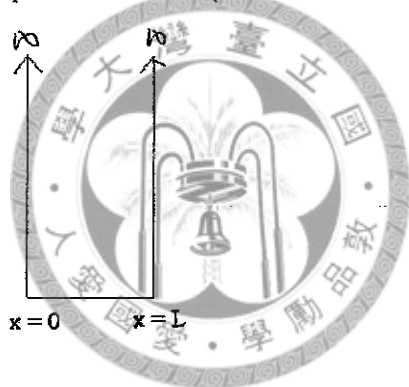


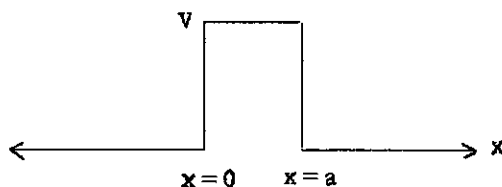
(每一大題 20 分)

$$c = 3.00 \times 10^8 \text{ m/s}; 1 \text{ eV} = 1.6 \times 10^{-19} \text{ J}; m_e = 9.11 \times 10^{-31} \text{ kg}; m_p = 1.67 \times 10^{-27} \text{ kg}; h = 6.63 \times 10^{-34} \text{ J}\cdot\text{s}$$

- (a) A clock moves along an x axis at a speed of $0.600c$ and reads zero as it passes the origin. What time does the clock read as it passes $x = 180 \text{ m}$? (b) What are the total energy E and the magnitude of momentum p of a 2.53 MeV electron?
- An electron is confined to a one-dimensional, infinitely deep potential energy well of width $L = 100 \text{ pm}$. (a) If the electron gains the energy by absorbing light and make a jump from its ground state to its second excited state, what is the wavelength of the light? (b) If the electron is in its ground state, what is the probability that this electron can be detected in the left one-quarter of the well ($x = 0$ to $x = 0.25 L$)?



- Consider a barrier potential as shown in the figure below. A beam of electrons with energy E travels to the right along the x -axis from $x < 0$. Calculate the ratio T of the intensity of the probability flux transmitted into the region $x > a$ to the intensity of the incident probability flux (i.e. the transmission coefficient T) in both cases $E > V$ and $E < V$.



- (a) A rigid rectangular box of widths $L_x = L_y = L$ and $L_z = 2L$, contains 8 electrons, please give the energies of the first excited state and third excited state. (Assume that the electrons do not interact with one another) (b) What are the uncertainties in the velocities of an electron and a proton confined in a 1-nm box?
- Calculate the Fermi energy for aluminum. For this metal, $A = 27$, the mass density is $\rho = 2.7 \times 10^3 \text{ kg/m}^3$, and, on average, three electrons per atom are free. Give your answer in terms of eV .