Module 4: Simple Applications of Schrodinger Equation

4.1 For a potential energy variation of the form

$$V(x,y,z) = 0 \quad \text{for} \quad 0 < x < L,\ 0 < y < L,\ 0 < z < L$$
$$= \infty \quad \text{everywhere else}$$

the energy eigenvalues are given by $E = K\left(n_x^2 + n_y^2 + n_z^2\right)$; $n_x, n_y, n_z = 1,2,3,\ldots$.

(a) $K = \dfrac{\pi^2 \hbar^2}{2\mu L^2}$

(b) $K = \dfrac{\pi^2 \hbar^2}{8\mu L^2}$

(c) $K = \dfrac{\hbar^2}{2\mu L^2}$

(d) $K = \dfrac{\hbar^2}{8\mu L^2}$

[Answer (a)]

4.2 For a potential energy variation of the form

$$V(x,y,z) = 0 \quad \text{for} \quad 0 < x < L,\ 0 < y < L,\ 0 < z < L$$
$$= \infty \quad \text{everywhere else}$$

the eigenfunctions are given by $\psi(x,y,z) = N \sin\left(\dfrac{n_x \pi}{L} x\right) \sin\left(\dfrac{n_y \pi}{L} y\right) \sin\left(\dfrac{n_z \pi}{L} z\right)$

where $n_x, n_y, n_z = 1,2,3,\ldots$ where N is the normalization constant which is given by

(a) $\left(\dfrac{2}{L}\right)^{1/2}$

(b) $\left(\dfrac{4}{L^3}\right)^{1/2}$

(c) $\left(\dfrac{2}{L^3}\right)^{1/2}$

(d) $\left(\dfrac{8}{L^3}\right)^{1/2}$

[Answer (d)]