

Additional 7th week homework problems

Problem 1:

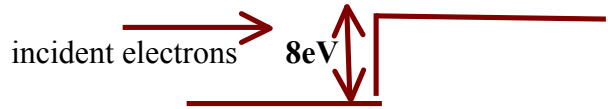
- (a) Compare the numerical value of the solution given in the textbook for Example 6.8 using the approximate equations (6.21), (6.22) with the exact solution obtained from the equation derived in class for the even solutions.
- (b) Show that the approximate equations (6.21), (6.22) agree with the exact solution in the limit $U/E \gg 1$.

Problem 2:

The wavefunction for electrons incident on a potential step of height 8eV at $x=0$ is

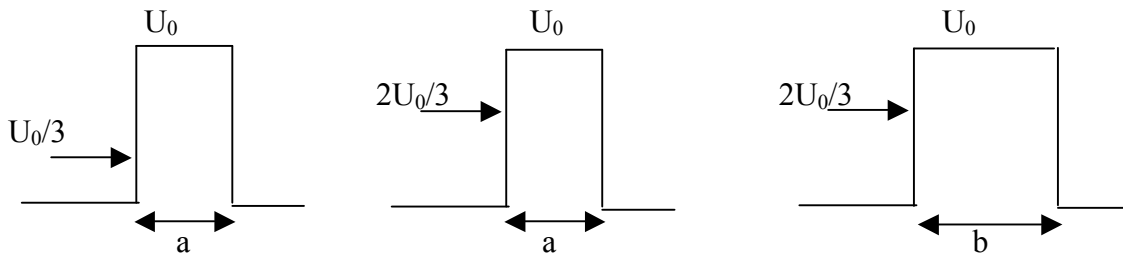
$$\psi(x) = e^{ik_1x} + Be^{-ik_1x} \quad x < 0$$

$$\psi(x) = 1.5e^{ik_2x} \quad x > 0$$



- (i) Find B
- (ii) For every 1000 incident electrons, how many are transmitted?
- (iii) Find the kinetic energy of the incident, reflected and transmitted electrons, in eV.

Problem 3



- For the barrier on the left, for every 10,000 particles of mass m incident, 100 particles tunnel through. The incident particle energy is $U_0/3$. U_0 =barrier height.
- For the case in the middle (same barrier), for every 10,000 particles of mass m incident with energy $2U_0/3$, how many tunnel through?
- For the barrier on the right and particles of mass m , for what width b do 100 particles tunnel through for every 10,000 incident with energy $2U_0/3$? Give b in terms of a .
- For the case in the middle and particles of mass M , 100 tunnel through for every 10,000 incident. Give M in terms of m .
- Use the approximate formula Eq. (7.10) rather than Eq. (7.9).