$N_A = 6.022 \times 10^{23}$

KINETIC THEORY OF GASES

$1gm \rightarrow 10^{-3}$ kg

* Ideal gas Equation :-

$$\boxed{PV = nRT}$$

P = Pressure, V = volume
n = moles, R = universal gas constant

$R = 8.314$ J/mol K
T = Temperature

* Kinetic theory :-

1. gas consist of large number of tiny particle
2. No intermolecular forces.

* Different form of Ideal gas equation :-

$n = \frac{m}{mw}$, $PV = \frac{m}{mw} RT$

$$\boxed{P \cdot mw = \rho RT} \; *$$

$n = \frac{N}{N_A}$ * RT

$PV = N\left(\frac{R}{N_A}\right)T$

$$\boxed{PV = Nk_bT} \; *$$

$K_b = 1.38 \times 10^{-23}$

* Mean free path :-

The average distance a molecule can travel without colliding is called the mean free path.

$$\boxed{\lambda = \frac{RT}{\sqrt{2}\pi d^2 N_A P}}$$

d = diameter.

$$\boxed{\lambda = \frac{1}{\sqrt{2}\pi d^2 n}}$$

n = number density

$n = \frac{N_A P}{RT}$

* Velocity of gas molecu

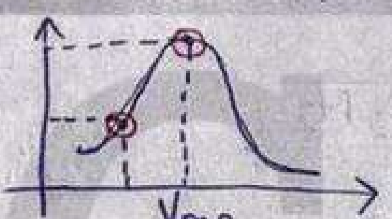
$V_{rms} = \sqrt{\frac{3RT}{mw}}$

$V_{avg} = \sqrt{\frac{8}{\pi}\frac{RT}{mw}}$

$V_{mp} = \sqrt{\frac{2RT}{mw}}$

max velocity RMS > Avg > most probable {RAM}

* Maxwell's Curve ;



* Pressure equation

$$\boxed{P = \frac{1}{3}\rho C_{rms}^2}$$

$C_{rms} = V_{rms}$ (same)

$P = \frac{2}{3}\frac{1}{V}(KE)$

$$\boxed{KE = \frac{3}{2} P \cdot V} \; *$$

$\left\{KE = \frac{3}{2}nRT\right\}$ for n moles

$\left\{KE = \frac{3}{2}RT\right\}$ for one moles

$\left\{KE = \frac{3}{2}\frac{RT}{N_A}\right\}$ p. molecule

$$\boxed{KE = \frac{3}{2}K_bT}$$

* GAS LAWS :-

1. Boyle's law $PV = const$
2. Charle's law $\frac{V}{T} = const$
3. gay lussac law $P/T = const$

* Degree of freedom :- (f)

V = Vibrational

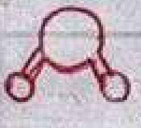
(i) Mono-atomic :-

3 Translation (x, y, z)
→ 0 Rotation
(R) → 3 +

(ii) diatomic :-

3 Translation (x, y, z)
→ 2 Rotation
(R) ⇒ 5 + 2V = 7

(iii) Poly-atomic :-



3 Translation (x, y, z)
→ 3 Rotation
⇒ 6 + 2V = 8
Rigid

* Cp and Cv :-

specific heat = amt of heat required to raise the temp of 1kg substance by one °C or 1°K.

Pressure ⇒ const ⇐ Volume
Cp Cv

$C_p > C_v$

$$\boxed{C_p - C_v = R}$$

$C_v = \frac{fR}{2}$ f = degree of freedom

mono ⇒ $C_v = \frac{3R}{2}$ $C_p = \frac{5R}{2}$

dia ⇒ $C_v = \frac{5R}{2}$ $C_p = \frac{7R}{2}$

Poly ⇒ $C_v = \frac{6R}{2}$ $C_p = 4R$

* Ratio of the specific heats :-

$\gamma = \frac{C_p}{C_v}$; $\gamma = 1 + \frac{2}{f}$