces mechanical energy is not conserved,mostly lost in the form of heat and light.The work done by a non conservative force is equal to the change in mechanical energy.

SetId=670

For non conservative force $E_{\text{initial}} > E_{\text{final}}$

[10] A particle moves on a circular path. Then under suitable conditions its speed and acceleration may remain constant, but the force, and velocity must always change with time.

[11] If two bodies starting from a point A reach a point B, following different paths, their displacement will be, in general different, but the distances covered will always be the same.

[12] A particle is observed from two frames S_1 and S_2. The frame S_2 moves with respect to S_1 with an acceleration a. If F_1 and F_2 be the pseudoforces when seen from S_1 and S_2 respectively it is not possible to have $F_1 = F_2 = 0$

[13] When a moving car hits a parked lorry and causes the parked lorry to move ,energy is transferred from moving the car to the lorry and the total energy of the lorry and the car is conserved.

[14] The kinetic energy of a body does not change if any one of the following is true
(i)force is always perpendicular to the velocity
(ii) the force is always perpendicular to the acceleration
(iii) the object remains stationary
(iv) the object moves in such a way that the point of application of the force remains fixed.

SetId=670

[15] These forces are non-real forces but must be taken into account while applying Newton's Law's of Motion in accelerating frame of reference as compared to an inertial frame of reference.

The centrifugal and centripetal forces are examples of pesudo-forces.

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SetId=671

[1] Displacement is equal to the vector difference $\vec{r}_f - \vec{r}_i$ of the position vectors of initial and final points. The distance covered will be $|\vec{r}_f - \vec{r}_i|$

[2] The angular momentum of a given system of bodies shall remain conserved unless acted upon by an external unbalanced torque.

[3] Consider a disc and a man system. man is standing on center of the disc rotating with angular velocity.initially man folded his hand.when man stretches his hands then momentum of inertia of system increases.and angular velocity decreases.and total angular momentum remains constant.

[4] For the motion of the Earth around the sun, the total of angular momenta of the Earth and the Sun, about in a reference frame fixed in the pole star, is conserved.

[5] Only the z component of the angular momentum of a conical pendulum is conserved w.r.t. the origin fixed at the point of suspension. SetId=671

[6] A sphere rolling on a rough surface.Due to friction there is external torque so the angular momentum changes which results in the slowing of the sphere. The angular momentum keeps changing. Even in case like this one, it is wrong to say that the Law of Angular Momentum Conservation does not hold.

[7] In a system of a canon and a canon ball, total momentum of the system is zero before canon ball is fired. After firing the canon ball, the momentum of the system seems to be conserved as the ball moves forward and the canon moves backward.

[8] In order to apply the law of conservation of momentum we must first identify the system. Then even if there is no *net external forces* acting on the system, all the three conservation laws of momentum, angular momentum and energy may not hold due to presence of internal forces.

[9] A force is said to be non-conservative, if the work done by the force is dependent on the path taken. It could also be defined as a force for which the work done during a cyclic process is non-zero.

SetId=671

[10] When the force is kept constant as function of time, it is possible for a particle to move on a circular path in such a way that its speed remains constant, but the velocity and acceleration must always change with time.

[11] Distance is equal to the length of the path covered. Displacement is the shortest distance between initial and final points.

[12] A particle is observed from two frames S_1 and S_2. The frame S_2 moves with respect to S_1 with an acceleration a. If F_1 and F_2 be the pseudoforces when seen from S_1 and S_2 respectively and if $F_1 = 0$ then we must have $F_2 \neq 0$

[13] When a bomb explodes the total mechanical energy is not conserved. But the total chemical energy and the mechanical energy is conserved.

[14] The total work done on a particle is always equal to the change in kinetic energy. SetId=671

[15] When observing our system from a reference frame which is accelerating compared to an inertial frame,in order to make it easier to apply newtons laws, we can apply a pseudo force on all objects in the universe proportional to their mass capable of causing an acceleration equal and opposite to that of our reference frame. Hence serving to in a way "stop"(or make inertial) our reference frame, and making it easier for us to investigate the motion.

This application of pseudo force doesn't change the motion of the object because just as we can choose an arbitrary reference frame, we can choose an arbitrary force to cause the same acceleration in every object in the whole universe without changing the relative motions of objects. (as all motion is truly relative, we will still get correct answers for our investigations.

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SetId=672

[1] Distance is equal to the length of the path covered. Displacement is the shortest distance between initial and final points.

[2] When the net external torque acting on a system about a given axis is zero, the total angular momentum of the system about that axis remains consant.

[3] The conservation of angular momentum of a system of bodies requires that the the sum of torque due to all forces be equal to zero. Now consider a situation where the forces are such that the sum of torques of external forces is zero w.r.t. some axes K. Since the value of torque depends of the choices of axes, the sum of torques due to all internal forces will depend on the choice of axes and in general it will be non zero. Therefore, for a system of several bodies, for a given choice of axes K, there will be situations when the total angular momentum may not be conserved.

[4] For the motion of the Earth around the sun, the total of angular momenta of the Earth and the Sun, is conserved in every inertial frame of reference; but the angular momentum of the Earth (or of the sun)is not conserved in every inertial frame.

[5] The z component of angular momentum of a conical pendulum is not conserved w.r.t. the origin fixed at the point of suspension; but the x and y components are conserved. SetId=672

[6] Consider a rod of length l. Let us give an impulse to one end . Now the angular momentum about the oposite end is not zero since the impulse provides some torque . So the angular momentum is not conserved .

$$\text{torque} = \text{impulse} * \ell.$$

$d\ell/dt$ is not equal to zero and the law of conservation of angular momentum does not hold.

[7] When applying the conservation laws of momentum, energy and angular momentum we must define the system first.Only then check if the laws is applicable or not.

As an example: when a ball is dropped from a height, it gains momentum down if we consider the ball as our system.This is because the force of gravity acts as an external force.

However, if we change our system and consider earth as a part of our system too, then the momentum remains conserved because the earth gains momentum up.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then check we should if the laws are applicable or not.

So if there is no *external force* acting on the system all the three quantities, total momentum, total angular momentum, and total kinetic energy will be conserved independent of the nature of forces.

[9] a force is said to be non conservative if work done is dependent on the path of the particle.potential cannot be defined in the case of non conservative forces.work done in closed loop is not equal to zero.

SetId=672

[10] It is not possible for a particle to move on a circular path in such a way that its speed and force remains constant, and only the velocity and acceleration may (or may not) always change with time.

[11] Distance is a scalar quantity where as the displacement is a vector quantity.

[12] If K is an inertial frame, any frame that moves w.r.t. the frame K with uniform velocity is also an inertial frame.

[13] When a ball rolls over a rough surface, it comes to stop after some time. This is because transational and rotational kinetic energy initially present in the ball continuosly gets converted to heat due to friction. When all the kinetic energy changes to heat, the ball stops. The total mechanical energy of the ball is not conserved.

[14] A particle is acted upon by a force of constant magnitude which is always perpendicular to the velocity of the particle and the motion of the particle takes place in a plane, Then its kinetic energy, speed, velocity acceleration will not change.

SetId=672

[15] Various types of forces in nature can be grouped in four categories:
(a)Gravitational; (b)Electromagnetic; (c)Nuclear; (d)Weak
There are also some non-fundamental forces such as:
(i)Normal reaction on bodies in contact with surfaces , (ii) Friction,(iii) Tension,(iv)Elastic force.

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[1] Distance is a scalar quantity where as the displacement is a vector quantity.

[2] This law sates that when no net torque of all forces acts on a object or a system of objects then total angular momentum of system is conserved.The angular momentum before an event is equal to angular momentum after that event.mathematically explained by when, net torque=0 ;then, total angular momentum(L)=constant.

[3] Example where law of conservation of angular momentum does not hold:
When there is external force like frictional force acting on a object when it is rotating we cannot use conservation of angular momentum as the friction force acting on the object produces an external torque.

[4] In the Sun Earth system the angular momentum of the Earth is conserved in every frame of reference

[5] Only the z component of angular momentum of a conical pendulum is conserved w.r.t. the origin fixed at the point of suspension.

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[6] Let us consider a rotating skew rod. In the absence of friction or any other drag force, the rod should continuously spin without stopping. Here the net torque about the axis of rotation is 0 and hence angular momentum is conserved. It therefore follows from law of conservation of angular momentum that a spinning skew rod will keep rotating with constant angular velocity if there is no external torque. So law of conservation of angular momentum does not hold.

[7] Statement: Law of Conservation of energy states that "ENERGY CAN NEITHER BE CREATED NOR DESTROYED",but it can be changed from one form to other.

EXPLANATION: Statement implies that the total amount of energy in an isolated system remains constant although it may change forms. viz, kinetic energy may change to potential;chemical to electrical energies etc.

[8] If we want to apply the conservation laws of momentum, energy and angular momentum, we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *external force* acting on the system, the momentum and angular momentum will be conserved, and depending on the nature of the forces but total energy may or may not be conserved.

[9] Explain Nonconservative Forces:

The forces that depend on the path taken by the particle are called non-conservative forces.

Mechanical energy is not conserved during the action of a non conservative force, instead, it is lost as other forms of enery like heat, light, etc.

Potential energy is not defined for a non-conservative force.

The initial and final kinetic energy in a closed loop is not equal.

The work done by a non conservative force in a closed loop is non zero. In practice, the net work is invariably negative.

Work done by a non conservative force cannot be completely recovered.

For a non conservative force,

$$/text(KE)//_f//+(\text{PE})//_f// = (\text{KE})_i+(\text{PE})_i//+//\text{Work Done})//\text{non-conservative force}//$$

SetId=673

[10] For a particle moving on circle the acceleration is always constant in magnitude and directed towards the centre of the circle.

[11] Both displacement and distance tell us about the motion of a body but their study does not tell much about the forces on the body

[12] If K is an inertial frame, any frame that moves w.r.t. the frame K with uniform speed is also an inertial frame.

[13] Let us consider that a pendulum is oscillating moving in a vertical plane. Mean while let another bob which is attached to a spring and is executing a simple harmonic motion in horizontal direction comes and hits the pendulum. Here conservation of momentum does not hold good as tension(external force) is acting on the system.(pendulum)

[14] The kinetic energy of a particle is continuously increasing with time, then the angle bewteen the net force and the velocity cannot be greater than or equal to 90^{o} at any time. SetId=673

[15] A force is agency that which changes or tends to change the state of rest or motion of a body.

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[1] The speed is rate of change of distance and the velocity is the rate of change of displacement.

[2] Statement of Law of Conservation of Angular Momentum:
Differentiating $\vec{L} = \vec{r} \times \vec{p}$ w.r.t, time,

$$
\begin{aligned}
\frac{dL}{dt} &= \frac{d\vec{r} \times \vec{p}}{dt} = \frac{d\vec{r}}{dt} \times \vec{p} + \vec{r} \times \frac{d\vec{p}}{dt} = \vec{v} \times (m\vec{v}) + \vec{r} \times \vec{F} \\
&= \vec{r} \times \vec{F} (\because v \times v = 0) \\
&= \vec{\tau}
\end{aligned}
$$

here $\vec{\tau}$ represents the net torque acting on a rigid body rotating about a fixed axis.This torque must take into account of all the forces, be it external or internal forces

[3] A bob attached to a ceiling by a string moving in a horizontal circular plane is an example where the total angular momentum of the bob about the point of suspension is not conserved. This is because the the torque due to the weight of the bob about the point of suspension does not vanish and has non zero horizontal component. Only the vertical component of the angular component is conserved.

[4] In the motion of earth around sun, the angular momentum of the earth about an axis passing through the sun and perpendicular to the plane of motion of earth is conserved.

[5] The projection of angular momentum of a conical pendulum in the horizontal plane is a constant of motion when the origin is chosen to be at fixed at the point of suspension.

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[6] In the example of skew rod the angular velocity does not change even though the torque applied is nonzero. However there is no contradiction as in this case the law of conservation of momentum is not applicable. conservation is violated.

[7] Oscillating simple pendulum is a very good example where potential energy gets converted to kinetic energy and kinetic to potential energy. Some energy gets dissipated as heat if we consider air resistance. Energy as a whole is conserved if we consider universe as system, the energy has just changed its form.

[8] To apply the conservation laws of momentum, energy and angular momentum, we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *external force* acting on the system, the energy and momentum will be conserved. However, depending on the nature of the system and of the forces, the total angular momentum may not be conserved.

[9] A non conservative force is one where the mechanical energy is not conserved.Here the work done is dependent on the path taken .Different amounts of work need to be done in different paths.Here potential energy would have no meaning as it would keep changing with the path.Here some amount of mechanical energy is lost as sound energy or heat energy and hence is not conserved.

SetId=674

[10] The motion of a bomb dropped from a plane does is not a uniform motion as it follows a parabolic path and not a straight line path.

[11] Displacement is the shortest distance between initial and final points with direction specified.

[12] A frame rotating w.r.t K with uniform angular velocity is also an inertial frame.

[13] The law of conservation of momentum does not hold in relativistic situations, i.e., where the speeds of the masses involved are close to the speed of light.

[14] A heavy body is attached from a spring and is held at point A and is such that the spring is not slack nor is it stretched. It is then released. It goes down upto a point B and then it rises upto point C and executes an oscillatory motion between B and C. During the motion from A to C is first positive (from A to B) and then it is negative from B to A and again remains negative from A to C.

SetId=674

[15] The forces may be of the following two types - *Contact forces* (those that act when bodies are in physical contact) eg. friction, normal reaction, bouyancy etc. and*Action-at-a-distance forces* (those that act when bodies are not in contact) eg. Gravity, electostatic forces, magnetic forces etc. There At the root level, forces are of the following fundamental types :- (a) *Gravitational forces* - weakest of all forces, always attractive
(b) *Electromagnetic forces* - stronger than gravitational forces, can be attractive or repulsive,
(c) *Nuclear forces* - exist at atomic level, have very short range,
(d) *Weak nuclear forces* associated with beta particle emission

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SetId=675

[1] For any type of translational motion of a body, the displacement cannot be zero, where as the distance travelled can be zero.

[2] Statement of Law of Conservation of Angular Momentum: For a system of many particles The net torque due all the forces, be it external or internal forces. But as the torque due to all the internal forces cancel out, it sufficient to consider the external forces acting on the system.

[3] Law of conservation of angular momentum holds in case of long jump. When a athlete takes off from the ground in a running long jump, the forces on the launching foot give the athlete an angular momentum with a forward rotation around a horizontal axis. Such rotation would not allow the jumper to land properly. In the landing, the legs should be together and extended forward at an angle so that the heels mark the sand at the greatest distance. Once airborne, the angular momentum cannot change (it is conserved) because no external torque acts to change it. However, the jumper can shift most of the angular momentum to the arms by rotating them in windmill fashion. Then the body remains upright in the proper orientation of landing.

[4] For the motion of earth around sun, the angular momentum of the earth about the center of mass of the sun + earth system and perpendicular to the plane of motion of earth is conserved.

[5] The law of angular momentum of a is not applicable for the conical pendulum conserved w.r.t. the origin fixed at the point of suspension. SetId=675

[6] Example where law of conservation of angular momentum does not hold:If a particle undergoes conical motion and the only force acting on particle is central force like tension of the string.Then total external torque about fixed point A is zero,yet angular momentum is not conserved,as angular momentum keeps on changing direction.

[7] Law of conservation of momentum does not hold whenever an external force or impulse acts on the system. For example,when a body collides with earth then it bounces back to a lesser height as it loses some velocity.

In this example the momentum of a ball is not conserved due to impulsive force by ground in the normal direction.

However, strictly speaking the system that should be considered here is the ball-earth system and the total momentum is conserved.

[8] In order to apply the law of conservation of momentum we must first identify the system. If there is no *external forces* acting on the system then conservation laws of momentum always holds. And depending on the nature of the system and of

the forces, the total kinetic energy and the total angular momentum may not be conserved.

[9] The force whose work depends on path taken is called a non conservative force.friction for example does less work on a book dragged across a table if the book is dragged straight across than if the book is dragged in a curved path.

SetId=675

[10] A wagon sliding on a roller coaster designed in such a way that the wagon covers equal distances in equal times. As the motion of the wagon is uniform, there will be no net force acting on it.

[11] Displacements, being vector quantity can not compared with, a scalar quantity such as distance.

[12] The Newton's Laws of motion will hold in all frames which are at rest w.r.t. K but do not remain valid in a frame that move with respect to K.

[13] when we are in accelerating frame if we observe any collision between two bodies then the law of conservation of momentum does not hold in that frame of reference.

[14] The kinetic energy of a body does not change if any one of the following is true
(i)force is always perpendicular to the velocity
(ii) the force is always perpendicular to the acceleration
(iii) the object remains stationary
(iv) the object moves in such a way that the point of application of the force remains fixed.

SetId=675

[15] The main differences between force and pseudo force are -
(1) Forces have a real presence while pseudo forces don't.
(2) Forces can be accounted for by Newton's laws.
(3) Pseudo forces are only taken into account when the reference frame is accelerated.

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SetId=676

[1] Displacements, being vector quantity can not compared with, a scalar quantity such as distance.

[2] Depending on the torques acting on a system, the angular momentum can be conserved only in one or two directions, but may not be conserved in all. For instance, if an isolated body has no torque acting on it only in the direction along the Z axis, then the angular momentum is conserved only in that direction.

[3] The total angular momentum of a body remains constant of motion when the net torque of the external forces acting on the body is zero.
In general, we have a system of particles such that the net torque of the external forces on the system, w.r.t. some axes K, is zero, the total angular momentum may not remain conserved, because the torque due to the internal forces may not be zero.

[4] In the Sun Earth system the angular momentum of the Earth about the pole star is conserved

[5] The law of angular momentum of a is not applicable for the conical pendulum conserved when the origin is chosen to be at the pendulum bob itself. SetId=676

[6] A nonzero torque always causes the angular velocity to change, because a change in angular momentum means a change in angular velocity $L = I\omega$

[7] If a bullet hits a wooden board and gets embedded in the board, the total energy and the total momentum of the bullet and the board are conserved.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then check if the laws is applicable or not.

So if there is no *net external force* acting on the system all the three conservation laws will hold.

SetId=676

[9] ** Nonconservative force is a force in which the amount of work done by the force is dependent of the path taken to change a state of a system.

[10] A simple pendulum moves along a circular arc and does not have constant speed and therefore its motion is not uniform.

[11] Distance depends on the path where as the displacement depends on the end point only

[12] Staying inside a bullet train moving with constant velocity (no jerks etc) an experiment can always be performed which will tell us the numerical velocity of the bullet train

[13] Give an example where law of conservation of momentum does not hold all cases when seen from non inertial frame of references for example when we see two cars collide from a moving bus there momentum is not conserved

[14] The total work done on a particle is always equal to the change in kinetic energy. SetId=676

[15] A force is any interaction which tends to change the motion of an object. It is also *defined* as rate of change of momentum. It is a vector quantity.

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[1] Distance depends on the path where as the displacement depends on the end point only.

[2] According to Law of Conservation of Angular momentum,if no external torque acts on an object or system of objects,angular momentum of an object or system of objects remains CONSTANT or no change in angular momentum can occur.

Also it states that,only external torque can change angular momentm of the system where as the torque produced by internal forces can not change the angular momentum of the system

[3] An example where law of conservation of angular momentum holds:
The Law of conservation of angular momentum holds in the case of a ballet dancer performing a pirouette.

When the dancer extends her arms outward, the angular velocity of her rotation decreases whereas when she keeps her arms close to her body, the angular velocity increases. This is because her moment of inertia changes as she moves her arms outward and inward. It can be noted that she as a system has no external torque acting upon her.

[4] For the motion of earth around sun, the angular momentum of the sun about the center of mass of the sun + earth system and perpendicular to the orbital plane of earth is conserved.

For the motion of earth around sun, the angular momentum of the sun about and axis passing through the Earth and perpendicular to the orbital plane of motion of earth is conserved.

[5] The three components of angular momentum of a conical pendulum is conserved w.r.t. the origin at the position of the center of mass of the pendulum. SetId=677

[6] A nonzero torque always implies change in angular momentum and may not give rise to a change in magnitude of angular velocity. A non zero torque may mean change only the direction of the angular momentum and not the angular velocity.

[7] If a bullet hits a wooden board and gets embedded in the board, the total energy of the bullet and the board system is conserved but the total momentum is not conserved.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then check we should if the laws are applicable or not.

So if there is no *external force* acting on the system all the three quantities, total momentum is conserved. The total angular momentum is also because the torque

of internal forces will be zero. The conservation of energy depends on the nature of forces. will be conserved.

[9] Nonconservative force is any force where the work done by the force on the object depends on the path of motion of the object.the work done by the frictional force results in to loss of the energy of the system in the form of heat or other form of energy.

SetId=677

[10] A satellite goes around the earth in a circular orbit of 600km with a time period of $5.8 \times 10^3 s$. Its motion will be uniform as it will cover equal distances in equal times.

[11] Distance equal to zero $\Rightarrow$ displacement=0; but Displacement=0

[12] Staying inside a bullet train moving with constant velocity (no jerks etc) an experiment can always be performed which will tell us the numerical value of the acceleration of the bullet train

[13] When a tennis ball hits the ground at an oblique angle, the angle of reflection is equal to the angle of incidence. This is a simple consequence of conservation of horizontal component of momentum.

[14] A particle is acted upon by a force of constant magnitude which is always perpendicular to the velocity of the particle and the motion of the particle takes place in a plane, Then its kinetic energy, speed, velocity acceleration will not change.

SetId=677

[15] Explain Pseudo Force: While applying Newton's laws of motion in non-inertial frame of reference it gives answers which contradict observations. Thus, to account for this,using Newton's Laws, we introduce a "fake" or pseudo force which gives answers that match the observations in a non-inertial frame.

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[1] Distance equal to zero implies displacement=0; and Displacement=0 also implies distance = 0

[2] The law of conservation of angular momentum states that when the net external torque acting on the system is zero, then the angular momentum of the system remains constant.both the initial and final momentum should be taken from a fixed inertial frame of reference provided.

[3] In case of a skater, who can be considered an isolated system, so no torue will be acting on him/her. When the arms are extended, the moment of inertia is more. When his hands are closely held, the moment of inertia is lesser. Since the angular momentum is same, the angular acceleration changes accordingly.

