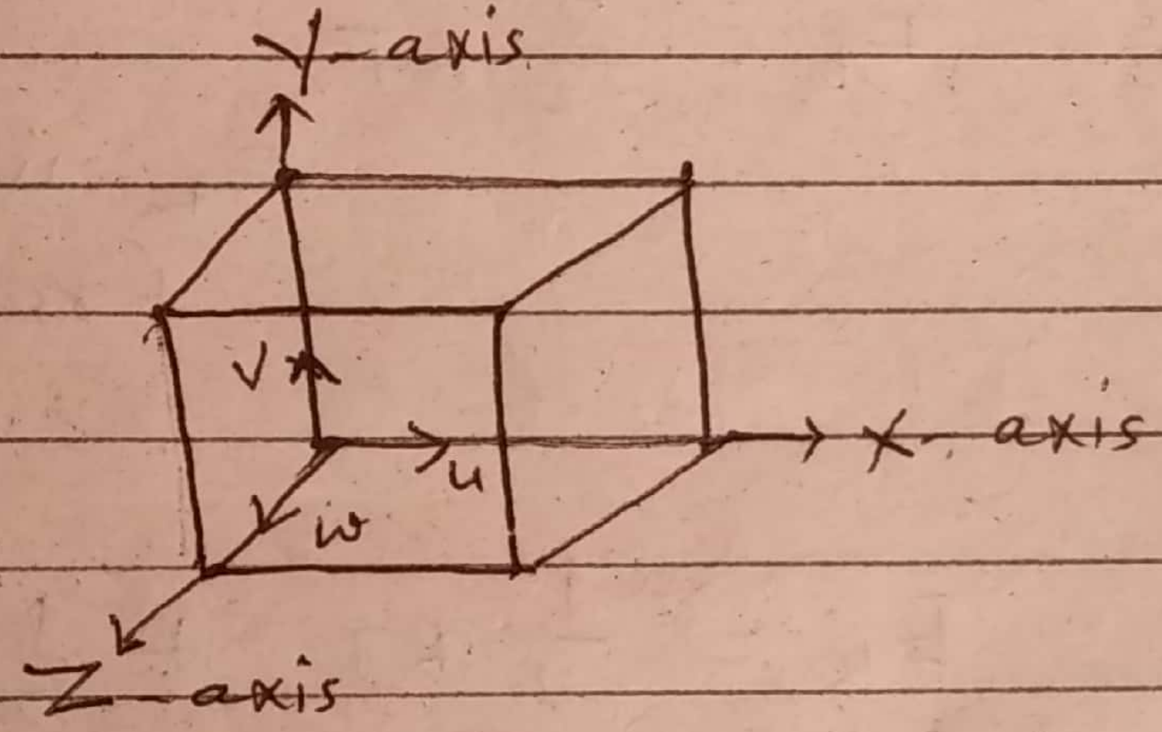
B.Sc. III Group-A

Law of Equipartition of energy of gas.

This law states that the total energy of molecule is divided equally in three axis (x, y, z).



$$KE_{(x)} = \frac{1}{2} m u^2$$

$$KE_{(y)} = \frac{1}{2} m v^2$$

$$KE_{(z)} = \frac{1}{2} m w^2$$

Total Kinetic energy

$$\therefore KE = E_K$$

$$= \frac{1}{2}mu^2 + \frac{1}{2}mv^2 + \frac{1}{2}mw^2$$

and

$$(KE)_x = (KE)_y = (KE)_z$$

as,

$$E_K = \frac{3}{2}RT$$

E_K is energy of translational

$$E_K = \frac{1}{2}RT + \frac{1}{2}RT\ \frac{1}{2}RT$$

$$= \frac{3}{2}RT$$

$$(KE)_x = \frac{1}{2}RT$$

$$(KE)_y = \frac{1}{2}RT$$

$$(KE)_z = \frac{1}{2}RT$$

This is called equipartition of gas.

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Degrees of freedom of a system

The number of independent coordinates which are required to explain the position or configuration of the system.

The number of degrees of freedom of a system is

$$f = 3N - A$$

f = No. of degrees of freedom

N = No. of atoms in one molecule

A = No. of independent relations between the atoms of one molecule

Law of equipartition of energy can also be stated as the total average kinetic energy of a molecule of a given gas at a constant pressure and temperature is equally distributed among all its degrees of freedom and the average kinetic energy per degrees of freedom is $\frac{1}{2}KT$.