

$$\psi_n(x) = \sqrt{\frac{2}{a}} \sin\left(\frac{n\pi x}{a}\right), \quad E_n =$$

$$n^2 \frac{\pi^2 \hbar^2}{2ma^2}$$

$$= n^2 K$$

case ①

Distinguishable particles case

total wave function

$$\psi_{n_1 n_2}(x_1, x_2) = \psi_{n_1}(x_1) \psi_{n_2}(x_2)$$

$$E_{n_1 n_2} = (n_1^2 + n_2^2) K$$

$$E_{n_1 n_2} = K n_1^2 + K n_2^2$$

$$E_{n_1} = (n_1)^2 \left[\frac{\pi^2 \hbar^2}{2ma^2} \right]$$

$$E_{n_1} = K(n_1)^2$$

$$E_{n_2} = K(n_2)^2$$

$$E_{n_2} = (n_2)^2 \left[\frac{\pi^2 \hbar^2}{2ma^2} \right]$$

$$E_{n_1 n_2} = K(n_1)^2 + K(n_2)^2$$

ground state

$$\psi_{(1,1)} \rightarrow \psi_{(1)}(x_1) = \sqrt{\frac{2}{a}} \sin\left(\frac{\pi x_1}{a}\right)$$

$\psi_{(1,1)}$

$$\psi_{(1)}(x_2) = \sqrt{\frac{2}{a}} \sin\left(\frac{\pi x_2}{a}\right)$$

n_2

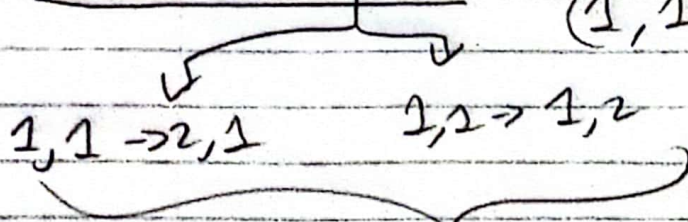
$$\psi_{(1)}(x_1) = \sqrt{\frac{2}{a}} \sin\left(\frac{n\pi x_1}{a}\right) = \sqrt{\frac{2}{a}} \sin\left(\frac{\pi x_1}{a}\right)$$

$$\psi_{(1)}(x_2) = \sqrt{\frac{2}{a}} \sin\left(\frac{n\pi x_2}{a}\right) = \sqrt{\frac{2}{a}} \sin\left(\frac{\pi x_2}{a}\right)$$

$$\psi_{(1,1)} = \left(\sqrt{\frac{2}{a}} \sin\left(\frac{\pi x_1}{a}\right)\right) \left(\sqrt{\frac{2}{a}} \sin\left(\frac{\pi x_2}{a}\right)\right)$$

$$E_{11} = 2K$$

1st excited state:



same thing

(1,1)

$$\begin{cases} E_{12} = (2^2 + 1^2)K = 5K \\ E_{21} = (1^2 + 2^2)K = 5K \end{cases}$$

doubling degeneracy

why degenerate

1) $[p, H]$ assume $[1, 2]$ or $[2, 1]$ eigen values aren't the same but the energy output is the same

$$\psi_{(1,2)} = \left(\frac{2}{a} \sin\left(\frac{\pi x_1}{a}\right)\right) \left(\frac{2}{a} \sin\left(\frac{2\pi x_2}{a}\right)\right)$$

$$\psi_{(2,1)} = \left(\frac{2}{a} \sin\left(\frac{2\pi x_1}{a}\right)\right) \left(\frac{2}{a} \sin\left(\frac{\pi x_2}{a}\right)\right)$$