[4] For the motion of earth around sun, the sum of angular momenta of the Sun and the Earth about the center of mass of the sun + earth system is conserved.

[5] Only the z component of the angular momentum of a conical pendulum is conserved w.r.t. the origin fixed at the point of suspension. SetId=678

[6] In the example of a rotating skew rod the torque due to the external gravitational forces is zero , but the angular momentum is not constant Therefore the law of conservation of angular momentum is violated.

[7] If a bullet hits a wooden board and gets embedded in the board, both total energy and the total momentum of the bullet and the board are not conserved.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *net external force* acting on the system, the momentum is conserved. The definition of angular momentum and torque depends on the choice of axes, and therefore it may not be be conserved. The conservation of total energy holds only for conservative forces.

When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *net external force* acting on the system, the energy and momentum will be conserved. However, the total angular momentum may not be conserved because the torque may not be zero.

[9] nonconservative force is any force ,where the work done by the force depends on the path of motion of the body.The work done by such a force is equal to the change in mechanical energy of the system.Energy mostly observed to be lost in form of heat, by the action of non conservative force.

SetId=678

[10] A uniform motion is defined to be the one in which a body covers equal distances in equal time intervals.

[11] If P and Q are the initial and the final points of a path of a particle, displacement is a vector whose direction is along PQ and has magnitude is equal to the length of line PQ

[12] Assume bullet train, moving with out any jerks, is going on a circular arc of radius R with constant speed. Then an experiment is to be performed entirely within the train without any measurement on objects outside the train. Such an experiment can tell only radius of the track.

[13] when a ball is dropped from a height, it gains momentum down if we consider the ball as our system.This is because the force of gravity acts as an external force.

However, if we change our system and consider earth as a part of our system too, then the momentum remains conserved because the earth gains momentum up.

[14] The kinetic energy of a particle is continuously increasing with time, then the angle bewteen the net force and the velocity cannot be greater than or equal to 90^o at any time. SetId=678

[15] When a train is at rest and a ball is hung from the ceiling with a string, an observer in the train sees that the string is vertical. But when the train starts moving, the observer sees that the string makes an angle with the vertical and is tilted in forward direction . This means that some force other than gravity and tension must act on the ball. That force is the pseudo force.

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[1] If P and Q are the initial and the final points of a path of a particle, displacement is a vector whose direction is along PQ and has magnitude is equal to the length of line PQ

[2] The law of conservation of angular momentum states that The total angular momentum of a system is constant in both magnitude and direction if the resultant torque, of the external forces acting on the system, is zero.

[3] Example where law of conservation of angular momentum holds:
Let us assume a student seated on a stool that can rotate freely about a vertical axis. The student has been set into rotation at a modest initial angular speed ω . He holds two dumbbells in his outstretched hands. His angular momentum vector L lies along the vertical rotation axis, pointing upwards. Now he pulls in his arms;this action reduces his rotational inertia from its value I_{initial} to a final value I_{final} because he moves the mass closer to the rotational axis. His rate of rotation increases markedly, from ω_{initial} to ω_{final}. The student can then slow down by extending his arms once more,moving the dumbbells outward. No external torque acts on the system consisting of the student, stool and the dumbbells. Thus the angular momentum of the system about the rotational axis remains constant. $I_{\text{initial}} * \omega_{\text{initial}} = I_{\text{final}} * \omega_{\text{final}}$.

[4] For the motion of the Earth around the sun, the total of angular momenta of the Earth and the Sun, about in a reference frame fixed in the pole star, is conserved.

[5] The z component of angular momentum of a conical pendulum is not conserved w.r.t. the origin fixed at the point of suspension; but the x and y components are conserved. SetId=679

[6] In the example of skew rod, the angular momentum changes with time and there is a non zero torque coming from action of forces other than gravitational forces. Hence the law of conservation of angular momentum dos not apply.

[7] There are certain situations where it appears that the law of conservation of linear momentum does not hold. For example if we take some amount of a substance like construction putty, cement, cake batter, playing dough,etc and drop it on the ground, it does not bounce back like a rubber ball would and hence the momentum it had before striking the ground seems to have been lost. Hence it appears that the law of conservation of linear momentum does not hold.

[8] In order to apply the law of conservation of momentum we must first identify the system. If there is no *net external forces* acting on the system then conservation laws of momentum always holds. The total energy and the total angular momentum may not be conserved.

[9] The work done by a "non-conservative" force does depend on the path taken. Non-conservative forces cannot be associated with a potential energy. If some of the internal forces of a system are non-conservative, the mechanical energy of the system is not constant.Work-energy theorem is valid even in the presence of some non-conservative forces.

SetId=679

[10] A particle moves on a circular path. Then its speed, direction of force, velocity and acceleration must always change with time.

[11] If P and Q are the initial and the final points of a path of a particle,the displacement is the vector $\overrightarrow{PQ}$.

[12] Assume bullet train, moving with out any jerks, is going on a circular arc of radius R with constant speed. Then an experiment is to be performed entirely within the train without any measurement on objects outside the train. Such an experiment can tell both speed of the train and radius of the track.

[13] There is no known exception to the law of conservation of momentum in classical mechanics however when two bodies collide and their mass converts to energy, an exception in nuclear physics is observed. In real life this is observed in nuclear reactions at atomic level.

[14] A heavy body is attached from a spring and is held at point A and is such that the spring is not slack nor is it stretched. It is then released. It goes down upto a point B and then it rises upto point C and executes an oscillatory motion between B and C. During the motion from A to C is first positive (from A to B) and then it is negative from B to A and again remains negative from A to C.

SetId=679

[15] Since newton's laws are not valid in non-inertial frames, pseudoforces (which do not exist in reality) are used to help us formualate and use Newton's laws of motion in non-inertial frames.

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SetId=680

[1] If P and Q are the initial and the final points of a path of a particle,the displacement is the vector $\overrightarrow{PQ}$.

[2] If the net external torque acting on a system is zero,the angular momentum L(vector) of the system remains constant,no matter what changes take place within the system.L(vector)=a constant (net external torque acting on system is zero)

[3] A bob is attached to ceiling by a string and moves in a horizontal circular plane is an example. In this case the law of conservation of angular momentum does not hold.

[4] For the motion of the Earth around the sun, the total of angular momenta of the Earth and the Sun, is conserved in every inertial frame of reference; but the angular momentum of the Earth (or of the sun)is not conserved in every inertial frame.

[5] Only the z component of angular momentum of a conical pendulum is conserved w.r.t. the origin fixed at the point of suspension. SetId=680

[6] In the example of conical pendulum, the z- component of angular momentum does not change. This follows from the angular momentum conservation as there is no external torque.

[7] A tennis ball is dropped from height h and after hitting the ground and it bounces back and rises to the same height. In this case the momentum of the ball is conserved because (under ideal conditions) the momentum after it hits the ground will be equal to the momentum it had before hitting the ground.

[8] In order to apply the law of conservation of momentum we must first identify the system. Then even if there is no *net external forces* acting on the system, all the three conservation laws of momentum, angular momentum and energy may not hold due to presence of internal forces.

[9] Non conservative forces are forces with the property that the work done by the force in moving a particle between two points is dependent on the path taken.Also the work done over a closed loop is not zero.Defining of scalar potential is not possible in case of non conservative forces because the change in potential energy between two points will depend on path taken.

SetId=680

[10] A particle moves on a circular path. Then its speed, direction offorce, can remain constant by velocity and acceleration must always change with time.

[11] If two bodies starting from a point A reach a point B, following different paths, their displacement will be, in general different, but the distances covered will always be the same.

[12] Assume bullet train, moving with out any jerks, is going on a circular arc of radius R with constant speed. Then an experiment is to be performed entirely within the train without any measurement on objects outside the train. Such an experiment can tell only speed of the track.

[13] When there is no external forces act on a system of many particles, and there are only internal forces acting on the particles. The third law gives that the internal forces are pairwise equal and opposite.Thus the sum of internal forces is zero and the momentum of each particle is conserved.

[14] The kinetic energy of a body does not change if any one of the following is true
(i)force is always perpendicular to the velocity
(ii) the force is always perpendicular to the acceleration
(iii) the object remains stationary
(iv) the object moves in such a way that the point of application of the force remains fixed.

SetId=680

[15] Force is defined as the rate of change of linear momentum. In other words it is the agency which changes or tends to change the (a) State of rest; (b)State of uniform motion (c) Direction of body's motion; (d) Shape of the body

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SetId=681

[1] If two bodies starting from a point A reach a point B, following different paths, their displacement will be, in general different, but the distances covered will always be the same.

[2] The Law of conservation of angular momentum states that when no external torque acts on an object or a closed system of objects undergoing motion about a given axis, the change in angular momentum is zero. Therefore, considering an event where only internal torque or no torque is involved, the total angular momentum of the system before the event is equal to the total angular momentum after the event

[3] Consider a disc rotating about an axis perpendicular to its plane. On placing a smaller disc with its surface parallel to the surface of the rotating disc, the angular momentum of the system of two discs remains constant as there is no external torque.

[4] In the Sun Earth system the angular momentum of the Earth is conserved in every frame of reference

[5] The projection of angular momentum of a conical pendulum in the horizontal plane is a constant of motion when the origin is chosen to be at fixed at the point of suspension. SetId=681

[6] In the example of conical pendulum, the x and$y$ components of angular momentum change. This follows from the angular momentum conservation as the z components external torque is zero and horizontal components of torque are non zero.

[7] Law of conservation of momentum does not hold when Newton's laws are not valid, e.g. in a non-inertial frame of reference. For example, when we consider collision between two bodies in a non-inertial frame of reference, the law of conservation of momentum cannot be applied because there will be a pseudo force acting on the frame itself.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then check we should if the laws are applicable or not.

So if there is no *external force* acting on the system all the three quantities, total momentum, total angular momentum, and total kinetic energy will be conserved independent of the nature of forces.

[9] A non conservative force is the force with the property that the work done in moving a particle between two points is dependent of the path taken.If a particle travels in a closed path, the net work done(the some of the forces acting along the path multiplied by the distance travelled) by a non conservative force is non zero. When an object

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moves from one location to another, the force changes the potential energy of the object by an amount that depends on the path taken.Non conservative force depends only on the path followed by the object.

[10] A particle moves on a circular path. Then under suitable conditions its speed may remain constant, but the force, velocity and acceleration must always change with time.

[11] Distance is equal to the length of the path covered. Displacement is the shortest distance between initial and final points.

[12] A particle is observed from two frames S_1 and S_2. The frame S_2 moves with respect to S_1 with an acceleration a. If F_1 and F_2 be the pseudoforces when seen from S_1 and S_2 respectively it is not possible to have $F_1 = F_2 = 0$

[13] During collision of billiard balls momentum is conserved. During explosion of a bomb also momentum is conserved and the total momentum of the fragments of bomb will be zero. This is because all the forces are only internal forces.

[14] The total work done on a particle is always equal to the change in kinetic energy. SetId=681

[15] Real forces have their origin in matter such as electricity, gravitation etc., while pseudo forces are caused by inertial motion.

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[1] Displacement is equal to the vector difference $\vec{r}_f - \vec{r}_i$ of the position vectors of initial and final points. The distance covered will be $|\vec{r}_f - \vec{r}_i|$

[2] The law of conservation of angular momentum states that when no external torque acts on an object or a closed system of objects, no change of angular momentum can occur. Hence, the angular momentum before an event involving only internal torques or no torques is equal to the angular momentum after the event . Angular momentum can be calculated with the help of the formula $L = I\omega$ where L stands for Angular momentum, I stands for moment of inertia and ω stands for angular velocity

[3] Consider a man standing on a spinning platform. Initially, the man spreads out his arms and he spins with a certain angular velocity. The next moment, he pulls his arms inwards keeping them close to his body. We will observe that the angular velocity with which he is spinning now increases. This phenomenon can be explained by the Law Of Conservation of Angular momentum. Initially, since his arms were spread wide, his moment of inertia was large. However, when he pulled them close to his body, his moment of inertia decreased.
In this example the angular velocity of the man increases and therefore the angular momentum also increases.The law of conservation of angular momentum does not apply because the torque of muscular forces is not zero.

[4] In the motion of earth around sun, the angular momentum of the earth about an axis passing through the sun and perpendicular to the plane of motion of earth is conserved.

[5] The law of angular momentum of a is not applicable for the conical pendulum conserved w.r.t. the origin fixed at the point of suspension. SetId=682

[6] Example where law of conservation of angular momentum does not hold: A disc rotating on a horizontal rough surface will not have a constant angular momentum because there will be a constant torque by frictional force. Hence, its angular momentum will decrease, and the law of conservation of angular momentum does not apply.

[7] If I throw a ball upward, it's speed decreases as it rises upwards. There is an external force (gravity) acting on the ball, so the momentum conservation law does not apply. Momentum of the ball is not conserved, however the momentum of the Earth-ball system is conserved as gravity will become an internal force in this case.

[8] If we want to apply the conservation laws of momentum, energy and angular momentum, we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *external force* acting on the system, the momentum and angular momentum will be conserved, and depending on the nature of the forces but total energy may or may not be conserved.

[9] In this type of force the work done depends on the path taken by the body.Mechanical energy is not conserved in the system if non conservative force acts on it.

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[10] A particle moves on a circular path. Then under suitable conditions its speed and acceleration may remain constant, but the force, and velocity must always change with time.

[11] Distance is a scalar quantity where as the displacement is a vector quantity.

[12] A particle is observed from two frames S_1 and S_2. The frame S_2 moves with respect to S_1 with an acceleration a. If F_1 and F_2 be the pseudoforces when seen from S_1 and S_2 respectively and if $F_1 = 0$ then we must have $F_2 \neq 0$

[13] Give an example where law of conservation of momentum holds: A mass exploding into several pieces in a conservative field like gravitational field(if air resistance is neglected), obeys law of conservation of momentum. If air resistance cannot be neglected then the law of conservation of momentum will not hold.

[14] A particle is acted upon by a force of constant magnitude which is always perpendicular to the velocity of the particle and the motion of the particle takes place in a plane, Then its kinetic energy, speed, velocity acceleration will not change. SetId=682

[15] 1)When we start rolling a body on a rough ground, it stops rolling after certain period because of frictional force.
2)When we leave a body from a certain height, it falls due to the act of gravitational force.

1)When a body is rotating in a circular path due to the centrifugal force which is the pseudo force. 2) When the lift is accelerating upwards, the upwards force felt by passengers a pseudo force.

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[1] Distance is equal to the length of the path covered. Displacement is the shortest distance between initial and final points.

[2] Newton's Second Law of Motion is defined by the expression $F = \frac{dp}{dT}$, where F gives the force vector acting on the system and p gives its momentum vector; in linear motion. A similar expression can be written to describe angular motion, i.e. : $\tau = \frac{dL}{dt}$, where τ is the external torque vector acting on the system, and L is the angular momentum.

If the external torque on the system is zero, then we get the expression as: dL/dt=0. This points out to the fact that, when no external torque is acting on the system, then its angular momentum is constant, no matter what changes occur in the system. This is the Law of Conservation Of Angular Momentum.

[3] In the Sun-Earth system, angular momentum of the earth is not conserved but the total angular momentum of the sun and the earth is constant of motion.

[4] For the motion of earth around sun, the angular momentum of the earth about the center of mass of the sun + earth system and perpendicular to the plane of motion of earth is conserved.

[5] The law of angular momentum of a is not applicable for the conical pendulum conserved when the origin is chosen to be at the pendulum bob itself. SetId=683

[6] Example where law of conservation of angular momentum does not hold:Consider a vertical stick on the ground falling to a horizontal position. During the fall, the conservation of angular momentum applied at the point of rotation on the ground and perpendicular to the plane of the stick is not applicable as, the gravitational force which acts vertically downwards assumed at the centre of mass produces an external torque about the axis of rotation

[7] A soldier accelerating away, after detonating a bomb, will find that the total momentum of the fragments of the bomb is zero. This is an example where the law of conservation of momentum holds as the forces on the fragments are internal forces only and sum of all such forces is zero.

[8] To apply the conservation laws of momentum, energy and angular momentum, we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *external force* acting on the system, the energy and momentum will be conserved. However, depending on the nature of the system and of the forces, the total angular momentum may not be conserved.

[9] A force is said to be a non-conservative force if the work done by the force in a closed path is non-zero;(i.e) the cyclic integral of the work done is non-zero.

Work done by a non-conservative force is equal to change in total energy of the system.Work-Energy theorem is not applicable in the case of a non-conservative force.Work done by conservative force depends on the path.It differs with the paths taken by the partical even if the initial and final points are same.In case of non-conservative forces,the total mechanical energy is not constant as the energy is dissipated in various forms such as heat energy,sound energy,etc and cannot be recovered.

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[10] When the force is kept constant as function of time, it is possible for a particle to move on a circular path in such a way that its speed remains constant, but the velocity and acceleration must always change with time.

[11] Both displacement and distance tell us about the motion of a body but their study does not tell much about the forces on the body

[12] If K is an inertial frame, any frame that moves w.r.t. the frame K with uniform velocity is also an inertial frame.

[13] Also a good example of law of conservation momentum can be seen when a bullet from a rifle is fired.As the bullet is fired and gets out of the rifle, the rifle gives a backward jerk due to the phenomenon of conservation of momentum.

[14] The kinetic energy of a particle is continuously increasing with time, then the angle bewteen the net force and the velocity cannot be greater than or equal to 90^o at any time.

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[15] Newton's first law defines inertial frame. An inertial frame is a frame in which the first law hold. It also makes it possible to compare and tell two force being equal or not. The second law defines the force.

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[1] Distance is a scalar quantity where as the displacement is a vector quantity.

[2] If the net external torque acting on a system is zero, the angular momentum L of the system remains constant, no matter what changes take place within the system.

$$\sum(T_{\text{ext}}) = \frac{dL}{dt}$$

The law states that when there is no net external torque, $\frac{dL}{dt}$ is zero implying that the total angular momentum of system is constant.

i.e. $L = a$ constant (isolated system)

[3] Consider a disc and a man system. man is standing on center of the disc rotating with angular velocity.initially man folded his hand.when man stretches his hands then momentum of inertia of system increases.and angular velocity decreases.and total angular momentum remains constant.

[4] In the Sun Earth system the angular momentum of the Earth about the pole star is conserved

[5] The three components of angular momentum of a conical pendulum is conserved w.r.t. the origin at the position of the center of mass of the pendulum. SetId=684

[6] We have a conical pendulum .The forces acting on the bob are tension (along the direction of the string) and gravitational force acting in the vertically downward direction.we have an additional force called the drag force which is tangential to the motion of the bob and acts in the direction opposite to the motion of the bob.The axis of rotation passes through the hinge point and is vertical.The torque due to tension is 0 because the force passes through the axis of rotation.The torque due to mg is also zero since it is parallel to the axis of rotation.but the torque due to drag force is not zero.since the net external torque acting on the bob is not zero,therefore the law of conservation of angular momentum does not hold here

[7] There is no known exception to the law of conservation of momentum in classical mechanics However, an exception to conservation of energy in nuclear physics is observed. In nuclear reactions when two nuclei collide and their mass converts to energy and energy momentum are not conserved.

[8] In order to apply the law of conservation of momentum we must first identify the system. If there is no *external forces* acting on the system then conservation laws of momentum always holds. And depending on the nature of the system and of the forces, the total kinetic energy and the total angular momentum may not be conserved.

[9] A non conservative force is a force where work done in moving a particle between two points depends on the path through which it is taken.Friction is an example of non conservative force.Mechanical energy is not conserved in case of a non conservative force

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[10] It is not possible for a particle to move on a circular path in such a way that its speed and force remains constant, and only the velocity and acceleration may (or may not) always change with time.

[11] Displacement is the shortest distance between initial and final points with direction specified.

[12] If K is an inertial frame, any frame that moves w.r.t. the frame K with uniform speed is also an inertial frame.

[13] when a man walks on the ice slab where friction does not exist between the ice block and the floor but between the feet of the man and the slab the slab moves back as per the law of conservation of momentum

[14] A heavy body is attached from a spring and is held at point A and is such that the spring is not slack nor is it stretched. It is then released. It goes down upto a point B and then it rises upto point C and executes an oscillatory motion between B and C. During the motion from A to C is first positive (from A to B) and then it is negative from B to A and again remains negative from A to C.

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[15] The magnitude of the pseudo force arising in a non-inertial frame is always equal to the mass of the body under consideration multiplied by the acceleration of the frame of reference and the direction of pseudoforce is always opposite to the direction of acceleration of the frame.

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[1] The speed is rate of change of distance and the velocity is the rate of change of displacement.

[2] When the net external torque acting on a body or a system of bodies is zero about a particular axis, then the angular momentum of each body is conserved about that axis.

[3] The conservation of angular momentum of a system of bodies requires that the the sum of torque due to all forces be equal to zero. Now consider a situation where the forces are such that the sum of torques of external forces is zero w.r.t. some axes K. Since the value of torque depends of the choices of axes, the sum of torques due to all internal forces will depend on the choice of axes and in general it will be non zero. Therefore, for a system of several bodies, for a given choice of axes K, there will be situations when the total angular momentum may not be conserved.

[4] For the motion of earth around sun, the angular momentum of the sun about the center of mass of the sun + earth system and perpendicular to the orbital plane of earth is conserved.

For the motion of earth around sun, the angular momentum of the sun about and axis passing through the Earth and perpendicular to the orbital plane of motion of earth is conserved.

[5] Only the z component of the angular momentum of a conical pendulum is conserved w.r.t. the origin fixed at the point of suspension. SetId=685

[6] When you release a toy gyroscope on its pedestal, it initially has no precessional rotation around that pedestal, i.e, the orientation of rotation is fixed. However, it instantaneously starts precessing around the pedestal. Both Kinetic Energy and Angular Momentum now exist where they did not exist a moment earlier. The Kinetic Energy is easy to explain, as appearing due to the body of the gyroscope dropping a tiny fraction of a millimeter in the Earth's gravitational field, giving up exactly the correct amount of Potential Energy. But the Angular Momentum of the Precession which just appeared, does not come from anywhere. This is therefore a Violation of the Conservation of Angular Momentum.

[7] In a system of a canon and a canon ball, total momentum of the system is zero before canon ball is fired. After firing the canon ball, the momentum of the system seems to be conserved as the ball moves forward and the canon moves backward.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then check if the laws is applicable or not.

