Lect-29.

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Dalton's Law :- (non-reactive gases)

In a mixture of non-reactive gases, total pressure of gaseous mixture is sum of partial pressure of all gases.

D_2 + Ne = O_2 + Ne

0.2 atm 0.6 atm 0.8 atm

A	B	C
n_A	n_B	n_C
P_A	P_B	P_C

(V, T)

$P_T = P_A + P_B + P_C$

$PV = nRT$

$P_A = \frac{n_A RT}{V}$

$P_B = \frac{n_B RT}{V}$

$P_C = \frac{n_C RT}{V}$

$P_T = P_A + P_B + P_C$

$= (n_A + n_B + n_C)\frac{RT}{V}$

$P_T = \frac{n_T RT}{V}$

$\frac{P_A}{P_T} = \frac{\frac{n_A RT}{V}}{\frac{n_T RT}{V}}$

$\frac{P_A}{P_T} = \frac{n_A}{n_T} = X_A$

$P_A = X_A P_T$

$P_B = X_B P_T$

$P_C = X_C P_T$

Quest- Equal masses of O_2 & N_2 are mixed in a Container then find ratio of their partial Pressure

$$P_{O_2} = \frac{n_{O_2} RT}{V}$$

$$P_{N_2} = \frac{n_{N_2} RT}{V}$$

$$\frac{P_{O_2}}{P_{N_2}} = \frac{n_{O_2}}{n_{N_2}} = \frac{m/32}{m/28} = \frac{28}{32} = \frac{7}{8}$$ (2)

Qn: In a container equal masses of the O_2 & N_2 are mixed find fraction of Partial Pressure exerted by O_2 ?

$$n_{He} = \frac{m}{4}$$

$$n_{O_2} = \frac{m}{32}$$

$$n_{N_2} = \frac{m}{28}$$

$$n_T = \frac{m}{4} + \frac{m}{32} + \frac{m}{28}$$

$$= m\left(\frac{32 \times 7 \times 28 \times 2}{32 \times 28}\right)$$

$$= m\left(\frac{224 + 28 + 32}{32 \times 28}\right)$$

$$\frac{P_{O_2}}{P_T} = X_{O_2}$$

$$= \frac{m/32}{m\,284/32 \times 28} = \frac{28}{284}$$

$P_{dry\ gas} = P_{Total} - aqueous\ Tension$

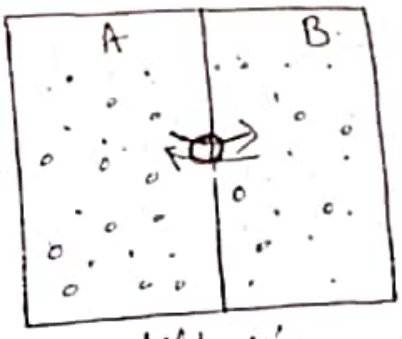
Pressure of saturated water vapours is called aq. Tension.

(3) Graham's Law of diffusion and effusion:-

When 2 or more gases are allowed to mix in a container then due to random motion of gaseous molecules intermixing of gases takes place is k/n as diffusion.

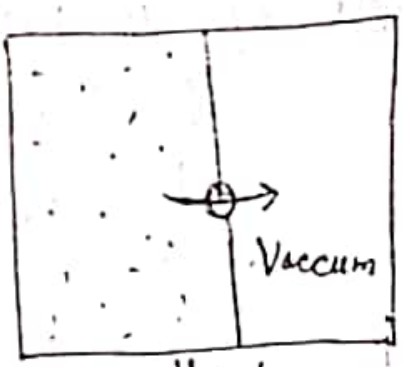
Lighter molecules diffuse faster than heavier molecules.

When gas particles are allowed to move out through a pin hole towards low pressure region process is k/n as effusion. Gaseous particles move from higher conc ~~effusion~~ to lower conc



diffusion

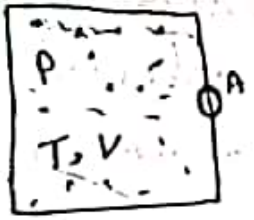
P_{ext} = Const.



