Quiz - 14

Que In the case of step potential with $E > V_0$ normalise the total wave function in both the regions.

$$\Rightarrow \quad \phi_1(x) = A\left(e^{ik_1x} + \left(\frac{k_1-k_2}{k_1+k_2}\right)e^{-ik_1x}\right)$$

★ Normalise :-

$$\int_{-\infty}^{0} \phi_1^* \phi_1 \, dx = 1$$

$$\therefore \int_{-\infty}^{0} A^2 \left(e^{ik_1x} + \frac{(k_1-k_2)}{k_1+k_2} e^{-ik_1x}\right)\left(e^{-ik_1x} + \left(\frac{k_1-k_2}{k_1+k_2}\right)e^{ik_1x}\right)$$

$$\therefore \int_{-\infty}^{0} A^2\left(1 + \left(\frac{k_1-k_2}{k_1+k_2}\right)^2 + \left(\frac{k_1-k_2}{k_1+k_2}\right)e^{2ik_1x} + \left(\frac{k_1-k_2}{k_1+k_2}\right)e^{-2ik_1x}\right)$$

∴ as above quantity is always greater than 1 so it is not normalizable !

$$\phi_2(x) = A\left(\frac{2k_1}{k_1+k_2}\right)e^{ik_2x}$$

$$\therefore \int_{0}^{\infty} \phi_2^* \phi_2 \, dx = 1$$

$$\therefore \int_{0}^{\infty} A^2 \left(\frac{2k_1}{k_1+k_2}\right)^2 dx = 1$$

→ Not normalizable !

∴ Hence both functions are not normalisable

Que: 2 How many bound states; step potential with $E > V_0$ host?

Ans. No, bounded states will be host by the step potential as E is greater than V_0. $(E > V_0)$