So if there is no *net external force* acting on the system all the three conservation laws will hold.

[9] A force:A force is said to be a *non-//**conservative force* if the*/ work done by it in a closed path is/*/ non-zero./For such forces,potential energy cannot be defined.

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[10] For a particle moving on circle the acceleration is always constant in magnitude and directed towards the centre of the circle.

[11] Displacements, being vector quantity can not compared with, a scalar quantity such as distance.

[12] A frame rotating w.r.t K with uniform angular velocity is also an inertial frame.

[13] When a freely falling rigid body collides another body in its path momentum the system of two particles is not conserved in the collision as there is external force mg acting on the system.

[14] The kinetic energy of a body does not change if any one of the following is true
(i)force is always perpendicular to the velocity
(ii) the force is always perpendicular to the acceleration
(iii) the object remains stationary
(iv) the object moves in such a way that the point of application of the force remains fixed.

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[15] A force is any interaction which tends to change the motion of an object. It is also *defined* as rate of change of momentum.It is a vector quantity.
A physically apparent but nonexistent force felt by an observer in a noninertial frame (that is, a frame undergoing acceleration).

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[1] For any type of translational motion of a body, the displacement cannot be zero, where as the distance travelled can be zero.

[2] The law of conservation of angular momentum states that in absence of an external torque on an object or a closed system of objects the total angular momentum of the system remains constant. Thus if $\vec{\tau} = 0 => \vec{L} =$ constant where τ is the torque and $\vec{L}$ is the angular momentum of the system.

[3] Example where law of conservation of angular momentum does not hold:
When there is external force like frictional force acting on a object when it is rotating we cannot use conservation of angular momentum as the friction force acting on the object produces an external torque.

[4] For the motion of earth around sun, the sum of angular momenta of the Sun and the Earth about the center of mass of the sun + earth system is conserved.

[5] The z component of angular momentum of a conical pendulum is not conserved w.r.t. the origin fixed at the point of suspension; but the x and y components are conserved. SetId=686

[6] There is no case where LAW OF CONSERVATION OF ANGULAR MOMENTUM does'nt hold.But there are cases where conservation of angular momentum does not hold.A body in vertical circular motion is an example where angular momentum is not conserved. Here the law of conservation does not apply.

[7] When applying the conservation laws of momentum, energy and angular momentum we must define the system first.Only then check if the laws is applicable or not.

As an example: when a ball is dropped from a height, it gains momentum down if we consider the ball as our system.This is because the force of gravity acts as an external force.

However, if we change our system and consider earth as a part of our system too, then the momentum remains conserved because the earth gains momentum up.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then check we should if the laws are applicable or not.

So if there is no *external force* acting on the system all the three quantities, total momentum is conserved. The total angular momentum is also because the torque of internal forces will be zero. The conservation of energy depends on the nature of forces. will be conserved.

[9] A force that is not conservative is nonconservative force. The work done by a noconservative force cannot be represented by a potential energy function. That is work done by a nonconservative force is dependent on the path through which the system is moved. Some nonconservative forces cause the mechanical energy to be lost or dissipiated. Such forces are called dissipiative forces. There is no way to get back the lost mechanical energy. Nonconservative forces can also increase the mechanical energy. This is arrived from the concept of irreversible process.

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[10] The motion of a bomb dropped from a plane does is not a uniform motion as it follows a parabolic path and not a straight line path.

[11] Distance depends on the path where as the displacement depends on the end point only

[12] The Newton's Laws of motion will hold in all frames which are at rest w.r.t. K but do not remain valid in a frame that move with respect to K.

[13] If we take some amount of a substance like construction putty, cement, cake batter, playing dough,etc and drop it on the ground, it does not bounce back, like a rubber ball would bounce, and hence the momentum it had before striking the ground seems to have been lost. Hence it appears that the law of conservation of linear momentum does not hold.

[14] The total work done on a particle is always equal to the change in kinetic energy. SetId=686

[15] Psuedo Force is defined as an apparent force that acts in only non-inertial frames. Pseudo Forces are also called Fictitious Forces. It is an Imaginary force. It is independent of mass.

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[1] Displacements, being vector quantity can not compared with, a scalar quantity such as distance.

[2] If no net external torque acts on a system, the total angular momentum of the system remains constant.

[3] A bob attached to a ceiling by a string moving in a horizontal circular plane is an example where the total angular momentum of the bob about the point of suspension is not conserved. This is because the the torque due to the weight of the bob about the point of suspension does not vanish and has non zero horizontal component. Only the vertical component of the angular component is conserved.

[4] For the motion of the Earth around the sun, the total of angular momenta of the Earth and the Sun, about in a reference frame fixed in the pole star, is conserved.

[5] Only the z component of angular momentum of a conical pendulum is conserved w.r.t. the origin fixed at the point of suspension.

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[6] A sphere rolling on a rough surface.Due to friction there is external torque so the angular momentum changes which results in the slowing of the sphere. The angular momentum keeps changing. Even in case like this one, it is wrong to say that the Law of Angular Momentum Conservation does not hold.

[7] Statement: Law of Conservation of energy states that "ENERGY CAN NEITHER BE CREATED NOR DESTROYED",but it can be changed from one form to other.

EXPLANATION: Statement implies that the total amount of energy in an isolated system remains constant although it may change forms. viz, kinetic energy may change to potential;chemical to electrical energies etc.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *net external force* acting on the system, the momentum is conserved. The definition of angular momentum and torque depends on the choice of axes, and therefore it may not be be conserved. The conservation of total energy holds only for conservative forces.

When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *net external force* acting on the system, the energy and momentum will be conserved. However, the total angular momentum may not be conserved because the torque may not be zero.

[9] Nonconservative forces are forces, such that the work done by these forces are path dependent. Work done by these forces around a close path is not necessarily equal to zero. Hence if a particle is acted on by a non-conservative force and that particle returns to its original position, that particle will experience a net loss of energy. Energy will thus not be conserved for particle. Potential Energy can not be defined for these type of forces.

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[10] A wagon sliding on a roller coaster designed in such a way that the wagon covers equal distances in equal times. As the motion of the wagon is uniform, there will be no net force acting on it.

[11] Distance equal to zero $\Rightarrow$ displacement=0; but Displacement=0

[12] Staying inside a bullet train moving with constant velocity (no jerks etc) an experiment can always be performed which will tell us the numerical velocity of the bullet train

[13] When we consider collision between two bodies in a non-inertial frame of reference, the law of conservation of momentum cannot be applied because there will be a pseudo force acting on the frame itself.

[14] A particle is acted upon by a force of constant magnitude which is always perpendicular to the velocity of the particle and the motion of the particle takes place in a plane, Then its kinetic energy, speed, velocity acceleration will not change. SetId=687

[15] Psuedo Force is defined as an apparent force that acts in only non-inertial frames. Pseudo Forces are also called Fictious Forces. It is an Imaginary force. It is always proportional to mass. It is sometimes dependent on speed.

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[1] Distance depends on the path where as the displacement depends on the end point only.

[2] The law of conservation of angular momentum states that when no external torque is applied on an object or a closed system of objects about an axis, the angular momentum about that axis remains constant.

[3] Law of conservation of angular momentum holds in case of long jump. When a athlete takes off from the ground in a running long jump, the forces on the launching foot give the athlete an angular momentum with a forward rotation around a horizontal axis. Such rotation would not allow the jumper to land properly. In the landing, the legs should be together and extended forward at an angle so that the heels mark the sand at the greatest distance. Once airborne, the angular momentum cannot change (it is conserved) because no external torque acts to change it. However, the jumper can shift most of the angular momentum to the arms by rotating them in windmill fashion. Then the body remains upright in the proper orientation of landing.

[4] For the motion of the Earth around the sun, the total of angular momenta of the Earth and the Sun, is conserved in every inertial frame of reference; but the angular momentum of the Earth (or of the sun)is not conserved in every inertial frame.

[5] The projection of angular momentum of a conical pendulum in the horizontal plane is a constant of motion when the origin is chosen to be at fixed at the point of suspension. SetId=688

[6] Consider a rod of length l. Let us give an impulse to one end . Now the angular momentum about the oposite end is not zero since the impulse provides some torque . So the angular momentum is not conserved .

$$\text{torque} = \text{impulse} * \ell.$$

$d\ell/dt$ is not equal to zero and the law of conservation of angular momentum does not hold.

[7] Oscillating simple pendulum is a very good example where potential energy gets converted to kinetic energy and kinetic to potential energy. Some energy gets dissipated as heat if we consider air resistance. Energy as a whole is conserved if we consider universe as system, the energy has just changed its form.

[8] In order to apply the law of conservation of momentum we must first identify the system. If there is no *net external forces* acting on the system then conservation laws of momentum always holds. The total energy and the total angular momentum may not be conserved.

[9] Non Conservative force is a force with the property that workdone in moving an object from one point to another is dependent on the path taken .

Non Conservative Force can arise in classical physics due to neglected degrees of freedom or time dependent potentials.

Friction may be treated without resorting the use of non conservative forces by considering the motion of individual molecules.

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[10] A simple pendulum moves along a circular arc and does not have constant speed and therefore its motion is not uniform.

[11] If P and Q are the initial and the final points of a path of a particle, displacement is a vector whose direction is along PQ and has magnitude is equal to the length of line PQ

[12] Staying inside a bullet train moving with constant velocity (no jerks etc) an experiment can always be performed which will tell us the numerical value of the acceleration of the bullet train

[13] When a system is acted upon by external forces like friction etc, the conservation principle does not hold good,there will be impulse imparted and so we cant conserve momentum. This is case when a collision between two elastic balls take place on a rough horizontal table. The total momentum just after the collision will be different from the total momentum just before the collision. Here momentum is not conserved as there is external force friction is present.

[14] The kinetic energy of a particle is continuously increasing with time, then the angle bewteen the net force and the velocity cannot be greater than or equal to 90^{o} at any time.

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[15] Since pseudo forces are not real forces, they do not affect the conservation laws and all the three conservation laws hold in noninertial frames.

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[1] Distance equal to zero implies displacement=0; and Displacement=0 also implies distance = 0

[2] The angular momentum of a given system of bodies shall remain conserved unless acted upon by an external unbalanced torque.

[3] The total angular momentum of a body remains constant of motion when the net torque of the external forces acting on the body is zero.
In general, we have a system of particles such that the net torque of the external forces on the system, w.r.t. some axes K, is zero, the total angular momentum may not remain conserved, because the torque due to the internal forces may not be zero.

[4] In the Sun Earth system the angular momentum of the Earth is conserved in every frame of reference

[5] The law of angular momentum of a is not applicable for the conical pendulum conserved w.r.t. the origin fixed at the point of suspension. SetId=689

[6] Let us consider a rotating skew rod. In the absence of friction or any other drag force, the rod should continuously spin without stopping. Here the net torque about the axis of rotation is 0 and hence angular momentum is conserved. It therefore follows from law of conservation of angular momentum that a spinning skew rod will keep rotating with constant angular velocity if there is no external torque. So law of conservation of angular momentum does not hold.

[7] Law of conservation of momentum does not hold whenever an external force or impulse acts on the system. For example,when a body collides with earth then it bounces back to a lesser height as it loses some velocity.

In this example the momentum of a ball is not conserved due to impulsive force by ground in the normal direction.

However, strictly speaking the system that should be considered here is the ball-earth system and the total momentum is conserved.

[8] In order to apply the law of conservation of momentum we must first identify the system. Then even if there is no *net external forces* acting on the system, all the three conservation laws of momentum, angular momentum and energy may not hold due to presence of internal forces.

[9] A non-conservative force is a force with the property that the work done in moving a particle between two points is dependent of the path taken . Mostly the enery of the particle in a non conservative force field dissipates in the form of heat or sound . Since the lost energy cannot be bought back ,conservation of mechanical energy does not hold true .

SetId=689

[10] A satellite goes around the earth in a circular orbit of 600km with a time period of $5.8 \times 10^3 s$. Its motion will be uniform as it will cover equal distances in equal times.

[11] If P and Q are the initial and the final points of a path of a particle,the displacement is the vector $\overrightarrow{PQ}$.

[12] Assume bullet train, moving with out any jerks, is going on a circular arc of radius R with constant speed. Then an experiment is to be performed entirely within the train without any measurement on objects outside the train. Such an experiment can tell only radius of the track.

[13] When we are in accelerating frame if we observe any collision between two bodies then the law of conservation of momentum does not hold in that frame of reference. On the other hand the law of conservation of momentum holds in all inertial frames.

[14] A heavy body is attached from a spring and is held at point A and is such that the spring is not slack nor is it stretched. It is then released. It goes down upto a point B and then it rises upto point C and executes an oscillatory motion between B and C. During the motion from A to C is first positive (from A to B) and then it is negative from B to A and again remains negative from A to C. SetId=689

[15] A force is any interaction which tends to change the motion of an object. Newtons' second tell us that it is *equal* to the rate of change of momentum.It is a vector quantity. Real forces can be distinguished from pseudo forces because the pseudo forces always proportional to the mass of the body. All real forces, except the gravitational force, do not depend on the mass of the body.

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[1] If P and Q are the initial and the final points of a path of a particle, displacement is a vector whose direction is along PQ and has magnitude is equal to the length of line PQ

SetId=690

[2] When the net external torque acting on a system about a given axis is zero, the total angular momentum of the system about that axis remains consant.

[3] An example where law of conservation of angular momentum holds:
The Law of conservation of angular momentum holds in the case of a ballet dancer performing a pirouette.

When the dancer extends her arms outward, the angular velocity of her rotation decreases whereas when she keeps her arms close to her body, the angular velocity increases. This is because her moment of inertia changes as she moves her arms outward and inward. It can be noted that she as a system has no external torque acting upon her.

[4] In the motion of earth around sun, the angular momentum of the earth about an axis passing through the sun and perpendicular to the plane of motion of earth is conserved.

[5] The law of angular momentum of a is not applicable for the conical pendulum conserved when the origin is chosen to be at the pendulum bob itself. SetId=690

[6] In the example of skew rod the angular velocity does not change even though the torque applied is nonzero. However there is no contradiction as in this case the law of conservation of momentum is not applicable. conservation is violated.

[7] If a bullet hits a wooden board and gets embedded in the board, the total energy and the total momentum of the bullet and the board are conserved.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then check we should if the laws are applicable or not.

So if there is no *external force* acting on the system all the three quantities, total momentum, total angular momentum, and total kinetic energy will be conserved independent of the nature of forces.

[9] If the work done by a force depends on the path followed by the particle, it is called a Non conservative force. Work done by a non conservative force is not zero in round trip.

SetId=690

[10] A uniform motion is defined to be the one in which a body covers equal distances in equal time intervals.

[11] If two bodies starting from a point A reach a point B, following different paths, their displacement will be, in general different, but the distances covered will always be the same.

[12] Assume bullet train, moving with out any jerks, is going on a circular arc of radius R with constant speed. Then an experiment is to be performed entirely within the train without any measurement on objects outside the train. Such an experiment can tell both speed of the train and radius of the track.

[13] When a freely falling body hits another rigid body in its path then momentum is not conserved as external force mg acts on both the bodies. The total momentum after the collision will be different from the total momentum before the hit.

[14] The kinetic energy of a body does not change if any one of the following is true
(i)force is always perpendicular to the velocity
(ii) the force is always perpendicular to the acceleration
(iii) the object remains stationary
(iv) the object moves in such a way that the point of application of the force remains fixed. SetId=690

[15] Examples of pseudoforce are Coriolis Force, Centrifugal Force, and magnetic force on currents.
Psuedo force also called as fictitious force is an apparent force that are needed for masses whose their motion is described using a non inertial frame of reference.

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[1] If P and Q are the initial and the final points of a path of a particle,the displacement is the vector $\overrightarrow{PQ}$.

[2] This law sates that when no net torque of all forces acts on a object or a system of objects then total angular momentum of system is conserved.The angular momentum before an event is equal to angular momentum after that event.mathematically explained by when, net torque=0 ;then, total angular momentum(L)=constant.

[3] In case of a skater, who can be considered an isolated system, so no torue will be acting on him/her. When the arms are extended, the moment of inertia is more. When his hands are closely held, the moment of inertia is lesser. Since the angular momentum is same, the angular acceleration changes accordingly.

[4] For the motion of earth around sun, the angular momentum of the earth about the center of mass of the sun + earth system and perpendicular to the plane of motion of earth is conserved.

[5] The three components of angular momentum of a conical pendulum is conserved w.r.t. the origin at the position of the center of mass of the pendulum. SetId=691

[6] Example where law of conservation of angular momentum does not hold:If a particle undergoes conical motion and the only force acting on particle is central force like tension of the string.Then total external torque about fixed point A is zero,yet angular momentum is not conserved,as angular momentum keeps on changing direction.

[7] If a bullet hits a wooden board and gets embedded in the board, the total energy of the bullet and the board system is conserved but the total momentum is not conserved.

[8] If we want to apply the conservation laws of momentum, energy and angular momentum, we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *external force* acting on the system, the momentum and angular momentum will be conserved, and depending on the nature of the forces but total energy may or may not be conserved.

SetId=691

[9] The workdone by a non conservative force is dependant on its path. the work varies as the path varies.

[10] A particle moves on a circular path. Then its speed, direction of force, velocity and acceleration must always change with time.

[11] Distance is equal to the length of the path covered. Displacement is the shortest distance between initial and final points.

[12] Assume bullet train, moving with out any jerks, is going on a circular arc of radius R with constant speed. Then an experiment is to be performed entirely within the train without any measurement on objects outside the train. Such an experiment can tell only speed of the track.

[13] .The law of conservation of momentum does not hold good when net external forces acting on the system is not zero.when two bodies collide law of conservation of momentum is applicable on system of two bodies but on not individual bodies because external impulse acts on them.

[14] The total work done on a particle is always equal to the change in kinetic energy. SetId=691

[15] Examples of pseudo-force are Coriolis Force, Centrifugal Force, Centripetal force and magnetic force on currents. The pseudo forces do not obey Newton's third law and therefore the total momentum does not appear to be conserved in a non-inertial frame.

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SetId=692

[1] If two bodies starting from a point A reach a point B, following different paths, their displacement will be, in general different, but the distances covered will always be the same.

[2] Statement of Law of Conservation of Angular Momentum:
Differentiating $\vec{L} = \vec{r} \times \vec{p}$ w.r.t, time,

$$\begin{aligned} \frac{dL}{dt} &= \frac{d\vec{r} \times \vec{p}}{dt} = \frac{d\vec{r}}{dt} \times \vec{p} + \vec{r} \times \frac{d\vec{p}}{dt} = \vec{v} \times (m\vec{v}) + \vec{r} \times \vec{F} \\ &= \vec{r} \times \vec{F} (\because v \times v = 0) \\ &= \vec{\tau} \end{aligned}$$

here $\vec{\tau}$ represents the net torque acting on a rigid body rotating about a fixed axis.This torque must take into account of all the forces, be it external or internal forces

[3] Example where law of conservation of angular momentum holds:
Let us assume a student seated on a stool that can rotate freely about a vertical axis. The student has been set into rotation at a modest initial angular speed ω . He holds two dumbbells in his outstretched hands. His angular momentum vector L lies along the vertical rotation axis, pointing upwards. Now he pulls in his arms;this action reduces his rotational inertia from its value I_{initial} to a final value I_{final} because he moves the mass closer to the rotational axis. His rate of rotation increases markedly, from ω_{initial} to ω_{final}. The student can then slow down by extending his arms once more,moving the dumbbells outward. No external torque acts on the system consisting of the student, stool and the dumbbells. Thus the angular momentum of the system about the rotational axis remains constant. $I_{\text{initial}} * \omega_{\text{initial}} = I_{\text{final}} * \omega_{\text{final}}$.

[4] In the Sun Earth system the angular momentum of the Earth about the pole star is conserved

[5] Only the z component of the angular momentum of a conical pendulum is conserved w.r.t. the origin fixed at the point of suspension.

SetId=692

[6] A nonzero torque always causes the angular velocity to change, because a change in angular momentum means a change in angular velocity $L = I\omega$

[7] If a bullet hits a wooden board and gets embedded in the board, both total energy and the total momentum of the bullet and the board are not conserved.

[8] To apply the conservation laws of momentum, energy and angular momentum, we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *external force* acting on the system, the energy and momentum will be conserved. However, depending on the nature of the system and of the forces, the total angular momentum may not be conserved.

SetId=692

[9] A non conservative force is a force with the property that the work done in moving a particle between two points is dependent on the path followed.

[10] A particle moves on a circular path. Then its speed, direction offorce, can remain constant by velocity and acceleration must always change with time.

[11] Distance is a scalar quantity where as the displacement is a vector quantity.

[12] A particle is observed from two frames S_1 and S_2. The frame S_2 moves with respect to S_1 with an acceleration a. If F_1 and F_2 be the pseudoforces when seen from S_1 and S_2 respectively it is not possible to have $F_1 = F_2 = 0$

[13] A block moving in the air breaks up into two parts and the parts separate, then the total momentum must be the same before and after the break.

[14] A particle is acted upon by a force of constant magnitude which is always perpendicular to the velocity of the particle and the motion of the particle takes place in a plane, Then its kinetic energy, speed, velocity acceleration will not change. SetId=692

[15] FORCE is any interaction which tends to change the motion of an object.It has both magnitude and direction,making it a vector quantity.

A psuedo force is an apparent force that acts on all masses whose motion is described with respect to a non-inertial frame of reference like a rotating frame of reference.This force is needed by an observer in an non-inertial frame to make all the Newtons Laws of motion hold true.

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[1] Displacement is equal to the vector difference $\vec{r}_f - \vec{r}_i$ of the position vectors of initial and final points. The distance covered will be $|\vec{r}_f - \vec{r}_i|$

[2] Statement of Law of Conservation of Angular Momentum: For a system of many particles The net torque due all the forces, be it external or internal forces. But as the torque due to all the internal forces cancel out, it sufficient to consider the external forces acting on the system.

[3] A bob is attached to ceiling by a string and moves in a horizontal circular plane is an example. In this case the law of conservation of angular momentum does not hold.

[4] For the motion of earth around sun, the angular momentum of the sun about the center of mass of the sun + earth system and perpendicular to the orbital plane of earth is conserved.

