1. Write the first two allowed Eigen function and corresponding Eigen value for a particle in an infinite potential well?

The Eigen wave functions of the particle in box in the first two states can be written as

$$\psi_1(x) = \sqrt{\frac{2}{a}} \cos\frac{\pi}{a}x \qquad \boldsymbol{n}{=}\mathbf{1} \qquad \text{(even parity)}$$

$$\psi_2(x) = \sqrt{\frac{2}{a}} \sin\frac{2\pi}{a}x \qquad \boldsymbol{n}{=}\mathbf{2} \qquad \text{(odd parity)}$$

The Eigen value of the particle in box in the first two states can be written as

- n=1 corresponds to the lowest allowed energy state which is the ground state of the system

$$E_1 = \frac{h^2 1^2}{8ma^2} = \frac{h^2}{8ma^2}$$

- n=2 corresponds to the first excited energy state

$$E_2 = \frac{h^2 2^2}{8ma^2} = 4E_1$$

2. What is parity function? Write the differences between odd and even parity function?

Parity is a fundamental symmetry property that describes how a physical system's wave function behaves under spatial inversion.

Parity helps us understand how physical systems behave under reflections and is a powerful tool for analyzing and classifying them in physics.

When the parity operator acts on a wave function, the result can be either the same as the original wave function or the negative of the original wave function.

If the wave function remains unchanged (i.e., Pψ(r) = ψ(r)), the system has even parity.

$$\psi(x) = \sqrt{\frac{2}{a}} \cos\frac{n\pi}{a}x$$

If the wave function changes sign (i.e., Pψ(r) = -ψ(r)), the system has odd parity.

$$\psi(x) = \sqrt{\frac{2}{a}} \sin\frac{n\pi}{a}x$$