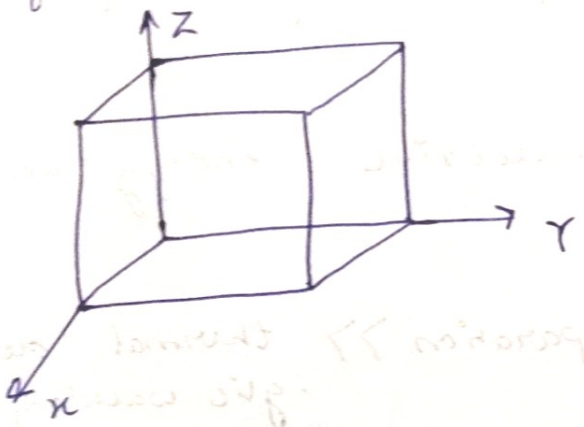
Partition function

$$q = \sum_i g_i e^{-\varepsilon_i / kT}$$

Particle in a box

We consider a collection of N ideal gas molecules confined in a parallelepiped.



Energy eigen value :-

$$E_{n_x n_y n_z} = \frac{h^2}{8m}\left(\frac{n_x^2}{a^2} + \frac{n_y^2}{b^2} + \frac{n_z^2}{c^2}\right)$$

$n_x = 1, 2, 3, \ldots$

$n_y = 1, 2, 3 \ldots$

$n_z = 1, 2, 3 \ldots$

Single particle partition function :-

$$q = \sum_{n_x=1}^{\infty}\sum_{n_y=1}^{\infty}\sum_{n_z=1}^{\infty} e^{-\frac{h^2}{8mkT}\left(\frac{n_x^2}{a^2} + \frac{n_y^2}{b^2} + \frac{n_z^2}{c^2}\right)}$$

$$= \sum_{n_x=1}^{\infty} e^{-\frac{h^2}{8mkTa^2} n_x^2} \sum_{n_y=1}^{\infty} e^{-\frac{h^2}{8mkTb^2} n_y^2} \sum_{n_z=1}^{\infty} e^{-\frac{h^2}{8mkTc^2} n_z^2}$$

$$= S_1 \times S_2 \times S_3$$