For the motion of earth around sun, the angular momentum of the sun about and axis passing through the Earth and perpendicular to the orbital plane of motion of earth is conserved.

[5] The z component of angular momentum of a conical pendulum is not conserved w.r.t. the origin fixed at the point of suspension; but the x and y components are conserved. SetId=693

[6] A nonzero torque always implies change in angular momentum and may not give rise to a change in magnitude of angular velocity. A non zero torque may mean change only the direction of the angular momentum and not the angular velocity.

[7] There are certain situations where it appears that the law of conservation of linear momentum does not hold. For example if we take some amount of a substance like construction putty, cement, cake batter, playing dough,etc and drop it on the ground, it does not bounce back like a rubber ball would and hence the momentum it had before striking the ground seems to have been lost. Hence it appears that the law of conservation of linear momentum does not hold.

[8] In order to apply the law of conservation of momentum we must first identify the system. If there is no *external forces* acting on the system then conservation laws of momentum always holds. And depending on the nature of the system and of the forces, the total kinetic energy and the total angular momentum may not be conserved.

[9] A non conservative force is a force with the property that the work done in moving a particle between two points is dependent of the taken path.

Friction, for example, does less work on a book dragged across a table if the book is dragged straight across than if the book is dragged in a curved path.

To write the equation for conservation of energy for non conservative forces we need to include the work done by the non conservative force also.This is because forces like friction liberate heat which are not included in the mechanical energy.

SetId=693

[10] A particle moves on a circular path. Then under suitable conditions its speed may remain constant, but the force, velocity and acceleration must always change with time.

[11] Both displacement and distance tell us about the motion of a body but their study does not tell much about the forces on the body

[12] A particle is observed from two frames S_1 and S_2. The frame S_2 moves with respect to S_1 with an acceleration a. If F_1 and F_2 be the pseudoforces when seen from S_1 and S_2 respectively and if $F_1 = 0$ then we must have $F_2 \neq 0$

[13] A ball hits the floor and rebounds after an inelastic collision. In this case the total momentum of the ball before and after the collsion is conserved. Also the total enrgy of the ball and the earth remains the same

[14] The kinetic energy of a particle is continuously increasing with time, then the angle bewteen the net force and the velocity cannot be greater than or equal to 90° at any time.

SetId=693

[15] FORCE is any interaction which tends to change the motion of an object.It has both magnitude and direction,making it a vector quantity. A pseudo-force F doesn't arise from any physical interaction between two objects, but rather from the acceleration 'a' of the non-inertial reference frame itself. These forces have no real existence but must be taken into account in an accelerating frame of reference to make all the three Newton's Laws of motion applicable to the system

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SetId=694

[1] Distance is equal to the length of the path covered. Displacement is the shortest distance between initial and final points.

[2] Depending on the torques acting on a system, the angular momentum can be conserved only in one or two directions, but may not be conserved in all. For instance, if an isolated body has no torque acting on it only in the direction along the Z axis, then the angular momentum is conserved only in that direction.

[3] Consider a disc rotating about an axis perpendicular to its plane. On placing a smaller disc with its surface parallel to the surface of the rotating disc, the angular momentum of the system of two discs remains constant as there is no external torque.

[4] For the motion of earth around sun, the sum of angular momenta of the Sun and the Earth about the center of mass of the sun + earth system is conserved.

[5] Only the z component of angular momentum of a conical pendulum is conserved w.r.t. the origin fixed at the point of suspension. SetId=694

[6] In the example of a rotating skew rod the torque due to the external gravitational forces is zero , but the angular momentum is not constant Therefore the law of conservation of angular momentum is violated.

[7] A tennis ball is dropped from height h and after hitting the ground and it bounces back and rises to the same height. In this case the momentum of the ball is conserved because (under ideal conditions) the momentum after it hits the ground will be equal to the momentum it had before hitting the ground.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then check if the laws is applicable or not.

So if there is no *net external force* acting on the system all the three conservation laws will hold.

[9] A non conservative force is a force with the property that the work done in moving a particle between two points is dependent of the taken path.

Friction, for example, does less work on a book dragged across a table if the book is dragged straight across than if the book is dragged in a curved path.

To write the equation for conservation of energy for nonconservative forces we need toinclude the work done by the non conservative force also.This is because forces like friction liberate heat which are not included in the mechanical energy.

SetId=694

[10] A particle moves on a circular path. Then under suitable conditions its speed and acceleration may remain constant, but the force, and velocity must always change with time.

[11] Displacement is the shortest distance between initial and final points with direction specified.

[12] If K is an inertial frame, any frame that moves w.r.t. the frame K with uniform velocity is also an inertial frame.

[13] In a head on elastic collision of two identical bodies of equal masses the velocities, the speeds, the momenta and the kinetic energy are all exchanged.

[14] A heavy body is attached from a spring and is held at point A and is such that the spring is not slack nor is it stretched. It is then released. It goes down upto a point B and then it rises upto point C and executes an oscillatory motion between B and C. During the motion from A to C is first positive (from A to B) and then it is negative from B to A and again remains negative from A to C. SetId=694

[15] FORCE is any interaction which tends to change the motion of an object.It has both magnitude and direction,making it a vector quantity.
A pseudo-force results from acceleration of the frame of reference in which the objects reside. It is taken into account so that Newton's second law isn't invalidated. The pseudo force acting on an object can always be mathematically expressed as the product of the mass of the object and the acceleration of the frame of reference.

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[1] Distance is a scalar quantity where as the displacement is a vector quantity.

[2] According to Law of Conservation of Angular momentum,if no external torque acts on an object or system of objects,angular momentum of an object or system of objects remains CONSTANT or no change in angular momentum can occur.

Also it states that,only external torque can change angular momentm of the system where as the torque produced by internal forces can not change the angular momentum of the system

[3] Consider a man standing on a spinning platform. Initially, the man spreads out his arms and he spins with a certain angular velocity. The next moment, he pulls his arms inwards keeping them close to his body. We will observe that the angular velocity with which he is spinning now increases. This phenomenon can be explained by the Law Of Conservation of Angular momentum. Initially, since his arms were spread wide, his moment of inertia was large. However, when he pulled them close to his body, his moment of inertia decreased.
In this example the angular velocity of the man increases and therefore the angular momentum also increases.The law of conservation of angular momentum does not apply because the torque of muscular forces is not zero.

[4] For the motion of the Earth around the sun, the total of angular momenta of the Earth and the Sun, about in a reference frame fixed in the pole star, is conserved.

[5] The projection of angular momentum of a conical pendulum in the horizontal plane is a constant of motion when the origin is chosen to be at fixed at the point of suspension.

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[6] In the example of skew rod, the angular momentum changes with time and there is a non zero torque coming from action of forces other than gravitational forces. Hence the law of conservation of angular momentum dos not apply.

[7] Law of conservation of momentum does not hold when Newton's laws are not valid, e.g. in a non-inertial frame of reference. For example, when we consider collision between two bodies in a non-inertial frame of reference, the law of conservation of momentum cannot be applied because there will be a pseudo force acting on the frame itself.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then check we should if the laws are applicable or not.

So if there is no *external force* acting on the system all the three quantities, total momentum is conserved. The total angular momentum is also because the torque

of internal forces will be zero. The conservation of energy depends on the nature of forces. will be conserved.

[9] The non conservative force is a force with a property thet the work done between two points depends on path taken. If a particle moves along a curve path, to know about the work done by a non conservative force we should have the equation of the path along which the particle had move.The work done would be

WORK = INTEGRAL (F.dx)

The equation of conservation of mechanical energy for a non conservative force would be

SetId=695

$KE_{\text{final}} + PE_{final} = KE_{initial} + PE_{initial} + W_{nc}$

[10] When the force is kept constant as function of time, it is possible for a particle to move on a circular path in such a way that its speed remains constant, but the velocity and acceleration must always change with time.

[11] Displacements, being vector quantity can not compared with, a scalar quantity such as distance.

[12] If K is an inertial frame, any frame that moves w.r.t. the frame K with uniform speed is also an inertial frame.

[13] For a system of several particles the conservation of total linear momentum is equivalent to the statement that their centre of mass moves like a free particle.

[14] The kinetic energy of a body does not change if any one of the following is true
(i)force is always perpendicular to the velocity
(ii) the force is always perpendicular to the acceleration
(iii) the object remains stationary
(iv) the object moves in such a way that the point of application of the force remains fixed.

SetId=695

[15] Explain Force:FORCE is any interaction which tends to change the motion of an object.It has both magnitude and direction,making it a vector quantity.
In the case of a non inertial frame, we can use the second law of motion by adding a pseudo force to the system which makes it an inertial frame of reference.

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[1] The speed is rate of change of distance and the velocity is the rate of change of displacement.

[2] The law of conservation of angular momentum states that when the net external torque acting on the system is zero, then the angular momentum of the system remains constant.both the initial and final momentum should be taken from a fixed inertial frame of reference provided.

[3] In the Sun-Earth system, angular momentum of the earth is not conserved but the total angular momentum of the sun and the earth is constant of motion.

[4] For the motion of the Earth around the sun, the total of angular momenta of the Earth and the Sun, is conserved in every inertial frame of reference; but the angular momentum of the Earth (or of the sun)is not conserved in every inertial frame.

[5] The law of angular momentum of a is not applicable for the conical pendulum conserved w.r.t. the origin fixed at the point of suspension.

SetId=696

[6] In the example of conical pendulum, the z- component of angular momentum does not change. This follows from the angular momentum conservation as there is no external torque.

[7] If I throw a ball upward, it's speed decreases as it rises upwards. There is an external force (gravity) acting on the ball, so the momentum conservation law does not apply. Momentum of the ball is not conserved, however the momentum of the Earth-ball system is conserved as gravity will become an internal force in this case.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *net external force* acting on the system, the momentum is conserved. The definition of angular momentum and torque depends on the choice of axes, and therefore it may not be be conserved. The conservation of total energy holds only for conservative forces.

When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *net external force* acting on the system, the energy and momentum will be conserved. However, the total angular momentum may not be conserved because the torque may not be zero.

[9] Nonconservative forces arise due to neglected degrees of freedom or from time dependent potentials. The work done by a nonconservative force depends upon the path taken. It causes a change in the mechanical energy of the system. It adds or removes mechanical energy from a system.

SetId=696

[10] It is not possible for a particle to move on a circular path in such a way that its speed and force remains constant, and only the velocity and acceleration may (or may not) always change with time.

[11] Distance depends on the path where as the displacement depends on the end point only

[12] A frame rotating w.r.t K with uniform angular velocity is also an inertial frame.

[13] The total mechanical energy of a system may not be conserved if there are no external forces and the internal forces are conservative.

[14] The total work done on a particle is always equal to the change in kinetic energy.

SetId=696

[15] For the Newton's Law of Motion to hold true,the physically apparent but nonexistent force needed by an observer in a non-inertial frame is called the pseudo force.
1) Caused by relative acceleration of the origin in a straight line
2) Centrifugal and Centripetal forces
3) Coriolis force
4) Euler force

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[1] For any type of translational motion of a body, the displacement cannot be zero, where as the distance travelled can be zero.

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[2] The law of conservation of angular momentum states that The total angular momentum of a system is constant in both magnitude and direction if the resultant torque, of the external forces acting on the system, is zero.

[3] Consider a disc and a man system. man is standing on center of the disc rotating with angular velocity.initially man folded his hand.when man stretches his hands then momentum of inertia of system increases.and angular velocity decreases.and total angular momentum remains constant.

[4] In the Sun Earth system the angular momentum of the Earth is conserved in every frame of reference

[5] The law of angular momentum of a is not applicable for the conical pendulum conserved when the origin is chosen to be at the pendulum bob itself.

SetId=697

[6] In the example of conical pendulum, the x and$y$ components of angular momentum change. This follows from the angular momentum conservation as the z components external torque is zero and horizontal components of torque are non zero.

[7] A soldier accelerating away, after detonating a bomb, will find that the total momentum of the fragments of the bomb is zero. This is an example where the law of conservation of momentum holds as the forces on the fragments are internal forces only and sum of all such forces is zero.

[8] In order to apply the law of conservation of momentum we must first identify the system. If there is no *net external forces* acting on the system then conservation laws of momentum always holds. The total energy and the total angular momentum may not be conserved.

[9] The work done by a *Nonconservative Force *is not recoverable*.*The work done by a *Non Conservative force* is usually dissipated in the form of Heat and Sound.

SetId=697

Non conservative force *cannot* be expressed in the form of *Potential Energy*.

[10] For a particle moving on circle the acceleration is always constant in magnitude and directed towards the centre of the circle.

[11] Distance equal to zero $\Rightarrow$ displacement=0; but Displacement=0

[12] The Newton's Laws of motion will hold in all frames which are at rest w.r.t. K but do not remain valid in a frame that move with respect to K.

[13] When a bullet fired on a wooden block, some energy is transferred to the block and the total mechanical energy of the block and the bullet is conserved.

[14] A particle is acted upon by a force of constant magnitude which is always perpendicular to the velocity of the particle and the motion of the particle takes place in a plane, Then its kinetic energy, speed, velocity acceleration will not change. SetId=697

[15] A force is any interaction which tends to change the motion of an object. It is also *defined* as rate of change of momentum.It is a vector quantity.

Pseudo-force is a fictitious force it is taken by an observer from non inertial frame of reference. This force arises from acceleration of reference frame that is a reference frame which is accelerating or rotating.

The equation of motion is then written by balancing all forces. As an example a particle moving in a circle is seen to be at rest by balancing the centripetal and centrifugal forces.

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[1] Displacements, being vector quantity can not compared with, a scalar quantity such as distance.

[2] If the net external torque acting on a system is zero,the angular momentum L(vector) of the system remains constant,no matter what changes take place within the system.L(vector)=a constant (net external torque acting on system is zero)

[3] The conservation of angular momentum of a system of bodies requires that the the sum of torque due to all forces be equal to zero. Now consider a situation where the forces are such that the sum of torques of external forces is zero w.r.t. some axes K. Since the value of torque depends of the choices of axes, the sum of torques due to all internal forces will depend on the choice of axes and in general it will be non zero. Therefore, for a system of several bodies, for a given choice of axes K, there will be situations when the total angular momentum may not be conserved.

[4] In the motion of earth around sun, the angular momentum of the earth about an axis passing through the sun and perpendicular to the plane of motion of earth is conserved.

[5] The three components of angular momentum of a conical pendulum is conserved w.r.t. the origin at the position of the center of mass of the pendulum. SetId=698

[6] Example where law of conservation of angular momentum does not hold: A disc rotating on a horizontal rough surface will not have a constant angular momentum because there will be a constant torque by frictional force. Hence, its angular momentum will decrease, and the law of conservation of angular momentum does not apply.

[7] There is no known exception to the law of conservation of momentum in classical mechanics However, an exception to conservation of energy in nuclear physics is observed. In nuclear reactions when two nuclei collide and their mass converts to energy and energy momentum are not conserved.

[8] In order to apply the law of conservation of momentum we must first identify the system. Then even if there is no *net external forces* acting on the system, all the three conservation laws of momentum, angular momentum and energy may not hold due to presence of internal forces.

[9] * A non conservative force is a force that acts on a particle(or point), such that the work done by this force in moving this particle from one point to another is */dependent of path taken/* that is the work done depends on the path itself. * For example frictional force is non conservative because the work done by friction always acts in the direction of travel and therefore depends on length L of the path taken.

SetId=698

[10] The motion of a bomb dropped from a plane does is not a uniform motion as it follows a parabolic path and not a straight line path.

[11] If P and Q are the initial and the final points of a path of a particle, displacement is a vector whose direction is along PQ and has magnitude is equal to the length of line PQ

[12] Staying inside a bullet train moving with constant velocity (no jerks etc) an experiment can always be performed which will tell us the numerical velocity of the bullet train

[13] When a moving car hits a parked lorry and causes the parked lorry to move ,energy is transferred from moving the car to the lorry and the total energy of the lorry and the car is conserved.

[14] The kinetic energy of a particle is continuously increasing with time, then the angle bewteen the net force and the velocity cannot be greater than or equal to 90^{o} at any time. SetId=698

[15] A psuedo force is an apparent force that acts on all masses whose motion is described with respect to a non-inertial frame of reference like a rotating frame of reference. This force is needed by an observer in an non-inertial frame to make all the Newtons second laws to write correct equation of motion..

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ASSIGNMENT-II **Due On : Nov 18, 2014**

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SetId=699

[1] Distance depends on the path where as the displacement depends on the end point only.

[2] The Law of conservation of angular momentum states that when no external torque acts on an object or a closed system of objects undergoing motion about a given axis, the change in angular momentum is zero. Therefore, considering an event where only internal torque or no torque is involved, the total angular momentum of the system before the event is equal to the total angular momentum after the event

[3] Example where law of conservation of angular momentum does not hold:
When there is external force like frictional force acting on a object when it is rotating we cannot use conservation of angular momentum as the friction force acting on the object produces an external torque.

[4] For the motion of earth around sun, the angular momentum of the earth about the center of mass of the sun + earth system and perpendicular to the plane of motion of earth is conserved.

[5] Only the z component of the angular momentum of a conical pendulum is conserved w.r.t. the origin fixed at the point of suspension. SetId=699

[6] Example where law of conservation of angular momentum does not hold:Consider a vertical stick on the ground falling to a horizontal position. During the fall, the conservation of angular momentum applied at the point of rotation on the ground and perpendicular to the plane of the stick is not applicable as, the gravitational force which acts vertically downwards assumed at the centre of mass produces an external torque about the axis of rotation

[7] In a system of a canon and a canon ball, total momentum of the system is zero before canon ball is fired. After firing the canon ball, the momentum of the system seems to be conserved as the ball moves forward and the canon moves backward.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then check we should if the laws are applicable or not.

So if there is no *external force* acting on the system all the three quantities, total momentum, total angular momentum, and total kinetic energy will be conserved independent of the nature of forces.

[9] A force with the property that the work done in moving a particle is dependent on the path followed. The work done by a conservative force in moving a body from an initial location to a final location is dependent on the path taken between the two points

SetId=699

[10] A wagon sliding on a roller coaster designed in such a way that the wagon covers equal distances in equal times. As the motion of the wagon is uniform, there will be no net force acting on it.

[11] If P and Q are the initial and the final points of a path of a particle,the displacement is the vector $\overrightarrow{PQ}$.

[12] Staying inside a bullet train moving with constant velocity (no jerks etc) an experiment can always be performed which will tell us the numerical value of the acceleration of the bullet train

[13] When a bomb explodes the total mechanical energy is not conserved. But the total chemical energy and the mechanical energy is conserved.

[14] A heavy body is attached from a spring and is held at point A and is such that the spring is not slack nor is it stretched. It is then released. It goes down upto a point B and then it rises upto point C and executes an oscillatory motion between B and C. During the motion from A to C is first positive (from A to B) and then it is negative from B to A and again remains negative from A to C. SetId=699

[15] One indication that pseudo forces are NON-NEWTONIAN is that they violate Newton's III law and violate the Newton's third law.

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SetId=700

[1] Distance equal to zero implies displacement=0; and Displacement=0 also implies distance = 0

[2] The law of conservation of angular momentum states that when no external torque acts on an object or a closed system of objects, no change of angular momentum can occur. Hence, the angular momentum before an event involving only internal torques or no torques is equal to the angular momentum after the event . Angular momentum can be calculated with the help of the formula $L = I\omega$ where L stands for Angular momentum, I stands for moment of inertia and ω stands for angular velocity

[3] A bob attached to a ceiling by a string moving in a horizontal circular plane is an example where the total angular momentum of the bob about the point of suspension is not conserved. This is because the the torque due to the weight of the bob about the point of suspension does not vanish and has non zero horizontal component. Only the vertical component of the angular component is conserved.

[4] In the Sun Earth system the angular momentum of the Earth about the pole star is conserved

[5] The z component of angular momentum of a conical pendulum is not conserved w.r.t. the origin fixed at the point of suspension; but the x and y components are conserved.

SetId=700

[6] We have a conical pendulum .The forces acting on the bob are tension (along the direction of the string) and gravitational force acting in the vertically downward direction.we have an additional force called the drag force which is tangential to the motion of the bob and acts in the direction opposite to the motion of the bob.The axis of rotation passes through the hinge point and is vertical.The torque due to tension is 0 because the force passes through the axis of rotation.The torque due to mg is also zero since it is parallel to the axis of rotation.but the torque due to drag force is not zero.since the net external torque acting on the bob is not zero,therefore the law of conservation of angular momentum does not hold here

[7] When applying the conservation laws of momentum, energy and angular momentum we must define the system first.Only then check if the laws is applicable or not.

As an example: when a ball is dropped from a height, it gains momentum down if we consider the ball as our system.This is because the force of gravity acts as an external force.

However, if we change our system and consider earth as a part of our system too, then the momentum remains conserved because the earth gains momentum up.

[8] If we want to apply the conservation laws of momentum, energy and angular momentum, we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *external force* acting on the system, the momentum and angular momentum will be conserved, and depending on the nature of the forces but total energy may or may not be conserved.

[9] The work done by non conservative force is dependent on the path taken by the particle in reaching final position from initial position. Non conservative force depends on the distance travelled by the particle

SetId=700

[10] A simple pendulum moves along a circular arc and does not have constant speed and therefore its motion is not uniform.

[11] If two bodies starting from a point A reach a point B, following different paths, their displacement will be, in general different, but the distances covered will always be the same.

[12] Assume bullet train, moving with out any jerks, is going on a circular arc of radius R with constant speed. Then an experiment is to be performed entirely within the train without any measurement on objects outside the train. Such an experiment can tell only radius of the track.

[13] When a ball rolls over a rough surface, it comes to stop after some time. This is because transational and rotational kinetic energy initially present in the ball continuosly gets converted to heat due to friction. When all the kinetic energy changes to heat, the ball stops. The total mechanical energy of the ball is not conserved.

[14] The kinetic energy of a body does not change if any one of the following is true
(i)force is always perpendicular to the velocity
(ii) the force is always perpendicular to the acceleration
(iii) the object remains stationary
(iv) the object moves in such a way that the point of application of the force remains fixed.

SetId=700

[15] The apparent force which seems to act on an object in an accelerating frame of reference if we wish to describe the object's motion is called a pseudo force.Its a non-existent force used only to describe the motion completely using Newton's second law even though the agent causing the force is undefined.

