University of Hyderabad

School of Physics

Jan 2010 - Apr 2010 | Time : 1hr
M.Sc. II-Semester | Quantum Mechanics-I | MM : 20

Tutorial-IX : Reflection and Transmission in One Dimension

[1] For a particle moving in a δ function potential, $V(x) = -\gamma\delta(x)$ and having energy E

(a) Write the form of solution $u(x)$ in the regions $x < 0$ and $x > 0$ separately.

(b) Write the matching conditions at $x = 0$

(c) Use your answers in parts (a) and (b) to find the reflection and transmission coefficients for the δ function potential.

[2] Compute the reflection and transmission coefficients for a particle incident on the potential

$$V(x) = -\frac{\hbar^2}{Ma^2}\cosh^{-2}(x/a)$$

For your help it is given that the equation

$$\frac{d^2y}{dx^2} + \beta^2 y + 2\cosh^{-2}x\ y = 0$$

has two linearly independent sloutions given by

$$y_1 = \tanh x \cos\beta x + \beta \sin\beta x$$

$$y_2 = \tanh x \sin\beta x - \beta \cos\beta x$$

Show that the transmission coefficient is unity.

[3] For a beam of particles incident on the potential step from the left

$$V(x) = \begin{cases} 0 & x \leq 0 \\ V_0 & x > 0 \end{cases} \tag{1}$$

find the reflection and transmission coefficients for $E > V_0$.

[4] What transmission and refelction coefficients would you get for the step potential of Q[2] if the beam of particles in incident from the right with $E > V_0$?