Show your work for full credit.

1. Electrons with energy of 10MeV are incident on a step of height 8MeV. Find the percent of electrons reflected back from the step.

Solution:

\[
\frac{k_1}{k_2} = \left( \frac{E}{E-U} \right)^{1/2} = \sqrt{\frac{10}{2}} = \sqrt{5} = 2.236
\]

So, \( R = \left( \frac{k_1 - k_2}{k_1 + k_2} \right)^2 = \left( \frac{2.236 - 1}{2.236 + 1} \right)^2 = 0.146 \)

Therefore, 14.6% reflected.

2. Consider the square well having a wall of infinite height \((U \to \infty)\) at \(x = 0\) and wall of height \(U\) at \(x = L\) and a particle inside the well with energy \(E < U\). Write the form of the wavefunction, \(\psi_1(x)\), inside the well \((0 < x < L)\) and \(\psi_2(x)\) for \(x > L\) in terms of unknown coefficients (A, B, etc.). Eliminate any unknown coefficients, if possible.

Solution:

\[
\psi_1(x) = Asin(kx) + Bcos(kx) \quad 0 < x < L
\]

and:

\[
\psi_2(x) = C e^{-\alpha x} \quad x > L
\]

But, \(\psi_1(0) = 0\) so \(B = 0\).