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[1] If P and Q are the initial and the final points of a path of a particle, displacement is a vector whose direction is along PQ and has magnitude is equal to the length of line PQ

SetId=701

[2] Newton's Second Law of Motion is defined by the expression $F = \frac{dp}{dT}$, where F gives the force vector acting on the system and p gives its momentum vector; in linear motion. A similar expression can be written to describe angular motion, i.e. : $\tau = \frac{dL}{dt}$, where τ is the external torque vector acting on the system, and L is the angular momentum.

If the external torque on the system is zero, then we get the expression as: dL/dt=0. This points out to the fact that, when no external torque is acting on the system, then its angular momentum is constant, no matter what changes occur in the system. This is the Law of Conservation Of Angular Momentum.

[3] Law of conservation of angular momentum holds in case of long jump. When a athlete takes off from the ground in a running long jump, the forces on the launching foot give the athlete an angular momentum with a forward rotation around a horizontal axis. Such rotation would not allow the jumper to land properly. In the landing, the legs should be together and extended forward at an angle so that the heels mark the sand at the greatest distance. Once airborne, the angular momentum cannot change (it is conserved) because no external torque acts to change it. However, the jumper can shift most of the angular momentum to the arms by rotating them in windmill fashion. Then the body remains upright in the proper orientation of landing.

[4] For the motion of earth around sun, the angular momentum of the sun about the center of mass of the sun + earth system and perpendicular to the orbital plane of earth is conserved.

For the motion of earth around sun, the angular momentum of the sun about and axis passing through the Earth and perpendicular to the orbital plane of motion of earth is conserved.

[5] Only the z component of angular momentum of a conical pendulum is conserved w.r.t. the origin fixed at the point of suspension. SetId=701

[6] When you release a toy gyroscope on its pedestal, it initially has no precessional rotation around that pedestal, i.e, the orientation of rotation is fixed. However, it instantaneously starts precessing around the pedestal. Both Kinetic Energy and Angular Momentum now exist where they did not exist a moment earlier. The Kinetic Energy is easy to explain, as appearing due to the body of the gyroscope dropping a tiny fraction of a millimeter in the Earth's gravitational field, giving up exactly the correct amount of Potential Energy. But the Angular Momentum of the

Precession which just appeared, does not come from anywhere. This is therefore a Violation of the Conservation of Angular Momentum.

[7] Statement: Law of Conservation of energy states that "ENERGY CAN NEITHER BE CREATED NOR DESTROYED",but it can be changed from one form to other.

EXPLANATION: Statement implies that the total amount of energy in an isolated system remains constant although it may change forms. viz, kinetic energy may change to potential;chemical to electrical energies etc.

[8] To apply the conservation laws of momentum, energy and angular momentum, we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *external force* acting on the system, the energy and momentum will be conserved. However, depending on the nature of the system and of the forces, the total angular momentum may not be conserved.

[9] The work done by non conservative force is dependent on the path taken by the particle in reaching final position from initial position. Non conservative force depends on the distance travelled by the particle

SetId=701

[10] A satellite goes around the earth in a circular orbit of 600km with a time period of $5.8 \times 10^3 s$. Its motion will be uniform as it will cover equal distances in equal times.

[11] Distance is equal to the length of the path covered. Displacement is the shortest distance between initial and final points.

[12] Assume bullet train, moving with out any jerks, is going on a circular arc of radius R with constant speed. Then an experiment is to be performed entirely within the train without any measurement on objects outside the train. Such an experiment can tell both speed of the train and radius of the track.

[13] Let us consider that a pendulum is oscillating moving in a vertical plane. Mean while let another bob which is attached to a spring and is executing a simple harmonic motion in horizontal direction comes and hits the pendulum. Here conservation of momentum does not hold good as tension(external force) is acting on the system.(pendulum)

[14] The total work done on a particle is always equal to the change in kinetic energy. SetId=701

[15] The physically apparent, but nonexistent, force needed by an observer in a noninertial frame to make Newton's laws of motion hold true is called pseudoforce.

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SetId=702

[1] If P and Q are the initial and the final points of a path of a particle,the displacement is the vector $\overrightarrow{PQ}$.

[2] If the net external torque acting on a system is zero, the angular momentum L of the system remains constant, no matter what changes take place within the system.

$$\sum(T_{\text{ext}}) = \frac{dL}{dt}$$

The law states that when there is no net external torque, $\frac{dL}{dt}$ is zero implying that the total angular momentum of system is constant.

i.e. $L = a$ constant (isolated system)

[3] The total angular momentum of a body remains constant of motion when the net torque of the external forces acting on the body is zero.
In general, we have a system of particles such that the net torque of the external forces on the system, w.r.t. some axes K, is zero, the total angular momentum may not remain conserved, because the torque due to the internal forces may not be zero.

[4] For the motion of earth around sun, the sum of angular momenta of the Sun and the Earth about the center of mass of the sun + earth system is conserved.

[5] The projection of angular momentum of a conical pendulum in the horizontal plane is a constant of motion when the origin is chosen to be at fixed at the point of suspension. SetId=702

[6] There is no case where LAW OF CONSERVATION OF ANGULAR MOMENTUM does'nt hold.But there are cases where conservation of angular momentum does not hold.A body in vertical circular motion is an example where angular momentum is not conserved. Here the law of conservation does not apply.

[7] Oscillating simple pendulum is a very good example where potential energy gets converted to kinetic energy and kinetic to potential energy. Some energy gets dissipated as heat if we consider air resistance. Energy as a whole is conserved if we consider universe as system, the energy has just changed its form.

[8] In order to apply the law of conservation of momentum we must first identify the system. If there is no *external forces* acting on the system then conservation laws of momentum always holds. And depending on the nature of the system and of the forces, the total kinetic energy and the total angular momentum may not be conserved.

SetId=702

[9] Nonconservative forces are those forces in which the work done in moving a particle is dependant on the path taken to cover the distance. Some energy woul be lost to the environment in the form of heat, sound, etc. The energy in the final state is less than that in the initial state.

[10] A uniform motion is defined to be the one in which a body covers equal distances in equal time intervals.

[11] Distance is a scalar quantity where as the displacement is a vector quantity.

[12] Assume bullet train, moving with out any jerks, is going on a circular arc of radius R with constant speed. Then an experiment is to be performed entirely within the train without any measurement on objects outside the train. Such an experiment can tell only speed of the track.

[13] The law of conservation of momentum does not hold in relativistic situations, i.e., where the speeds of the masses involved are close to the speed of light.

[14] A particle is acted upon by a force of constant magnitude which is always perpendicular to the velocity of the particle and the motion of the particle takes place in a plane, Then its kinetic energy, speed, velocity acceleration will not change. SetId=702

[15] Pseudo forces come into picture when Newton's laws of motion have to be applied to describe the motion of bodies in non-inertial frames. These forces have no real existence.

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SetId=703

[1] If two bodies starting from a point A reach a point B, following different paths, their displacement will be, in general different, but the distances covered will always be the same.

[2] When the net external torque acting on a body or a system of bodies is zero about a particular axis, then the angular momentum of each body is conserved about that axis.

[3] An example where law of conservation of angular momentum holds:
The Law of conservation of angular momentum holds in the case of a ballet dancer performing a pirouette.

When the dancer extends her arms outward, the angular velocity of her rotation decreases whereas when she keeps her arms close to her body, the angular velocity increases. This is because her moment of inertia changes as she moves her arms outward and inward. It can be noted that she as a system has no external torque acting upon her.

[4] For the motion of the Earth around the sun, the total of angular momenta of the Earth and the Sun, about in a reference frame fixed in the pole star, is conserved.

[5] The law of angular momentum of a is not applicable for the conical pendulum conserved w.r.t. the origin fixed at the point of suspension. SetId=703

[6] A sphere rolling on a rough surface.Due to friction there is external torque so the angular momentum changes which results in the slowing of the sphere. The angular momentum keeps changing. Even in case like this one, it is wrong to say that the Law of Angular Momentum Conservation does not hold.

[7] Law of conservation of momentum does not hold whenever an external force or impulse acts on the system. For example,when a body collides with earth then it bounces back to a lesser height as it loses some velocity.

In this example the momentum of a ball is not conserved due to impulsive force by ground in the normal direction.

However, strictly speaking the system that should be considered here is the ball-earth system and the total momentum is conserved.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then check if the laws is applicable or not.

So if there is no *net external force* acting on the system all the three conservation laws will hold.

[9] The work done by such forces depends on the path taken. The work done cannot be represented as a potential energy function.Work done by such forces is always negative.

SetId=703

[10] A particle moves on a circular path. Then its speed, direction of force, velocity and acceleration must always change with time.

[11] Both displacement and distance tell us about the motion of a body but their study does not tell much about the forces on the body

[12] A particle is observed from two frames S_1 and S_2. The frame S_2 moves with respect to S_1 with an acceleration a. If F_1 and F_2 be the pseudoforces when seen from S_1 and S_2 respectively it is not possible to have $F_1 = F_2 = 0$

[13] when we are in accelerating frame if we observe any collision between two bodies then the law of conservation of momentum does not hold in that frame of reference.

[14] The kinetic energy of a particle is continuously increasing with time, then the angle bewteen the net force and the velocity cannot be greater than or equal to $90^{\rm o}$ at any time.

SetId=703

[15] In a non-inertial frame of reference the accelration of the body that we measure, is not the true acceleration, as the frame itself accelerates.Thus,force(F=ma) is also not the true force acting on the body.The extra force added to make it a true value is called pseudo force.Thus pseudo force does not really act on a body but just compensates the change produced by the non inertial frame, in true acceleration.

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SetId=704

[1] Displacement is equal to the vector difference $\vec{r}_f - \vec{r}_i$ of the position vectors of initial and final points. The distance covered will be $|\vec{r}_f - \vec{r}_i|$

[2] The law of conservation of angular momentum states that in absence of an external torque on an object or a closed system of objects the total angular momentum of the system remains constant. Thus if $\vec{\tau} = 0 => \vec{L} =$ constant where τ is the torque and $\vec{L}$ is the angular momentum of the system.

[3] In case of a skater, who can be considered an isolated system, so no torue will be acting on him/her. When the arms are extended, the moment of inertia is more. When his hands are closely held, the moment of inertia is lesser. Since the angular momentum is same, the angular acceleration changes accordingly.

[4] For the motion of the Earth around the sun, the total of angular momenta of the Earth and the Sun, is conserved in every inertial frame of reference; but the angular momentum of the Earth (or of the sun)is not conserved in every inertial frame.

[5] The law of angular momentum of a is not applicable for the conical pendulum conserved when the origin is chosen to be at the pendulum bob itself. SetId=704

[6] Consider a rod of length l. Let us give an impulse to one end . Now the angular momentum about the oposite end is not zero since the impulse provides some torque . So the angular momentum is not conserved .

$$\text{torque} = \text{impulse} * \ell.$$

$d\ell/dt$ is not equal to zero and the law of conservation of angular momentum does not hold.

[7] If a bullet hits a wooden board and gets embedded in the board, the total energy and the total momentum of the bullet and the board are conserved.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then check we should if the laws are applicable or not.

So if there is no *external force* acting on the system all the three quantities, total momentum is conserved. The total angular momentum is also because the torque of internal forces will be zero. The conservation of energy depends on the nature of forces. will be conserved.

SetId=704

[9] A nonconservative force is a force with the property that the work done in moving a particle depends on the path taken.Also, the net work done in a closed loop is non zero.

[10] A particle moves on a circular path. Then its speed, direction offorce, can remain constant by velocity and acceleration must always change with time.

[11] Displacement is the shortest distance between initial and final points with direction specified.

[12] A particle is observed from two frames S_1 and S_2. The frame S_2 moves with respect to S_1 with an acceleration a. If F_1 and F_2 be the pseudoforces when seen from S_1 and S_2 respectively and if $F_1 = 0$ then we must have $F_2 \neq 0$

[13] Give an example where law of conservation of momentum does not hold all cases when seen from non inertial frame of references for example when we see two cars collide from a moving bus there momentum is not conserved

[14] A heavy body is attached from a spring and is held at point A and is such that the spring is not slack nor is it stretched. It is then released. It goes down upto a point B and then it rises upto point C and executes an oscillatory motion between B and C. During the motion from A to C is first positive (from A to B) and then it is negative from B to A and again remains negative from A to C. $\boxed{\text{SetId=704}}$

[15] A force is any interaction which tends to change the motion of an object. It is *equal to* the rate of change of momentum by Newton's second law.

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SetId=705

[1] Distance is equal to the length of the path covered. Displacement is the shortest distance between initial and final points.

[2] If no net external torque acts on a system, the total angular momentum of the system remains constant.

[3] Example where law of conservation of angular momentum holds:
Let us assume a student seated on a stool that can rotate freely about a vertical axis. The student has been set into rotation at a modest initial angular speed ω . He holds two dumbbells in his outstretched hands. His angular momentum vector L lies along the vertical rotation axis, pointing upwards. Now he pulls in his arms;this action reduces his rotational inertia from its value I_{initial} to a final value I_{final} because he moves the mass closer to the rotational axis. His rate of rotation increases markedly, from ω_{initial} to ω_{final}. The student can then slow down by extending his arms once more,moving the dumbbells outward. No external torque acts on the system consisting of the student, stool and the dumbbells. Thus the angular momentum of the system about the rotational axis remains constant. $I_{\text{initial}} * \omega_{\text{initial}} = I_{\text{final}} * \omega_{\text{final}}$.

[4] In the Sun Earth system the angular momentum of the Earth is conserved in every frame of reference

[5] The three components of angular momentum of a conical pendulum is conserved w.r.t. the origin at the position of the center of mass of the pendulum. SetId=705

[6] Let us consider a rotating skew rod. In the absence of friction or any other drag force, the rod should continuously spin without stopping. Here the net torque about the axis of rotation is 0 and hence angular momentum is conserved. It therefore follows from law of conservation of angular momentum that a spinning skew rod will keep rotating with constant angular velocity if there is no external torque. So law of conservation of angular momentum does not hold.

[7] If a bullet hits a wooden board and gets embedded in the board, the total energy of the bullet and the board system is conserved but the total momentum is not conserved.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *net external force* acting on the system, the momentum is conserved. The definition of angular momentum and torque depends on the choice of axes, and therefore it may not be be conserved. The conservation of total energy holds only for conservative forces.

When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *net external force* acting on the system, the energy and momentum will be conserved. However, the total angular momentum may not be conserved because the torque may not be zero.

[9] A force whose work done is a path function is called a non-conservative force. All the forces which do not satisfy the definition of conservative forces are non-conservative in nature. The work done by these forces dissipates into heat energy, sound energy, light energy, etc. Therefore, law of conservation of mechanical energy cannot be applied to a system on which a non-conservative force is acting. No potential function can be defined for these forces.

SetId=705

[10] A particle moves on a circular path. Then under suitable conditions its speed may remain constant, but the force, velocity and acceleration must always change with time.

[11] Displacements, being vector quantity can not compared with, a scalar quantity such as distance.

[12] If K is an inertial frame, any frame that moves w.r.t. the frame K with uniform velocity is also an inertial frame.

[13] When a tennis ball hits the ground at an oblique angle, the angle of reflection is equal to the angle of incidence. This is a simple consequence of conservation of horizontal component of momentum.

[14] The kinetic energy of a body does not change if any one of the following is true
(i)force is always perpendicular to the velocity
(ii) the force is always perpendicular to the acceleration
(iii) the object remains stationary
(iv) the object moves in such a way that the point of application of the force remains fixed.

SetId=705

[15] Newton's laws are not valid on non-inertial frame of reference. So to validate Newton's laws of motion pseudo force (fictious or virtual force) is introduced.
Pseudo force acts in non-inertial frame. Its magnitude is always mass of the body multiplied by acceleration of the frame. It is always in direction opposite to the acceleration of the frame of reference. The resultant of pseudo forces and real forces is always zero.

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SetId=706

[1] Distance is a scalar quantity where as the displacement is a vector quantity.

[2] The law of conservation of angular momentum states that when no external torque is applied on an object or a closed system of objects about an axis, the angular momentum about that axis remains constant.

[3] A bob is attached to ceiling by a string and moves in a horizontal circular plane is an example. In this case the law of conservation of angular momentum does not hold.

[4] In the motion of earth around sun, the angular momentum of the earth about an axis passing through the sun and perpendicular to the plane of motion of earth is conserved.

[5] Only the z component of the angular momentum of a conical pendulum is conserved w.r.t. the origin fixed at the point of suspension. SetId=706

[6] In the example of skew rod the angular velocity does not change even though the torque applied is nonzero. However there is no contradiction as in this case the law of conservation of momentum is not applicable. conservation is violated.

[7] If a bullet hits a wooden board and gets embedded in the board, both total energy and the total momentum of the bullet and the board are not conserved.

[8] In order to apply the law of conservation of momentum we must first identify the system. If there is no *net external forces* acting on the system then conservation laws of momentum always holds. The total energy and the total angular momentum may not be conserved.

[9] *Non conservative forces* are the type of forces in which the work done by the forces is purely dependent on the path taken by the body.Thus the net work done by the forces in cyclic path is never equal to zero.

SetId=706

[10] A particle moves on a circular path. Then under suitable conditions its speed and acceleration may remain constant, but the force, and velocity must always change with time.

[11] Distance depends on the path where as the displacement depends on the end point only

[12] If K is an inertial frame, any frame that moves w.r.t. the frame K with uniform speed is also an inertial frame.

[13] when a ball is dropped from a height, it gains momentum down if we consider the ball as our system.This is because the force of gravity acts as an external force.

However, if we change our system and consider earth as a part of our system too, then the momentum remains conserved because the earth gains momentum up.

[14] The total work done on a particle is always equal to the change in kinetic energy. SetId=706

[15] These forces are non-real forces but must be taken into account while applying Newton's Law's of Motion in accelerating frame of reference as compared to an inertial frame of reference.

The centrifugal and centripetal forces are examples of pesudo-forces.

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SetId=707

[1] The speed is rate of change of distance and the velocity is the rate of change of displacement.

[2] The angular momentum of a given system of bodies shall remain conserved unless acted upon by an external unbalanced torque.

[3] Consider a disc rotating about an axis perpendicular to its plane. On placing a smaller disc with its surface parallel to the surface of the rotating disc, the angular momentum of the system of two discs remains constant as there is no external torque.

[4] For the motion of earth around sun, the angular momentum of the earth about the center of mass of the sun + earth system and perpendicular to the plane of motion of earth is conserved.

[5] The z component of angular momentum of a conical pendulum is not conserved w.r.t. the origin fixed at the point of suspension; but the x and y components are conserved.

SetId=707

[6] Example where law of conservation of angular momentum does not hold:If a particle undergoes conical motion and the only force acting on particle is central force like tension of the string.Then total external torque about fixed point A is zero,yet angular momentum is not conserved,as angular momentum keeps on changing direction.

[7] There are certain situations where it appears that the law of conservation of linear momentum does not hold. For example if we take some amount of a substance like construction putty, cement, cake batter, playing dough,etc and drop it on the ground, it does not bounce back like a rubber ball would and hence the momentum it had before striking the ground seems to have been lost. Hence it appears that the law of conservation of linear momentum does not hold.

[8] In order to apply the law of conservation of momentum we must first identify the system. Then even if there is no *net external forces* acting on the system, all the three conservation laws of momentum, angular momentum and energy may not hold due to presence of internal forces.

[9] Non-conservative forces are path-dependent forces, i.e. the work done on a body by these forces depends on the path taken by the body. Mechanical energy of a system is not conserved when a conservative force acts on it but the total energy is conserved. Therefore, the mechanical energy lost by the system is liberated in some other form such as light energy, heat energy, etc.

For example, when a body is moving along a surface, frictional force acts on the body as well. Due to this frictional force, the body loses its mechanical energy, and

this loss is generally released in the form of heat energy to the surroundings. Thus, the mechanical energy will not be conserved and frictional force can be classified as a non-conservative force. SetId=707

[10] When the force is kept constant as function of time, it is possible for a particle to move on a circular path in such a way that its speed remains constant, but the velocity and acceleration must always change with time.

[11] Distance equal to zero $\Rightarrow$ displacement=0; but Displacement=0

[12] A frame rotating w.r.t K with uniform angular velocity is also an inertial frame.

[13] There is no known exception to the law of conservation of momentum in classical mechanics however when two bodies collide and their mass converts to energy, an exception in nuclear physics is observed. In real life this is observed in nuclear reactions at atomic level.

[14] A particle is acted upon by a force of constant magnitude which is always perpendicular to the velocity of the particle and the motion of the particle takes place in a plane, Then its kinetic energy, speed, velocity acceleration will not change. SetId=707

[15] When observing our system from a reference frame which is accelerating compared to an inertial frame,in order to make it easier to apply newtons laws, we can apply a pseudo force on all objects in the universe proportional to their mass capable of causing an acceleration equal and opposite to that of our reference frame. Hence serving to in a way "stop"(or make inertial) our reference frame, and making it easier for us to investigate the motion.

This application of pseudo force doesn't change the motion of the object because just as we can choose an arbitrary reference frame, we can choose an arbitrary force to cause the same acceleration in every object in the whole universe without changing the relative motions of objects. (as all motion is truly relative, we will still get correct answers for our investigations.

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SetId=708

[1] For any type of translational motion of a body, the displacement cannot be zero, where as the distance travelled can be zero.

[2] When the net external torque acting on a system about a given axis is zero, the total angular momentum of the system about that axis remains consant.

[3] Consider a man standing on a spinning platform. Initially, the man spreads out his arms and he spins with a certain angular velocity. The next moment, he pulls his arms inwards keeping them close to his body. We will observe that the angular velocity with which he is spinning now increases. This phenomenon can be explained by the Law Of Conservation of Angular momentum. Initially, since his arms were spread wide, his moment of inertia was large. However, when he pulled them close to his body, his moment of inertia decreased.
In this example the angular velocity of the man increases and therefore the angular momentum also increases.The law of conservation of angular momentum does not apply because the torque of muscular forces is not zero.

[4] In the Sun Earth system the angular momentum of the Earth about the pole star is conserved

[5] Only the z component of angular momentum of a conical pendulum is conserved w.r.t. the origin fixed at the point of suspension. SetId=708

[6] A nonzero torque always causes the angular velocity to change, because a change in angular momentum means a change in angular velocity $L = I\omega$

[7] A tennis ball is dropped from height h and after hitting the ground and it bounces back and rises to the same height. In this case the momentum of the ball is conserved because (under ideal conditions) the momentum after it hits the ground will be equal to the momentum it had before hitting the ground.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then check we should if the laws are applicable or not.

