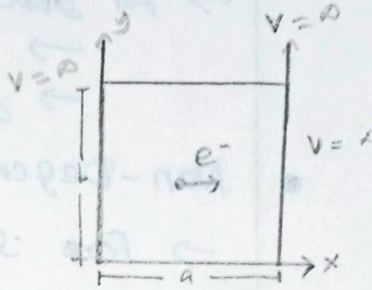
0-11-22

2D Potential box Day 57

$E_{nx} = n_x^2 h^2 / 8ma^2 \rightarrow (1)$

$\psi_x = \sqrt{2/a} \sin \frac{n\pi x}{a} \rightarrow (2)$

By 'y'



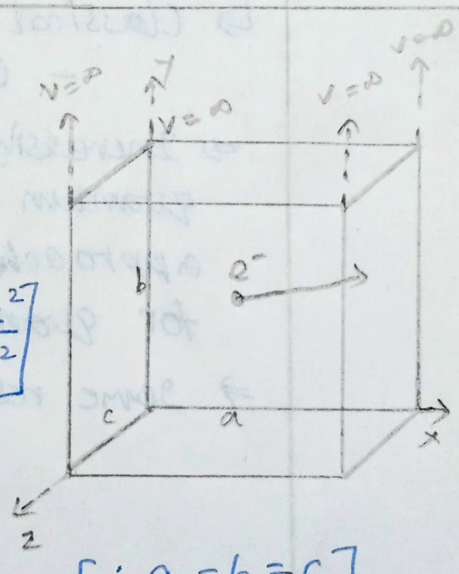
$E_{ny} = n_y^2 h^2 / 8mb^2 \rightarrow (3)$

$\psi_y = \sqrt{2/b} \sin \frac{n_y \pi y}{b} \rightarrow (4)$

- $E_{nx \cdot ny} = \frac{n_x^2}{a^2} + \frac{n_y^2}{b^2} \left[\frac{h^2}{8m}\right] \rightarrow (5)$

- $\psi_x \cdot \psi_y = \sqrt{2/a} \sin \frac{n_x \pi x}{a} \sqrt{2/b} \sin \frac{n_y \pi y}{b} \rightarrow (6)$

3D Potential box.



$E_{n_z} = \frac{n_z^2 h^2}{8mc^2} \rightarrow (7)$

From (1), (3) and (7)

$E_{nx \cdot ny \cdot nz} = \frac{h^2}{8m}\left[\frac{n_x^2}{a^2} + \frac{n_y^2}{b^2} + \frac{n_z^2}{c^2}\right]$

- $E_{nx \cdot ny \cdot nz} = \frac{h^2}{8ma^2}\left[n_x^2 + n_y^2 + n_z^2\right] \rightarrow (8) \rightarrow (9)$

From (2), (4) and (10)

$\psi_z = \sqrt{2/c} \sin \frac{n_z \pi z}{c} \rightarrow (10)$ $[\because a = b = c]$

$\psi_x \cdot \psi_y \cdot \psi_z = \sqrt{2/a}\sqrt{2/b}\sqrt{2/c} \sin \frac{n_x \pi x}{a} \sin \frac{n_y \pi y}{b} \sin \frac{n_z \pi z}{c}$

- $\psi_{xyz} = \sqrt{8/a^3} \sin \frac{n_x \pi x}{a} \sin \frac{n_y \pi y}{a} \sin \frac{n_z \pi z}{a} \rightarrow (11)$

Respectively for 1, 1, 2 (quantum nos)

from (8)

$E = \frac{h^2}{8m}\left[\frac{1}{a^2} + \frac{1}{b^2} + \frac{4}{c^2}\right] = \frac{h^2}{8ma^2}[6]$

- Degeneracy : (Eg : 1,1,2)

↳ For several combination of quantum nos,

→ Same Eigen value

→ different Eigen functions.

- Non-Degeneracy (Eg : 3,3,3)

→ For same energy .

→ Same Eigen value

→ Same Eigen function.

Probabilities and correspondence principle.

↳ Quantum mechanics

- discrete energy levels

↳ Classical mechanics

- Continuous energy levels

⇒ Increasing energy / mass / length / quantum number ⇒ merge (or) approaches with classical mechanics for quantum mechanics.

→ Same results when n = high.