University of Hyderabad
School of Physics

M.Sc.-I/IMSc.-III Quantum Mechanics **June 20, 2018**

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Quiz-III

[1] Wave function of a particle in a potential for large distance is given by

$$\psi(x) \to \begin{cases} Ae^{ikx} + Be^{-ikx} & x \to -\infty \\ Ce^{iqx} + De^{-iqx} & x \to \infty \end{cases} \tag{1}$$

Taking the incident beam **coming from left /right** complete the following table.

	Beam from Left	Beam from Right
Incident Wave	Ae^{ikx}	De^{-iqx}
Reflected Wave	Be^{-ikx}	Ce^{iqx}
Transmitted Wave	Ce^{iqx}	Be^{-ikx}
Incident Intensity	$\frac{\hbar k}{m}\|A\|^2$	$\frac{\hbar q}{m}\|D\|^2$
Reflected Intensity	$\frac{\hbar k}{m}\|B\|^2$	$\frac{\hbar q}{m}\|C\|^2$
Transmitted Intensity	$\frac{\hbar q}{m}\|C\|^2$	$\frac{\hbar k}{m}\|B\|^2$
Refl. Coeff.	$\left\|\frac{B}{A}\right\|^2$	$\left\|\frac{C}{D}\right\|^2$
Trans. Coeff.	$\frac{q}{k}\left\|\frac{C}{A}\right\|^2$	$\frac{k}{q}\left\|\frac{B}{D}\right\|^2$
BoundaryCondition	D=0	A=0

[2] If the potential is given by

$$V(x) = \begin{cases} V_1 & \text{for } x < -a, \\ 0 & \text{for } -a < y < a, \\ V_2 & \text{for } x > a. \end{cases} \tag{2}$$

Give expressions for q, p in eq, (1) in terms of energy E of the beam and V_1, V_2.

Answer:

$$k = \sqrt{\frac{2m(E - V_1)}{\hbar^2}}; \qquad q = \sqrt{\frac{2m(E - V_2)}{\hbar^2}}$$