So if there is no *external force* acting on the system all the three quantities, total momentum, total angular momentum, and total kinetic energy will be conserved independent of the nature of forces.

[9] It is a force for which the work done by that force on an object or a particle in moving it between any two points depends on its path travelled.This force doesn't conserves the mechanical energy.The work done by a non-conservative force on an object in moving it in a circular path is not equal to zero.

SetId=708

[10] It is not possible for a particle to move on a circular path in such a way that its speed and force remains constant, and only the velocity and acceleration may (or may not) always change with time.

[11] If P and Q are the initial and the final points of a path of a particle, displacement is a vector whose direction is along PQ and has magnitude is equal to the length of line PQ

[12] The Newton's Laws of motion will hold in all frames which are at rest w.r.t. K but do not remain valid in a frame that move with respect to K.

[13] When there is no external forces act on a system of many particles, and there are only internal forces acting on the particles. The third law gives that the internal forces are pairwise equal and opposite.Thus the sum of internal forces is zero and the momentum of each particle is conserved.

[14] The kinetic energy of a particle is continuously increasing with time, then the angle bewteen the net force and the velocity cannot be greater than or equal to 90^{o} at any time. SetId=708

[15] Various types of forces in nature can be grouped in four categories:
(a)Gravitational; (b)Electromagnetic; (c)Nuclear; (d)Weak
There are also some non-fundamental forces such as:
(i)Normal reaction on bodies in contact with surfaces , (ii) Friction,(iii) Tension,(iv)Elastic force.

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SetId=709

[1] Displacements, being vector quantity can not compared with, a scalar quantity such as distance.

[2] This law sates that when no net torque of all forces acts on a object or a system of objects then total angular momentum of system is conserved.The angular momentum before an event is equal to angular momentum after that event.mathematically explained by when, net torque=0 ;then, total angular momentum(L)=constant.

[3] In the Sun-Earth system, angular momentum of the earth is not conserved but the total angular momentum of the sun and the earth is constant of motion.

[4] For the motion of earth around sun, the angular momentum of the sun about the center of mass of the sun + earth system and perpendicular to the orbital plane of earth is conserved.

For the motion of earth around sun, the angular momentum of the sun about and axis passing through the Earth and perpendicular to the orbital plane of motion of earth is conserved.

[5] The projection of angular momentum of a conical pendulum in the horizontal plane is a constant of motion when the origin is chosen to be at fixed at the point of suspension.

SetId=709

[6] A nonzero torque always implies change in angular momentum and may not give rise to a change in magnitude of angular velocity. A non zero torque may mean change only the direction of the angular momentum and not the angular velocity.

[7] Law of conservation of momentum does not hold when Newton's laws are not valid, e.g. in a non-inertial frame of reference. For example, when we consider collision between two bodies in a non-inertial frame of reference, the law of conservation of momentum cannot be applied because there will be a pseudo force acting on the frame itself.

[8] If we want to apply the conservation laws of momentum, energy and angular momentum, we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *external force* acting on the system, the momentum and angular momentum will be conserved, and depending on the nature of the forces but total energy may or may not be conserved.

[9] Explain Nonconservative force: This force is just opposite to that of conservative force. The work done by this force depends on the path taken by the particle on which the force is applied.This force does not conserve mechanical energy.If a particle travels in a closed loop, the net work done by a non consevative force is non zero.

SetId=709

[10] For a particle moving on circle the acceleration is always constant in magnitude and directed towards the centre of the circle.

[11] If P and Q are the initial and the final points of a path of a particle,the displacement is the vector $\overrightarrow{PQ}$.

[12] Staying inside a bullet train moving with constant velocity (no jerks etc) an experiment can always be performed which will tell us the numerical velocity of the bullet train

[13] During collision of billiard balls momentum is conserved. During explosion of a bomb also momentum is conserved and the total momentum of the fragments of bomb will be zero. This is because all the forces are only internal forces.

[14] A heavy body is attached from a spring and is held at point A and is such that the spring is not slack nor is it stretched. It is then released. It goes down upto a point B and then it rises upto point C and executes an oscillatory motion between B and C. During the motion from A to C is first positive (from A to B) and then it is negative from B to A and again remains negative from A to C. SetId=709

[15] A force is agency that which changes or tends to change the state of rest or motion of a body.

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SetId=710

[1] Distance depends on the path where as the displacement depends on the end point only.

[2] Statement of Law of Conservation of Angular Momentum:
Differentiating $\vec{L} = \vec{r} \times \vec{p}$ w.r.t, time,

$$\begin{aligned} \frac{dL}{dt} &= \frac{d\vec{r} \times \vec{p}}{dt} = \frac{d\vec{r}}{dt} \times \vec{p} + \vec{r} \times \frac{d\vec{p}}{dt} = \vec{v} \times (m\vec{v}) + \vec{r} \times \vec{F} \\ &= \vec{r} \times \vec{F} (\because v \times v = 0) \\ &= \vec{\tau} \end{aligned}$$

here $\vec{\tau}$ represents the net torque acting on a rigid body rotating about a fixed axis.This torque must take into account of all the forces, be it external or internal forces

[3] Consider a disc and a man system. man is standing on center of the disc rotating with angular velocity.initially man folded his hand.when man stretches his hands then momentum of inertia of system increases.and angular velocity decreases.and total angular momentum remains constant.

[4] For the motion of earth around sun, the sum of angular momenta of the Sun and the Earth about the center of mass of the sun + earth system is conserved.

[5] The law of angular momentum of a is not applicable for the conical pendulum conserved w.r.t. the origin fixed at the point of suspension. SetId=710

[6] In the example of a rotating skew rod the torque due to the external gravitational forces is zero , but the angular momentum is not constant Therefore the law of conservation of angular momentum is violated.

[7] If I throw a ball upward, it's speed decreases as it rises upwards. There is an external force (gravity) acting on the ball, so the momentum conservation law does not apply. Momentum of the ball is not conserved, however the momentum of the Earth-ball system is conserved as gravity will become an internal force in this case.

[8] To apply the conservation laws of momentum, energy and angular momentum, we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *external force* acting on the system, the energy and momentum will be conserved. However, depending on the nature of the system and of the forces, the total angular momentum may not be conserved.

[9] Non conservative force is the force in which the work done by a particle in going from one point to another is path dependent.

For non conservative forces mechanical energy is not conserved,mostly lost in the form of heat and light.The work done by a non conservative force is equal to the change in mechanical energy.

SetId=710

For non conservative force $E_{\text{initial}} > E_{\text{final}}$

[10] The motion of a bomb dropped from a plane does is not a uniform motion as it follows a parabolic path and not a straight line path.

[11] If two bodies starting from a point A reach a point B, following different paths, their displacement will be, in general different, but the distances covered will always be the same.

[12] Staying inside a bullet train moving with constant velocity (no jerks etc) an experiment can always be performed which will tell us the numerical value of the acceleration of the bullet train

[13] Give an example where law of conservation of momentum holds: A mass exploding into several pieces in a conservative field like gravitational field(if air resistance is neglected), obeys law of conservation of momentum. If air resistance cannot be neglected then the law of conservation of momentum will not hold.

[14] The kinetic energy of a body does not change if any one of the following is true
(i)force is always perpendicular to the velocity
(ii) the force is always perpendicular to the acceleration
(iii) the object remains stationary
(iv) the object moves in such a way that the point of application of the force remains fixed. SetId=710

[15] The forces may be of the following two types - *Contact forces* (those that act when bodies are in physical contact) eg. friction, normal reaction, bouyancy etc. and*Action-at-a-distance forces* (those that act when bodies are not in contact) eg. Gravity, electostatic forces, magnetic forces etc. There At the root level, forces are of the following fundamental types :- (a) *Gravitational forces* - weakest of all forces, always attractive
(b) *Electromagnetic forces* - stronger than gravitational forces, can be attractive or repulsive,
(c) *Nuclear forces* - exist at atomic level, have very short range,
(d) *Weak nuclear forces* associated with beta particle emission

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SetId=711

[1] Distance equal to zero implies displacement=0; and Displacement=0 also implies distance = 0

[2] Statement of Law of Conservation of Angular Momentum: For a system of many particles The net torque due all the forces, be it external or internal forces. But as the torque due to all the internal forces cancel out, it sufficient to consider the external forces acting on the system.

[3] The conservation of angular momentum of a system of bodies requires that the the sum of torque due to all forces be equal to zero. Now consider a situation where the forces are such that the sum of torques of external forces is zero w.r.t. some axes K. Since the value of torque depends of the choices of axes, the sum of torques due to all internal forces will depend on the choice of axes and in general it will be non zero. Therefore, for a system of several bodies, for a given choice of axes K, there will be situations when the total angular momentum may not be conserved.

[4] For the motion of the Earth around the sun, the total of angular momenta of the Earth and the Sun, about in a reference frame fixed in the pole star, is conserved.

[5] The law of angular momentum of a is not applicable for the conical pendulum conserved when the origin is chosen to be at the pendulum bob itself. SetId=711

[6] In the example of skew rod, the angular momentum changes with time and there is a non zero torque coming from action of forces other than gravitational forces. Hence the law of conservation of angular momentum dos not apply.

[7] A soldier accelerating away, after detonating a bomb, will find that the total momentum of the fragments of the bomb is zero. This is an example where the law of conservation of momentum holds as the forces on the fragments are internal forces only and sum of all such forces is zero.

[8] In order to apply the law of conservation of momentum we must first identify the system. If there is no *external forces* acting on the system then conservation laws of momentum always holds. And depending on the nature of the system and of the forces, the total kinetic energy and the total angular momentum may not be conserved.

SetId=711

[9] A force is said to be non-conservative, if the work done by the force is dependent on the path taken. It could also be defined as a force for which the work done during a cyclic process is non-zero.

[10] A wagon sliding on a roller coaster designed in such a way that the wagon covers equal distances in equal times. As the motion of the wagon is uniform, there will be no net force acting on it.

[11] Distance is equal to the length of the path covered. Displacement is the shortest distance between initial and final points.

[12] Assume bullet train, moving with out any jerks, is going on a circular arc of radius R with constant speed. Then an experiment is to be performed entirely within the train without any measurement on objects outside the train. Such an experiment can tell only radius of the track.

[13] Also a good example of law of conservation momentum can be seen when a bullet from a rifle is fired.As the bullet is fired and gets out of the rifle, the rifle gives a backward jerk due to the phenomenon of conservation of momentum.

[14] The total work done on a particle is always equal to the change in kinetic energy. SetId=711

[15] The main differences between force and pseudo force are -
(1) Forces have a real presence while pseudo forces don't.
(2) Forces can be accounted for by Newton's laws.
(3) Pseudo forces are only taken into account when the reference frame is accelerated.

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[1] If P and Q are the initial and the final points of a path of a particle, displacement is a vector whose direction is along PQ and has magnitude is equal to the length of line PQ

SetId=712

[2] Depending on the torques acting on a system, the angular momentum can be conserved only in one or two directions, but may not be conserved in all. For instance, if an isolated body has no torque acting on it only in the direction along the Z axis, then the angular momentum is conserved only in that direction.

[3] Example where law of conservation of angular momentum does not hold:
When there is external force like frictional force acting on a object when it is rotating we cannot use conservation of angular momentum as the friction force acting on the object produces an external torque.

[4] For the motion of the Earth around the sun, the total of angular momenta of the Earth and the Sun, is conserved in every inertial frame of reference; but the angular momentum of the Earth (or of the sun)is not conserved in every inertial frame.

[5] The three components of angular momentum of a conical pendulum is conserved w.r.t. the origin at the position of the center of mass of the pendulum. SetId=712

[6] In the example of conical pendulum, the z- component of angular momentum does not change. This follows from the angular momentum conservation as there is no external torque.

[7] There is no known exception to the law of conservation of momentum in classical mechanics However, an exception to conservation of energy in nuclear physics is observed. In nuclear reactions when two nuclei collide and their mass converts to energy and energy momentum are not conserved.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then check if the laws is applicable or not.

So if there is no *net external force* acting on the system all the three conservation laws will hold.

[9] a force is said to be non conservative if work done is dependent on the path of the particle.potential cannot be defined in the case of non conservative forces.work done in closed loop is not equal to zero.

SetId=712

[10] A simple pendulum moves along a circular arc and does not have constant speed and therefore its motion is not uniform.

[11] Distance is a scalar quantity where as the displacement is a vector quantity.

[12] Assume bullet train, moving with out any jerks, is going on a circular arc of radius R with constant speed. Then an experiment is to be performed entirely within the train without any measurement on objects outside the train. Such an experiment can tell both speed of the train and radius of the track.

[13] when a man walks on the ice slab where friction does not exist between the ice block and the floor but between the feet of the man and the slab the slab moves back as per the law of conservation of momentum

[14] A particle is acted upon by a force of constant magnitude which is always perpendicular to the velocity of the particle and the motion of the particle takes place in a plane, Then its kinetic energy, speed, velocity acceleration will not change. SetId=712

[15] A force is any interaction which tends to change the motion of an object. It is also *defined* as rate of change of momentum. It is a vector quantity.

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SetId=713

[1] If P and Q are the initial and the final points of a path of a particle,the displacement is the vector $\overrightarrow{PQ}$.

[2] According to Law of Conservation of Angular momentum,if no external torque acts on an object or system of objects,angular momentum of an object or system of objects remains CONSTANT or no change in angular momentum can occur.

Also it states that,only external torque can change angular momentm of the system where as the torque produced by internal forces can not change the angular momentum of the system

[3] A bob attached to a ceiling by a string moving in a horizontal circular plane is an example where the total angular momentum of the bob about the point of suspension is not conserved. This is because the the torque due to the weight of the bob about the point of suspension does not vanish and has non zero horizontal component. Only the vertical component of the angular component is conserved.

[4] In the Sun Earth system the angular momentum of the Earth is conserved in every frame of reference

[5] Only the z component of the angular momentum of a conical pendulum is conserved w.r.t. the origin fixed at the point of suspension. SetId=713

[6] In the example of conical pendulum, the x and$y$ components of angular momentum change. This follows from the angular momentum conservation as the z components external torque is zero and horizontal components of torque are non zero.

[7] In a system of a canon and a canon ball, total momentum of the system is zero before canon ball is fired. After firing the canon ball, the momentum of the system seems to be conserved as the ball moves forward and the canon moves backward.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then check we should if the laws are applicable or not.

So if there is no *external force* acting on the system all the three quantities, total momentum is conserved. The total angular momentum is also because the torque of internal forces will be zero. The conservation of energy depends on the nature of forces. will be conserved.

[9] Explain Nonconservative Forces:

The forces that depend on the path taken by the particle are called non-conservative forces.

Mechanical energy is not conserved during the action of a non conservative force, instead, it is lost as other forms of enery like heat, light, etc.

Potential energy is not defined for a non-conservative force.

The initial and final kinetic energy in a closed loop is not equal.

The work done by a non conservative force in a closed loop is non zero. In practice, the net work is invariably negative.

Work done by a non conservative force cannot be completely recovered.

For a non conservative force,

$$/text(KE)//_f//+\text{(PE)}//_f// = \text{(KE)}_i+\text{(PE)}_i//+//\text{Work Done)}//\text{non-conservative force}//$$

SetId=713

[10] A satellite goes around the earth in a circular orbit of 600km with a time period of $5.8 \times 10^3 s$. Its motion will be uniform as it will cover equal distances in equal times.

[11] Both displacement and distance tell us about the motion of a body but their study does not tell much about the forces on the body

[12] Assume bullet train, moving with out any jerks, is going on a circular arc of radius R with constant speed. Then an experiment is to be performed entirely within the train without any measurement on objects outside the train. Such an experiment can tell only speed of the track.

[13] When a freely falling rigid body collides another body in its path momentum the system of two particles is not conserved in the collision as there is external force mg acting on the system.

[14] The kinetic energy of a particle is continuously increasing with time, then the angle bewteen the net force and the velocity cannot be greater than or equal to 90^o at any time. SetId=713

[15] Explain Pseudo Force: While applying Newton's laws of motion in non-inertial frame of reference it gives answers which contradict observations. Thus, to account for this,using Newton's Laws, we introduce a "fake" or pseudo force which gives answers that match the observations in a non-inertial frame.

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SetId=714

[1] If two bodies starting from a point A reach a point B, following different paths, their displacement will be, in general different, but the distances covered will always be the same.

[2] The law of conservation of angular momentum states that when the net external torque acting on the system is zero, then the angular momentum of the system remains constant.both the initial and final momentum should be taken from a fixed inertial frame of reference provided.

[3] Law of conservation of angular momentum holds in case of long jump. When a athlete takes off from the ground in a running long jump, the forces on the launching foot give the athlete an angular momentum with a forward rotation around a horizontal axis. Such rotation would not allow the jumper to land properly. In the landing, the legs should be together and extended forward at an angle so that the heels mark the sand at the greatest distance. Once airborne, the angular momentum cannot change (it is conserved) because no external torque acts to change it. However, the jumper can shift most of the angular momentum to the arms by rotating them in windmill fashion. Then the body remains upright in the proper orientation of landing.

[4] In the motion of earth around sun, the angular momentum of the earth about an axis passing through the sun and perpendicular to the plane of motion of earth is conserved.

[5] The z component of angular momentum of a conical pendulum is not conserved w.r.t. the origin fixed at the point of suspension; but the x and y components are conserved.

SetId=714

[6] Example where law of conservation of angular momentum does not hold: A disc rotating on a horizontal rough surface will not have a constant angular momentum because there will be a constant torque by frictional force. Hence, its angular momentum will decrease, and the law of conservation of angular momentum does not apply.

[7] When applying the conservation laws of momentum, energy and angular momentum we must define the system first.Only then check if the laws is applicable or not.

As an example: when a ball is dropped from a height, it gains momentum down if we consider the ball as our system.This is because the force of gravity acts as an external force.

However, if we change our system and consider earth as a part of our system too, then the momentum remains conserved because the earth gains momentum up.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *net external force* acting on the system, the momentum is conserved. The definition of angular momentum and torque depends on the choice of axes, and therefore it may not be be conserved. The conservation of total energy holds only for conservative forces.

When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *net external force* acting on the system, the energy and momentum will be conserved. However, the total angular momentum may not be conserved because the torque may not be zero.

[9] A non conservative force is one where the mechanical energy is not conserved.Here the work done is dependent on the path taken .Different amounts of work need to be done in different paths.Here potential energy would have no meaning as it would keep changing with the path.Here some amount of mechanical energy is lost as sound energy or heat energy and hence is not conserved.

SetId=714

[10] A uniform motion is defined to be the one in which a body covers equal distances in equal time intervals.

[11] Displacement is the shortest distance between initial and final points with direction specified.

[12] A particle is observed from two frames S_1 and S_2. The frame S_2 moves with respect to S_1 with an acceleration a. If F_1 and F_2 be the pseudoforces when seen from S_1 and S_2 respectively it is not possible to have $F_1 = F_2 = 0$

[13] If we take some amount of a substance like construction putty, cement, cake batter, playing dough,etc and drop it on the ground, it does not bounce back, like a rubber ball would bounce, and hence the momentum it had before striking the ground seems to have been lost. Hence it appears that the law of conservation of linear momentum does not hold.

[14] A heavy body is attached from a spring and is held at point A and is such that the spring is not slack nor is it stretched. It is then released. It goes down upto a point B and then it rises upto point C and executes an oscillatory motion between B and C. During the motion from A to C is first positive (from A to B) and then it is negative from B to A and again remains negative from A to C.

SetId=714

[15] When a train is at rest and a ball is hung from the ceiling with a string, an observer in the train sees that the string is vertical. But when the train starts moving, the observer sees that the string makes an angle with the vertical and is tilted in forward direction . This means that some force other than gravity and tension must act on the ball. That force is the pseudo force.

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SetId=715

[1] Displacement is equal to the vector difference $\vec{r}_f - \vec{r}_i$ of the position vectors of initial and final points. The distance covered will be $|\vec{r}_f - \vec{r}_i|$

[2] The law of conservation of angular momentum states that The total angular momentum of a system is constant in both magnitude and direction if the resultant torque, of the external forces acting on the system, is zero.

[3] The total angular momentum of a body remains constant of motion when the net torque of the external forces acting on the body is zero.
In general, we have a system of particles such that the net torque of the external forces on the system, w.r.t. some axes K, is zero, the total angular momentum may not remain conserved, because the torque due to the internal forces may not be zero.

[4] For the motion of earth around sun, the angular momentum of the earth about the center of mass of the sun + earth system and perpendicular to the plane of motion of earth is conserved.

[5] Only the z component of angular momentum of a conical pendulum is conserved w.r.t. the origin fixed at the point of suspension. SetId=715

[6] Example where law of conservation of angular momentum does not hold:Consider a vertical stick on the ground falling to a horizontal position. During the fall, the conservation of angular momentum applied at the point of rotation on the ground and perpendicular to the plane of the stick is not applicable as, the gravitational force which acts vertically downwards assumed at the centre of mass produces an external torque about the axis of rotation

[7] Statement: Law of Conservation of energy states that "ENERGY CAN NEITHER BE CREATED NOR DESTROYED",but it can be changed from one form to other.

EXPLANATION: Statement implies that the total amount of energy in an isolated system remains constant although it may change forms. viz, kinetic energy may change to potential;chemical to electrical energies etc.

[8] In order to apply the law of conservation of momentum we must first identify the system. If there is no *net external forces* acting on the system then conservation laws of momentum always holds. The total energy and the total angular momentum may not be conserved.

[9] The force whose work depends on path taken is called a non conservative force.friction for example does less work on a book dragged across a table if the book is dragged straight across than if the book is dragged in a curved path.

SetId=715

[10] A particle moves on a circular path. Then its speed, direction of force, velocity and acceleration must always change with time.

[11] Displacements, being vector quantity can not compared with, a scalar quantity such as distance.

[12] A particle is observed from two frames S_1 and S_2. The frame S_2 moves with respect to S_1 with an acceleration a. If F_1 and F_2 be the pseudoforces when seen from S_1 and S_2 respectively and if $F_1 = 0$ then we must have $F_2 \neq 0$

[13] When we consider collision between two bodies in a non-inertial frame of reference, the law of conservation of momentum cannot be applied because there will be a pseudo force acting on the frame itself.