Effusion

P_{ext} = Vary

Law:- At Const. Pressure and temp., rate of diffusion/effusion is inversely proportion to square root of density.



$r \propto \frac{1}{\sqrt{d}}$

$r \propto \frac{1}{\sqrt{V.D.}}$

$$r \propto \frac{P}{\sqrt{T.M}} \cdot A$$

$$r \propto \frac{1}{\sqrt{M}}$$

$$r = \frac{l \text{ diffused gas}}{t} = \frac{V \text{diffused gas}}{t}$$

$$= \frac{n \text{ diffused gas}}{t}$$

Ques:- If He & CH_4 are allowed to diffused in a gaseous container at 27°C & 1 atm then ratio of rate of diffusion of He & CH_4

① 2 ② 0.25 ③ 0.5 ④ 4

$$r \propto \frac{1}{\sqrt{M}}$$

$$\frac{r_{He}}{r_{CH_4}} = \sqrt{\frac{M_{CH_4}}{M_{He}}} = \sqrt{\frac{16}{4}} = \sqrt{4} = 2$$

$$r \propto \frac{1}{M}$$

$$\sqrt{M} \downarrow \quad r \uparrow$$

① H_2 $\sqrt{2} = 1$ ② H_2S $\sqrt{34} = 5.$ ③ O_2 $\sqrt{32} = 5.$ ④ Cl_2 $\sqrt{71} = 8.$

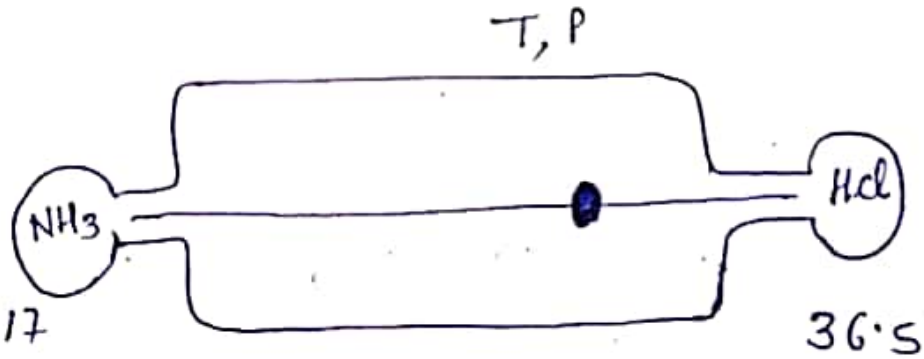
Ques:- 2 bottles of ammonia & hydrogen chloride are connected through a tube and opened simultaneously. Then white rings are ammonium chlorides are formed at.

① at centre of tube

② near hydrogen chloride bottle

③ near ammonia bottle

④ no white rings are formed



$$r \propto \frac{1}{\sqrt{M}}$$

$$r = \frac{l_{diff}}{t}$$

Ques- Rate of diffusion of SO_2 gas is 2 time the rate of diffusion of a gas X. then M.wt of X at STP.

Let rate of diff of X be $\rightarrow r_X$

$$r_{SO_2} = 2\, r_X$$

$$\sqrt{\frac{M_{W_X}}{M_{W_{SO_2}}}} = \frac{r_{SO_2}}{r_X} = 2$$

$$\sqrt{\frac{M_{W_X}}{64}} = 2$$

$$\frac{\sqrt{M_{W_X}}}{8} = 2$$

$$\sqrt{M_{W_X}} = 16$$

$$M_{W_X} = 256$$

Ques- which gas diffuse fastest at same T&P

(1) He (2) SO_2 (3) CO_2 (4) N_2

$\sqrt{4} = 2.$ $\sqrt{64} = 8.$ $\sqrt{44} = 6.$ $\sqrt{28} = 5.$