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. An electron with energy \(E = 4.95eV\) is incident on a barrier of width 1nm and height \(U = 5eV\). What is the probability that the electron tunnels through the barrier?

Solution:
\[
T(E) = \left\{1 + \frac{1}{4}\frac{U^2}{E(U-E)} sinh^2(\alpha L)\right\}^{-1}
\]
and:
\[
\alpha = \frac{(2m(U-E))^{1/2}}{h} = 1.142 \times 10^9
\]
Therefore, \(\alpha L = 1.142\) and \(T(E) = 0.0196\)