[14] The kinetic energy of a body does not change if any one of the following is true
(i)force is always perpendicular to the velocity
(ii) the force is always perpendicular to the acceleration
(iii) the object remains stationary
(iv) the object moves in such a way that the point of application of the force remains fixed. SetId=715

[15] Since newton's laws are not valid in non-inertial frames, pseudoforces (which do not exist in reality) are used to help us formualate and use Newton's laws of motion in non-inertial frames.

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[1] Distance is equal to the length of the path covered. Displacement is the shortest distance between initial and final points.

[2] If the net external torque acting on a system is zero,the angular momentum L(vector) of the system remains constant,no matter what changes take place within the system.L(vector)=a constant (net external torque acting on system is zero)

[3] An example where law of conservation of angular momentum holds:
The Law of conservation of angular momentum holds in the case of a ballet dancer performing a pirouette.

When the dancer extends her arms outward, the angular velocity of her rotation decreases whereas when she keeps her arms close to her body, the angular velocity increases. This is because her moment of inertia changes as she moves her arms outward and inward. It can be noted that she as a system has no external torque acting upon her.

[4] In the Sun Earth system the angular momentum of the Earth about the pole star is conserved

[5] The projection of angular momentum of a conical pendulum in the horizontal plane is a constant of motion when the origin is chosen to be at fixed at the point of suspension.

SetId=716

[6] We have a conical pendulum .The forces acting on the bob are tension (along the direction of the string) and gravitational force acting in the vertically downward direction.we have an additional force called the drag force which is tangential to the motion of the bob and acts in the direction opposite to the motion of the bob.The axis of rotation passes through the hinge point and is vertical.The torque due to tension is 0 because the force passes through the axis of rotation.The torque due to mg is also zero since it is parallel to the axis of rotation.but the torque due to drag force is not zero.since the net external torque acting on the bob is not zero,therefore the law of conservation of angular momentum does not hold here

[7] Oscillating simple pendulum is a very good example where potential energy gets converted to kinetic energy and kinetic to potential energy. Some energy gets dissipated as heat if we consider air resistance. Energy as a whole is conserved if we consider universe as system, the energy has just changed its form.

[8] In order to apply the law of conservation of momentum we must first identify the system. Then even if there is no *net external forces* acting on the system, all the three conservation laws of momentum, angular momentum and energy may not hold due to presence of internal forces.

SetId=716

[9] ** Nonconservative force is a force in which the amount of work done by the force is dependent of the path taken to change a state of a system.

[10] A particle moves on a circular path. Then its speed, direction offorce, can remain constant by velocity and acceleration must always change with time.

[11] Distance depends on the path where as the displacement depends on the end point only

[12] If K is an inertial frame, any frame that moves w.r.t. the frame K with uniform velocity is also an inertial frame.

[13] When a system is acted upon by external forces like friction etc, the conservation principle does not hold good,there will be impulse imparted and so we cant conserve momentum. This is case when a collision between two elastic balls take place on a rough horizontal table. The total momentum just after the collision will be different from the total momentum just before the collision. Here momentum is not conserved as there is external force friction is present.

[14] The total work done on a particle is always equal to the change in kinetic energy. SetId=716

[15] Force is defined as the rate of change of linear momentum. In other words it is the agency which changes or tends to change the (a) State of rest; (b)State of uniform motion (c) Direction of body's motion; (d) Shape of the body

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SetId=717

[1] Distance is a scalar quantity where as the displacement is a vector quantity.

[2] The Law of conservation of angular momentum states that when no external torque acts on an object or a closed system of objects undergoing motion about a given axis, the change in angular momentum is zero. Therefore, considering an event where only internal torque or no torque is involved, the total angular momentum of the system before the event is equal to the total angular momentum after the event

[3] In case of a skater, who can be considered an isolated system, so no torue will be acting on him/her. When the arms are extended, the moment of inertia is more. When his hands are closely held, the moment of inertia is lesser. Since the angular momentum is same, the angular acceleration changes accordingly.

[4] For the motion of earth around sun, the angular momentum of the sun about the center of mass of the sun + earth system and perpendicular to the orbital plane of earth is conserved.

For the motion of earth around sun, the angular momentum of the sun about and axis passing through the Earth and perpendicular to the orbital plane of motion of earth is conserved.

[5] The law of angular momentum of a is not applicable for the conical pendulum conserved w.r.t. the origin fixed at the point of suspension. SetId=717

[6] When you release a toy gyroscope on its pedestal, it initially has no precessional rotation around that pedestal, i.e, the orientation of rotation is fixed. However, it instantaneously starts precessing around the pedestal. Both Kinetic Energy and Angular Momentum now exist where they did not exist a moment earlier. The Kinetic Energy is easy to explain, as appearing due to the body of the gyroscope dropping a tiny fraction of a millimeter in the Earth's gravitational field, giving up exactly the correct amount of Potential Energy. But the Angular Momentum of the Precession which just appeared, does not come from anywhere. This is therefore a Violation of the Conservation of Angular Momentum.

[7] Law of conservation of momentum does not hold whenever an external force or impulse acts on the system. For example,when a body collides with earth then it bounces back to a lesser height as it loses some velocity.

In this example the momentum of a ball is not conserved due to impulsive force by ground in the normal direction.

However, strictly speaking the system that should be considered here is the ball-earth system and the total momentum is conserved.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then check we should if the laws are applicable or not.

So if there is no *external force* acting on the system all the three quantities, total momentum, total angular momentum, and total kinetic energy will be conserved independent of the nature of forces.

[9] Nonconservative force is any force where the work done by the force on the object depends on the path of motion of the object.the work done by the frictional force results in to loss of the energy of the system in the form of heat or other form of energy.

SetId=717

[10] A particle moves on a circular path. Then under suitable conditions its speed may remain constant, but the force, velocity and acceleration must always change with time.

[11] Distance equal to zero $\Rightarrow$ displacement=0; but Displacement=0

[12] If K is an inertial frame, any frame that moves w.r.t. the frame K with uniform speed is also an inertial frame.

[13] When we are in accelerating frame if we observe any collision between two bodies then the law of conservation of momentum does not hold in that frame of reference. On the other hand the law of conservation of momentum holds in all inertial frames.

[14] A particle is acted upon by a force of constant magnitude which is always perpendicular to the velocity of the particle and the motion of the particle takes place in a plane, Then its kinetic energy, speed, velocity acceleration will not change.

SetId=717

[15] Real forces have their origin in matter such as electricity, gravitation etc., while pseudo forces are caused by inertial motion.

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SetId=718

[1] The speed is rate of change of distance and the velocity is the rate of change of displacement.

[2] The law of conservation of angular momentum states that when no external torque acts on an object or a closed system of objects, no change of angular momentum can occur. Hence, the angular momentum before an event involving only internal torques or no torques is equal to the angular momentum after the event . Angular momentum can be calculated with the help of the formula $L = I\omega$ where L stands for Angular momentum, I stands for moment of inertia and ω stands for angular velocity

[3] Example where law of conservation of angular momentum holds:
Let us assume a student seated on a stool that can rotate freely about a vertical axis. The student has been set into rotation at a modest initial angular speed ω . He holds two dumbbells in his outstretched hands. His angular momentum vector L lies along the vertical rotation axis, pointing upwards. Now he pulls in his arms;this action reduces his rotational inertia from its value I_{initial} to a final value I_{final} because he moves the mass closer to the rotational axis. His rate of rotation increases markedly, from ω_{initial} to ω_{final}. The student can then slow down by extending his arms once more,moving the dumbbells outward. No external torque acts on the system consisting of the student, stool and the dumbbells. Thus the angular momentum of the system about the rotational axis remains constant. $I_{\text{initial}} * \omega_{\text{initial}} = I_{\text{final}} * \omega_{\text{final}}$.

[4] For the motion of earth around sun, the sum of angular momenta of the Sun and the Earth about the center of mass of the sun + earth system is conserved.

[5] The law of angular momentum of a is not applicable for the conical pendulum conserved when the origin is chosen to be at the pendulum bob itself. SetId=718

[6] There is no case where LAW OF CONSERVATION OF ANGULAR MOMENTUM does'nt hold.But there are cases where conservation of angular momentum does not hold.A body in vertical circular motion is an example where angular momentum is not conserved. Here the law of conservation does not apply.

[7] If a bullet hits a wooden board and gets embedded in the board, the total energy and the total momentum of the bullet and the board are conserved.

[8] If we want to apply the conservation laws of momentum, energy and angular momentum, we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *external force* acting on the system, the momentum and angular momentum will be conserved, and depending on the nature of the forces but total energy may or may not be conserved.

[9] nonconservative force is any force ,where the work done by the force depends on the path of motion of the body.The work done by such a force is equal to the change in mechanical energy of the system.Energy mostly observed to be lost in form of heat, by the action of non conservative force.

SetId=718

[10] A particle moves on a circular path. Then under suitable conditions its speed and acceleration may remain constant, but the force, and velocity must always change with time.

[11] If P and Q are the initial and the final points of a path of a particle, displacement is a vector whose direction is along PQ and has magnitude is equal to the length of line PQ

[12] A frame rotating w.r.t K with uniform angular velocity is also an inertial frame.

[13] When a freely falling body hits another rigid body in its path then momentum is not conserved as external force mg acts on both the bodies. The total momentum after the collision will be different from the total momentum before the hit.

[14] The kinetic energy of a particle is continuously increasing with time, then the angle bewteen the net force and the velocity cannot be greater than or equal to 90^{o} at any time.

SetId=718

[15] 1)When we start rolling a body on a rough ground, it stops rolling after certain period because of frictional force.
2)When we leave a body from a certain height, it falls due to the act of gravitational force.

1)When a body is rotating in a circular path due to the centrifugal force which is the pseudo force. 2) When the lift is accelerating upwards, the upwards force felt by passengers a pseudo force.

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[1] For any type of translational motion of a body, the displacement cannot be zero, where as the distance travelled can be zero.

[2] Newton's Second Law of Motion is defined by the expression $F = \frac{dp}{dT}$, where F gives the force vector acting on the system and p gives its momentum vector; in linear motion. A similar expression can be written to describe angular motion, i.e. : $\tau = \frac{dL}{dt}$, where τ is the external torque vector acting on the system, and L is the angular momentum.

If the external torque on the system is zero, then we get the expression as: dL/dt=0. This points out to the fact that, when no external torque is acting on the system, then its angular momentum is constant, no matter what changes occur in the system. This is the Law of Conservation Of Angular Momentum.

[3] A bob is attached to ceiling by a string and moves in a horizontal circular plane is an example. In this case the law of conservation of angular momentum does not hold.

[4] For the motion of the Earth around the sun, the total of angular momenta of the Earth and the Sun, about in a reference frame fixed in the pole star, is conserved.

[5] The three components of angular momentum of a conical pendulum is conserved w.r.t. the origin at the position of the center of mass of the pendulum. SetId=719

[6] A sphere rolling on a rough surface.Due to friction there is external torque so the angular momentum changes which results in the slowing of the sphere. The angular momentum keeps changing. Even in case like this one, it is wrong to say that the Law of Angular Momentum Conservation does not hold.

[7] If a bullet hits a wooden board and gets embedded in the board, the total energy of the bullet and the board system is conserved but the total momentum is not conserved.

[8] To apply the conservation laws of momentum, energy and angular momentum, we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *external force* acting on the system, the energy and momentum will be conserved. However, depending on the nature of the system and of the forces, the total angular momentum may not be conserved.

[9] The work done by a "non-conservative" force does depend on the path taken. Non-conservative forces cannot be associated with a potential energy. If some of the internal forces of a system are non-conservative, the mechanical energy of the system is not constant.Work-energy theorem is valid even in the presence of some non-conservative forces.

SetId=719

[10] When the force is kept constant as function of time, it is possible for a particle to move on a circular path in such a way that its speed remains constant, but the velocity and acceleration must always change with time.

[11] If P and Q are the initial and the final points of a path of a particle,the displacement is the vector $\overrightarrow{PQ}$.

[12] The Newton's Laws of motion will hold in all frames which are at rest w.r.t. K but do not remain valid in a frame that move with respect to K.

[13] .The law of conservation of momentum does not hold good when net external forces acting on the system is not zero.when two bodies collide law of conservation of momentum is applicable on system of two bodies but on not individual bodies because external impulse acts on them.

[14] A heavy body is attached from a spring and is held at point A and is such that the spring is not slack nor is it stretched. It is then released. It goes down upto a point B and then it rises upto point C and executes an oscillatory motion between B and C. During the motion from A to C is first positive (from A to B) and then it is negative from B to A and again remains negative from A to C. SetId=719

[15] Newton's first law defines inertial frame. An inertial frame is a frame in which the first law hold. It also makes it possible to compare and tell two force being equal or not. The second law defines the force.

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SetId=720

[1] Displacements, being vector quantity can not compared with, a scalar quantity such as distance.

[2] If the net external torque acting on a system is zero, the angular momentum L of the system remains constant, no matter what changes take place within the system.

$$\sum(T_{\text{ext}}) = \frac{dL}{dt}$$

The law states that when there is no net external torque, $\frac{dL}{dt}$ is zero implying that the total angular momentum of system is constant.

i.e. $L = a$ constant (isolated system)

[3] Consider a disc rotating about an axis perpendicular to its plane. On placing a smaller disc with its surface parallel to the surface of the rotating disc, the angular momentum of the system of two discs remains constant as there is no external torque.

[4] For the motion of the Earth around the sun, the total of angular momenta of the Earth and the Sun, is conserved in every inertial frame of reference; but the angular momentum of the Earth (or of the sun)is not conserved in every inertial frame.

[5] Only the z component of the angular momentum of a conical pendulum is conserved w.r.t. the origin fixed at the point of suspension. SetId=720

[6] Consider a rod of length l. Let us give an impulse to one end . Now the angular momentum about the oposite end is not zero since the impulse provides some torque . So the angular momentum is not conserved .

$$\text{torque} = \text{impulse} * \ell.$$

$d\ell/dt$ is not equal to zero and the law of conservation of angular momentum does not hold.

[7] If a bullet hits a wooden board and gets embedded in the board, both total energy and the total momentum of the bullet and the board are not conserved.

[8] In order to apply the law of conservation of momentum we must first identify the system. If there is no *external forces* acting on the system then conservation laws of momentum always holds. And depending on the nature of the system and of the forces, the total kinetic energy and the total angular momentum may not be conserved.

[9] Non conservative forces are forces with the property that the work done by the force in moving a particle between two points is dependent on the path taken.Also the work done over a closed loop is not zero.Defining of scalar potential is not possible in case of non conservative forces because the change in potential energy between two points will depend on path taken.

SetId=720

[10] It is not possible for a particle to move on a circular path in such a way that its speed and force remains constant, and only the velocity and acceleration may (or may not) always change with time.

[11] If two bodies starting from a point A reach a point B, following different paths, their displacement will be, in general different, but the distances covered will always be the same.

[12] Staying inside a bullet train moving with constant velocity (no jerks etc) an experiment can always be performed which will tell us the numerical velocity of the bullet train

[13] A block moving in the air breaks up into two parts and the parts separate, then the total momentum must be the same before and after the break.

[14] The kinetic energy of a body does not change if any one of the following is true
(i)force is always perpendicular to the velocity
(ii) the force is always perpendicular to the acceleration
(iii) the object remains stationary
(iv) the object moves in such a way that the point of application of the force remains fixed.

SetId=720

[15] The magnitude of the pseudo force arising in a non-inertial frame is always equal to the mass of the body under consideration multiplied by the acceleration of the frame of reference and the direction of pseudoforce is always opposite to the direction of acceleration of the frame.

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[1] Distance depends on the path where as the displacement depends on the end point only.

[2] When the net external torque acting on a body or a system of bodies is zero about a particular axis, then the angular momentum of each body is conserved about that axis.

[3] Consider a man standing on a spinning platform. Initially, the man spreads out his arms and he spins with a certain angular velocity. The next moment, he pulls his arms inwards keeping them close to his body. We will observe that the angular velocity with which he is spinning now increases. This phenomenon can be explained by the Law Of Conservation of Angular momentum. Initially, since his arms were spread wide, his moment of inertia was large. However, when he pulled them close to his body, his moment of inertia decreased.
In this example the angular velocity of the man increases and therefore the angular momentum also increases.The law of conservation of angular momentum does not apply because the torque of muscular forces is not zero.

[4] In the Sun Earth system the angular momentum of the Earth is conserved in every frame of reference

[5] The z component of angular momentum of a conical pendulum is not conserved w.r.t. the origin fixed at the point of suspension; but the x and y components are conserved.

SetId=721

[6] Let us consider a rotating skew rod. In the absence of friction or any other drag force, the rod should continuously spin without stopping. Here the net torque about the axis of rotation is 0 and hence angular momentum is conserved. It therefore follows from law of conservation of angular momentum that a spinning skew rod will keep rotating with constant angular velocity if there is no external torque. So law of conservation of angular momentum does not hold.

[7] There are certain situations where it appears that the law of conservation of linear momentum does not hold. For example if we take some amount of a substance like construction putty, cement, cake batter, playing dough,etc and drop it on the ground, it does not bounce back like a rubber ball would and hence the momentum it had before striking the ground seems to have been lost. Hence it appears that the law of conservation of linear momentum does not hold.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then check if the laws is applicable or not.

So if there is no *net external force* acting on the system all the three conservation laws will hold.

[9] A non conservative force is the force with the property that the work done in moving a particle between two points is dependent of the path taken.If a particle travels in a closed path, the net work done(the some of the forces acting along the path multiplied by the distance travelled) by a non conservative force is non zero. When an object moves from one location to another, the force changes the potential energy of the object by an amount that depends on the path taken.Non conservative force depends only on the path followed by the object.

SetId=721

[10] For a particle moving on circle the acceleration is always constant in magnitude and directed towards the centre of the circle.

[11] Distance is equal to the length of the path covered. Displacement is the shortest distance between initial and final points.

[12] Staying inside a bullet train moving with constant velocity (no jerks etc) an experiment can always be performed which will tell us the numerical value of the acceleration of the bullet train

[13] A ball hits the floor and rebounds after an inelastic collision. In this case the total momentum of the ball before and after the collsion is conserved. Also the total enrgy of the ball and the earth remains the same

[14] The total work done on a particle is always equal to the change in kinetic energy.

SetId=721

[15] A force is any interaction which tends to change the motion of an object. It is also *defined* as rate of change of momentum.It is a vector quantity.
A physically apparent but nonexistent force felt by an observer in a noninertial frame (that is, a frame undergoing acceleration).

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SetId=722

[1] Distance equal to zero implies displacement=0; and Displacement=0 also implies distance = 0

[2] The law of conservation of angular momentum states that in absence of an external torque on an object or a closed system of objects the total angular momentum of the system remains constant. Thus if $\vec{\tau} = 0 => \vec{L} =$ constant where τ is the torque and $\vec{L}$ is the angular momentum of the system.

[3] In the Sun-Earth system, angular momentum of the earth is not conserved but the total angular momentum of the sun and the earth is constant of motion.

[4] In the motion of earth around sun, the angular momentum of the earth about an axis passing through the sun and perpendicular to the plane of motion of earth is conserved.

[5] Only the z component of angular momentum of a conical pendulum is conserved w.r.t. the origin fixed at the point of suspension. SetId=722

[6] In the example of skew rod the angular velocity does not change even though the torque applied is nonzero. However there is no contradiction as in this case the law of conservation of momentum is not applicable. conservation is violated.

[7] A tennis ball is dropped from height h and after hitting the ground and it bounces back and rises to the same height. In this case the momentum of the ball is conserved because (under ideal conditions) the momentum after it hits the ground will be equal to the momentum it had before hitting the ground.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then check we should if the laws are applicable or not.

So if there is no *external force* acting on the system all the three quantities, total momentum is conserved. The total angular momentum is also because the torque of internal forces will be zero. The conservation of energy depends on the nature of forces. will be conserved.

SetId=722

[9] In this type of force the work done depends on the path taken by the body.Mechanical energy is not conserved in the system if non conservative force acts on it.

[10] The motion of a bomb dropped from a plane does is not a uniform motion as it follows a parabolic path and not a straight line path.

[11] Distance is a scalar quantity where as the displacement is a vector quantity.

[12] Assume bullet train, moving with out any jerks, is going on a circular arc of radius R with constant speed. Then an experiment is to be performed entirely within the train without any measurement on objects outside the train. Such an experiment can tell only radius of the track.

[13] In a head on elastic collision of two identical bodies of equal masses the velocities, the speeds, the momenta and the kinetic energy are all exchanged.

[14] A particle is acted upon by a force of constant magnitude which is always perpendicular to the velocity of the particle and the motion of the particle takes place in a plane, Then its kinetic energy, speed, velocity acceleration will not change. SetId=722

[15] Psuedo Force is defined as an apparent force that acts in only non-inertial frames. Pseudo Forces are also called Fictitious Forces. It is an Imaginary force. It is independent of mass.

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SetId=723

[1] If P and Q are the initial and the final points of a path of a particle, displacement is a vector whose direction is along PQ and has magnitude is equal to the length of line PQ

[2] If no net external torque acts on a system, the total angular momentum of the system remains constant.

[3] Consider a disc and a man system. man is standing on center of the disc rotating with angular velocity.initially man folded his hand.when man stretches his hands then momentum of inertia of system increases.and angular velocity decreases.and total angular momentum remains constant.

[4] For the motion of earth around sun, the angular momentum of the earth about the center of mass of the sun + earth system and perpendicular to the plane of motion of earth is conserved.

[5] The projection of angular momentum of a conical pendulum in the horizontal plane is a constant of motion when the origin is chosen to be at fixed at the point of suspension.

SetId=723

[6] Example where law of conservation of angular momentum does not hold:If a particle undergoes conical motion and the only force acting on particle is central force like tension of the string.Then total external torque about fixed point A is zero,yet angular momentum is not conserved,as angular momentum keeps on changing direction.

[7] Law of conservation of momentum does not hold when Newton's laws are not valid, e.g. in a non-inertial frame of reference. For example, when we consider collision between two bodies in a non-inertial frame of reference, the law of conservation of momentum cannot be applied because there will be a pseudo force acting on the frame itself.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *net external force* acting on the system, the momentum is conserved. The definition of angular momentum and torque depends on the choice of axes, and therefore it may not be be conserved. The conservation of total energy holds only for conservative forces.

When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *net external force* acting on the system, the energy and momentum will be conserved. However, the total angular momentum may not be conserved because the torque may not be zero.

[9] A force is said to be a non-conservative force if the work done by the force in a closed path is non-zero;(i.e) the cyclic integral of the work done is non-zero.

Work done by a non-conservative force is equal to change in total energy of the system.Work-Energy theorem is not applicable in the case of a non-conservative force.Work done by conservative force depends on the path.It differs with the paths taken by the partical even if the initial and final points are same.In case of non-conservative forces,the total mechanical energy is not constant as the energy is dissipated in various forms such as heat energy,sound energy,etc and cannot be recovered.

SetId=723

[10] A wagon sliding on a roller coaster designed in such a way that the wagon covers equal distances in equal times. As the motion of the wagon is uniform, there will be no net force acting on it.

[11] Both displacement and distance tell us about the motion of a body but their study does not tell much about the forces on the body

[12] Assume bullet train, moving with out any jerks, is going on a circular arc of radius R with constant speed. Then an experiment is to be performed entirely within the train without any measurement on objects outside the train. Such an experiment can tell both speed of the train and radius of the track.

[13] For a system of several particles the conservation of total linear momentum is equivalent to the statement that their centre of mass moves like a free particle.

[14] The kinetic energy of a particle is continuously increasing with time, then the angle bewteen the net force and the velocity cannot be greater than or equal to 90^o at any time.

SetId=723

[15] Psuedo Force is defined as an apparent force that acts in only non-inertial frames. Pseudo Forces are also called Fictious Forces. It is an Imaginary force. It is always proportional to mass. It is sometimes dependent on speed.

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ASSIGNMENT-II **Due On : Nov 18, 2014**

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SetId=724

[1] If P and Q are the initial and the final points of a path of a particle,the displacement is the vector $\overrightarrow{PQ}$.

[2] The law of conservation of angular momentum states that when no external torque is applied on an object or a closed system of objects about an axis, the angular momentum about that axis remains constant.

[3] The conservation of angular momentum of a system of bodies requires that the the sum of torque due to all forces be equal to zero. Now consider a situation where the forces are such that the sum of torques of external forces is zero w.r.t. some axes K. Since the value of torque depends of the choices of axes, the sum of torques due to all internal forces will depend on the choice of axes and in general it will be non zero. Therefore, for a system of several bodies, for a given choice of axes K, there will be situations when the total angular momentum may not be conserved.

[4] In the Sun Earth system the angular momentum of the Earth about the pole star is conserved

[5] The law of angular momentum of a is not applicable for the conical pendulum conserved w.r.t. the origin fixed at the point of suspension. SetId=724

[6] A nonzero torque always causes the angular velocity to change, because a change in angular momentum means a change in angular velocity $L = I\omega$

[7] If I throw a ball upward, it's speed decreases as it rises upwards. There is an external force (gravity) acting on the ball, so the momentum conservation law does not apply. Momentum of the ball is not conserved, however the momentum of the Earth-ball system is conserved as gravity will become an internal force in this case.

[8] In order to apply the law of conservation of momentum we must first identify the system. If there is no *net external forces* acting on the system then conservation laws of momentum always holds. The total energy and the total angular momentum may not be conserved.

[9] A non conservative force is a force where work done in moving a particle between two points depends on the path through which it is taken.Friction is an example of non conservative force.Mechanical energy is not conserved in case of a non conservative force

SetId=724

[10] A simple pendulum moves along a circular arc and does not have constant speed and therefore its motion is not uniform.

[11] Displacement is the shortest distance between initial and final points with direction specified.

[12] Assume bullet train, moving with out any jerks, is going on a circular arc of radius R with constant speed. Then an experiment is to be performed entirely within the train without any measurement on objects outside the train. Such an experiment can tell only speed of the track.

[13] The total mechanical energy of a system may not be conserved if there are no external forces and the internal forces are conservative.

[14] A heavy body is attached from a spring and is held at point A and is such that the spring is not slack nor is it stretched. It is then released. It goes down upto a point B and then it rises upto point C and executes an oscillatory motion between B and C. During the motion from A to C is first positive (from A to B) and then it is negative from B to A and again remains negative from A to C. $\boxed{\text{SetId=724}}$

[15] Since pseudo forces are not real forces, they do not affect the conservation laws and all the three conservation laws hold in noninertial frames.

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SetId=725

[1] If two bodies starting from a point A reach a point B, following different paths, their displacement will be, in general different, but the distances covered will always be the same.

[2] The angular momentum of a given system of bodies shall remain conserved unless acted upon by an external unbalanced torque.

[3] Example where law of conservation of angular momentum does not hold:
When there is external force like frictional force acting on a object when it is rotating we cannot use conservation of angular momentum as the friction force acting on the object produces an external torque.

[4] For the motion of earth around sun, the angular momentum of the sun about the center of mass of the sun + earth system and perpendicular to the orbital plane of earth is conserved.

For the motion of earth around sun, the angular momentum of the sun about and axis passing through the Earth and perpendicular to the orbital plane of motion of earth is conserved.

[5] The law of angular momentum of a is not applicable for the conical pendulum conserved when the origin is chosen to be at the pendulum bob itself. SetId=725

[6] A nonzero torque always implies change in angular momentum and may not give rise to a change in magnitude of angular velocity. A non zero torque may mean change only the direction of the angular momentum and not the angular velocity.

[7] A soldier accelerating away, after detonating a bomb, will find that the total momentum of the fragments of the bomb is zero. This is an example where the law of conservation of momentum holds as the forces on the fragments are internal forces only and sum of all such forces is zero.

[8] In order to apply the law of conservation of momentum we must first identify the system. Then even if there is no *net external forces* acting on the system, all the three conservation laws of momentum, angular momentum and energy may not hold due to presence of internal forces.

SetId=725

[9] A force:A force is said to be a *non-//**conservative force* if the*/ work done by it in a closed path is/*/ non-zero./For such forces,potential energy cannot be defined.

[10] A satellite goes around the earth in a circular orbit of 600km with a time period of $5.8 \times 10^3 s$. Its motion will be uniform as it will cover equal distances in equal times.

[11] Displacements, being vector quantity can not compared with, a scalar quantity such as distance.

[12] A particle is observed from two frames S_1 and S_2. The frame S_2 moves with respect to S_1 with an acceleration a. If F_1 and F_2 be the pseudoforces when seen from S_1 and S_2 respectively it is not possible to have $F_1 = F_2 = 0$

[13] When a bullet fired on a wooden block, some energy is transferred to the block and the total mechanical energy of the block and the bullet is conserved.

[14] The kinetic energy of a body does not change if any one of the following is true
(i)force is always perpendicular to the velocity
(ii) the force is always perpendicular to the acceleration
(iii) the object remains stationary
(iv) the object moves in such a way that the point of application of the force remains fixed.

SetId=725

[15] A force is any interaction which tends to change the motion of an object. Newtons' second tell us that it is *equal* to the rate of change of momentum.It is a vector quantity. Real forces can be distinguished from pseudo forces because the pseudo forces always proportional to the mass of the body. All real forces, except the gravitational force, do not depend on the mass of the body.

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SetId=726

[1] Displacement is equal to the vector difference $\vec{r}_f - \vec{r}_i$ of the position vectors of initial and final points. The distance covered will be $|\vec{r}_f - \vec{r}_i|$

[2] When the net external torque acting on a system about a given axis is zero, the total angular momentum of the system about that axis remains consant.

[3] A bob attached to a ceiling by a string moving in a horizontal circular plane is an example where the total angular momentum of the bob about the point of suspension is not conserved. This is because the the torque due to the weight of the bob about the point of suspension does not vanish and has non zero horizontal component. Only the vertical component of the angular component is conserved.

[4] For the motion of earth around sun, the sum of angular momenta of the Sun and the Earth about the center of mass of the sun + earth system is conserved.

[5] The three components of angular momentum of a conical pendulum is conserved w.r.t. the origin at the position of the center of mass of the pendulum. SetId=726

[6] In the example of a rotating skew rod the torque due to the external gravitational forces is zero , but the angular momentum is not constant Therefore the law of conservation of angular momentum is violated.

[7] There is no known exception to the law of conservation of momentum in classical mechanics However, an exception to conservation of energy in nuclear physics is observed. In nuclear reactions when two nuclei collide and their mass converts to energy and energy momentum are not conserved.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then check we should if the laws are applicable or not.

So if there is no *external force* acting on the system all the three quantities, total momentum, total angular momentum, and total kinetic energy will be conserved independent of the nature of forces.

[9] A force that is not conservative is nonconservative force. The work done by a noconservative force cannot be represented by a potential energy function. That is work done by a nonconservative force is dependent on the path through which the system is moved. Some nonconservative forces cause the mechanical energy to be lost or dissipiated. Such forces are called dissipiative forces. There is no way to get back the lost mechanical energy. Nonconservative forces can also increase the mechanical energy. This is arrived from the concept of irreversible process.

SetId=726

[10] A uniform motion is defined to be the one in which a body covers equal distances in equal time intervals.

[11] Distance depends on the path where as the displacement depends on the end point only

[12] A particle is observed from two frames S_1 and S_2. The frame S_2 moves with respect to S_1 with an acceleration a. If F_1 and F_2 be the pseudoforces when seen from S_1 and S_2 respectively and if $F_1 = 0$ then we must have $F_2 \neq 0$

[13] When a moving car hits a parked lorry and causes the parked lorry to move ,energy is transferred from moving the car to the lorry and the total energy of the lorry and the car is conserved.

[14] The total work done on a particle is always equal to the change in kinetic energy. SetId=726

[15] Examples of pseudoforce are Coriolis Force, Centrifugal Force, and magnetic force on currents.
Psuedo force also called as fictitious force is an apparent force that are needed for masses whose their motion is described using a non inertial frame of reference.

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SetId=727

[1] Distance is equal to the length of the path covered. Displacement is the shortest distance between initial and final points.

[2] This law sates that when no net torque of all forces acts on a object or a system of objects then total angular momentum of system is conserved.The angular momentum before an event is equal to angular momentum after that event.mathematically explained by when, net torque=0 ;then, total angular momentum(L)=constant.

[3] Law of conservation of angular momentum holds in case of long jump. When a athlete takes off from the ground in a running long jump, the forces on the launching foot give the athlete an angular momentum with a forward rotation around a horizontal axis. Such rotation would not allow the jumper to land properly. In the landing, the legs should be together and extended forward at an angle so that the heels mark the sand at the greatest distance. Once airborne, the angular momentum cannot change (it is conserved) because no external torque acts to change it. However, the jumper can shift most of the angular momentum to the arms by rotating them in windmill fashion. Then the body remains upright in the proper orientation of landing.

[4] For the motion of the Earth around the sun, the total of angular momenta of the Earth and the Sun, about in a reference frame fixed in the pole star, is conserved.

[5] Only the z component of the angular momentum of a conical pendulum is conserved w.r.t. the origin fixed at the point of suspension.

SetId=727

[6] In the example of skew rod, the angular momentum changes with time and there is a non zero torque coming from action of forces other than gravitational forces. Hence the law of conservation of angular momentum dos not apply.

[7] In a system of a canon and a canon ball, total momentum of the system is zero before canon ball is fired. After firing the canon ball, the momentum of the system seems to be conserved as the ball moves forward and the canon moves backward.

[8] If we want to apply the conservation laws of momentum, energy and angular momentum, we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *external force* acting on the system, the momentum and angular momentum will be conserved, and depending on the nature of the forces but total energy may or may not be conserved.

[9] Nonconservative forces are forces, such that the work done by these forces are path dependent. Work done by these forces around a close path is not necessarily equal to zero. Hence if a particle is acted on by a non-conservative force and that particle

returns to its original position, that particle will experience a net loss of energy. Energy will thus not be conserved for particle. Potential Energy can not be defined for these type of forces. SetId=727

[10] A particle moves on a circular path. Then its speed, direction of force, velocity and acceleration must always change with time.

[11] Distance equal to zero $\Rightarrow$ displacement=0; but Displacement=0

[12] If K is an inertial frame, any frame that moves w.r.t. the frame K with uniform velocity is also an inertial frame.

[13] When a bomb explodes the total mechanical energy is not conserved. But the total chemical energy and the mechanical energy is conserved.

[14] A particle is acted upon by a force of constant magnitude which is always perpendicular to the velocity of the particle and the motion of the particle takes place in a plane, Then its kinetic energy, speed, velocity acceleration will not change. SetId=727

[15] Examples of pseudo-force are Coriolis Force, Centrifugal Force, Centripetal force and magnetic force on currents. The pseudo forces do not obey Newton's third law and therefore the total momentum does not appear to be conserved in a non-inertial frame.

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SetId=728 [1] Distance is a scalar quantity where as the displacement is a vector quantity.

[2] Statement of Law of Conservation of Angular Momentum:
Differentiating $\vec{L} = \vec{r} \times \vec{p}$ w.r.t, time,

$$\begin{aligned} \frac{dL}{dt} &= \frac{d\vec{r} \times \vec{p}}{dt} = \frac{d\vec{r}}{dt} \times \vec{p} + \vec{r} \times \frac{d\vec{p}}{dt} = \vec{v} \times (m\vec{v}) + \vec{r} \times \vec{F} \\ &= \vec{r} \times \vec{F}(\because v \times v = 0) \\ &= \vec{\tau} \end{aligned}$$

here $\vec{\tau}$ represents the net torque acting on a rigid body rotating about a fixed axis.This torque must take into account of all the forces, be it external or internal forces

[3] The total angular momentum of a body remains constant of motion when the net torque of the external forces acting on the body is zero.
In general, we have a system of particles such that the net torque of the external forces on the system, w.r.t. some axes K, is zero, the total angular momentum may not remain conserved, because the torque due to the internal forces may not be zero.

[4] For the motion of the Earth around the sun, the total of angular momenta of the Earth and the Sun, is conserved in every inertial frame of reference; but the angular momentum of the Earth (or of the sun)is not conserved in every inertial frame.

[5] The z component of angular momentum of a conical pendulum is not conserved w.r.t. the origin fixed at the point of suspension; but the x and y components are conserved. SetId=728

[6] In the example of conical pendulum, the z- component of angular momentum does not change. This follows from the angular momentum conservation as there is no external torque.

[7] When applying the conservation laws of momentum, energy and angular momentum we must define the system first.Only then check if the laws is applicable or not.

As an example: when a ball is dropped from a height, it gains momentum down if we consider the ball as our system.This is because the force of gravity acts as an external force.

However, if we change our system and consider earth as a part of our system too, then the momentum remains conserved because the earth gains momentum up.

[8] To apply the conservation laws of momentum, energy and angular momentum, we must define the system first. Only then we should check if the laws are applicable or not.

So if there is no *external force* acting on the system, the energy and momentum will be conserved. However, depending on the nature of the system and of the forces, the total angular momentum may not be conserved.

[9] Non Conservative force is a force with the property that workdone in moving an object from one point to another is dependent on the path taken .

Non Conservative Force can arise in classical physics due to neglected degrees of freedom or time dependent potentials.

Friction may be treated without resorting the use of non conservative forces by considering the motion of individual molecules.

SetId=728

[10] A particle moves on a circular path. Then its speed, direction offorce, can remain constant by velocity and acceleration must always change with time.

[11] If P and Q are the initial and the final points of a path of a particle, displacement is a vector whose direction is along PQ and has magnitude is equal to the length of line PQ

[12] If K is an inertial frame, any frame that moves w.r.t. the frame K with uniform speed is also an inertial frame.

[13] When a ball rolls over a rough surface, it comes to stop after some time. This is because transational and rotational kinetic energy initially present in the ball continuosly gets converted to heat due to friction. When all the kinetic energy changes to heat, the ball stops. The total mechanical energy of the ball is not conserved.

[14] The kinetic energy of a particle is continuously increasing with time, then the angle bewteen the net force and the velocity cannot be greater than or equal to 90^{o} at any time. SetId=728

[15] FORCE is any interaction which tends to change the motion of an object.It has both magnitude and direction,making it a vector quantity.

A psuedo force is an apparent force that acts on all masses whose motion is described with respect to a non-inertial frame of reference like a rotating frame of reference.This force is needed by an observer in an non-inertial frame to make all the Newtons Laws of motion hold true.

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SetId=729

[1] The speed is rate of change of distance and the velocity is the rate of change of displacement.

[2] Statement of Law of Conservation of Angular Momentum: For a system of many particles The net torque due all the forces, be it external or internal forces. But as the torque due to all the internal forces cancel out, it sufficient to consider the external forces acting on the system.

[3] An example where law of conservation of angular momentum holds:
The Law of conservation of angular momentum holds in the case of a ballet dancer performing a pirouette.

When the dancer extends her arms outward, the angular velocity of her rotation decreases whereas when she keeps her arms close to her body, the angular velocity increases. This is because her moment of inertia changes as she moves her arms outward and inward. It can be noted that she as a system has no external torque acting upon her.

[4] In the Sun Earth system the angular momentum of the Earth is conserved in every frame of reference

[5] Only the z component of angular momentum of a conical pendulum is conserved w.r.t. the origin fixed at the point of suspension. SetId=729

[6] In the example of conical pendulum, the x and$y$ components of angular momentum change. This follows from the angular momentum conservation as the z components external torque is zero and horizontal components of torque are non zero.

[7] Statement: Law of Conservation of energy states that "ENERGY CAN NEITHER BE CREATED NOR DESTROYED",but it can be changed from one form to other.

EXPLANATION: Statement implies that the total amount of energy in an isolated system remains constant although it may change forms. viz, kinetic energy may change to potential;chemical to electrical energies etc.

[8] In order to apply the law of conservation of momentum we must first identify the system. If there is no *external forces* acting on the system then conservation laws of momentum always holds. And depending on the nature of the system and of the forces, the total kinetic energy and the total angular momentum may not be conserved.

[9] A non-conservative force is a force with the property that the work done in moving a particle between two points is dependent of the path taken . Mostly the enery of the particle in a non conservative force field dissipates in the form of heat or sound . Since the lost energy cannot be bought back ,conservation of mechanical energy does not hold true .

SetId=729

[10] A particle moves on a circular path. Then under suitable conditions its speed may remain constant, but the force, velocity and acceleration must always change with time.

[11] If P and Q are the initial and the final points of a path of a particle,the displacement is the vector $\overrightarrow{PQ}$.

[12] A frame rotating w.r.t K with uniform angular velocity is also an inertial frame.

[13] Let us consider that a pendulum is oscillating moving in a vertical plane. Mean while let another bob which is attached to a spring and is executing a simple harmonic motion in horizontal direction comes and hits the pendulum. Here conservation of momentum does not hold good as tension(external force) is acting on the system.(pendulum)

[14] A heavy body is attached from a spring and is held at point A and is such that the spring is not slack nor is it stretched. It is then released. It goes down upto a point B and then it rises upto point C and executes an oscillatory motion between B and C. During the motion from A to C is first positive (from A to B) and then it is negative from B to A and again remains negative from A to C. SetId=729

[15] FORCE is any interaction which tends to change the motion of an object.It has both magnitude and direction,making it a vector quantity. A pseudo-force F doesn't arise from any physical interaction between two objects, but rather from the acceleration 'a' of the non-inertial reference frame itself. These forces have no real existence but must be taken into account in an accelerating frame of reference to make all the three Newton's Laws of motion applicable to the system

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SetId=730

[1] For any type of translational motion of a body, the displacement cannot be zero, where as the distance travelled can be zero.

[2] Depending on the torques acting on a system, the angular momentum can be conserved only in one or two directions, but may not be conserved in all. For instance, if an isolated body has no torque acting on it only in the direction along the Z axis, then the angular momentum is conserved only in that direction.

[3] In case of a skater, who can be considered an isolated system, so no torue will be acting on him/her. When the arms are extended, the moment of inertia is more. When his hands are closely held, the moment of inertia is lesser. Since the angular momentum is same, the angular acceleration changes accordingly.

[4] In the motion of earth around sun, the angular momentum of the earth about an axis passing through the sun and perpendicular to the plane of motion of earth is conserved.

[5] The projection of angular momentum of a conical pendulum in the horizontal plane is a constant of motion when the origin is chosen to be at fixed at the point of suspension.

SetId=730

[6] Example where law of conservation of angular momentum does not hold: A disc rotating on a horizontal rough surface will not have a constant angular momentum because there will be a constant torque by frictional force. Hence, its angular momentum will decrease, and the law of conservation of angular momentum does not apply.

[7] Oscillating simple pendulum is a very good example where potential energy gets converted to kinetic energy and kinetic to potential energy. Some energy gets dissipated as heat if we consider air resistance. Energy as a whole is conserved if we consider universe as system, the energy has just changed its form.

[8] When applying the conservation laws of momentum, energy and angular momentum we must define the system first. Only then check if the laws is applicable or not.

So if there is no *net external force* acting on the system all the three conservation laws will hold.

[9] If the work done by a force depends on the path followed by the particle, it is called a Non conservative force. Work done by a non conservative force is not zero in round trip.

SetId=730

[10] A particle moves on a circular path. Then under suitable conditions its speed and acceleration may remain constant, but the force, and velocity must always change with time.

[11] If two bodies starting from a point A reach a point B, following different paths, their displacement will be, in general different, but the distances covered will always be the same.

[12] The Newton's Laws of motion will hold in all frames which are at rest w.r.t. K but do not remain valid in a frame that move with respect to K.

[13] The law of conservation of momentum does not hold in relativistic situations, i.e., where the speeds of the masses involved are close to the speed of light.

[14] The kinetic energy of a body does not change if any one of the following is true
(i)force is always perpendicular to the velocity
(ii) the force is always perpendicular to the acceleration
(iii) the object remains stationary
(iv) the object moves in such a way that the point of application of the force remains fixed.

SetId=730

[15] FORCE is any interaction which tends to change the motion of an object.It has both magnitude and direction,making it a vector quantity.
A pseudo-force results from acceleration of the frame of reference in which the objects reside. It is taken into account so that Newton's second law isn't invalidated. The pseudo force acting on an object can always be mathematically expressed as the product of the mass of the object and the acceleration of the frame of reference.