Practice sheet → upto 10 solved

Gaseous State

Gas laws

Use ⟶ $n_i = n_f$

$PV = nRT$

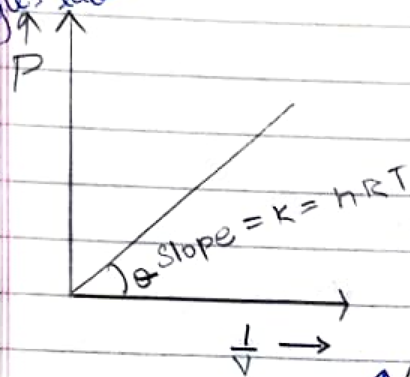
$n = \frac{PV}{RT}$

i.e $\frac{P_i V_i}{R T_i} = \frac{P_f V_f}{R T_f}$

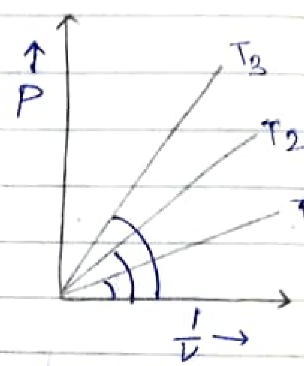
Graph

Boyle's law

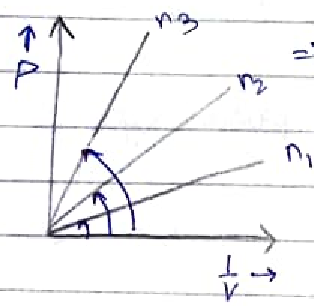
①



$\theta \propto nT$

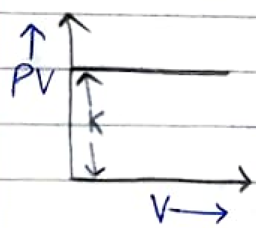


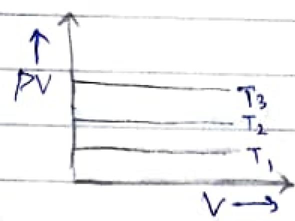
$\Rightarrow T_3 > T_2 > T_1$



$n_3 > n_2 > n_1$

②

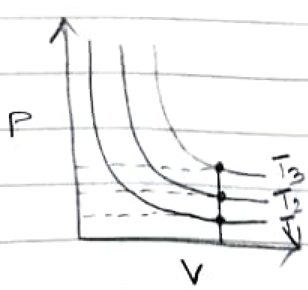




$PV = nRT$

~~now~~ $PV \propto T \Rightarrow T_3 > T_2 > T_1$

③



$PV = nRT$

At. V $P \propto T$

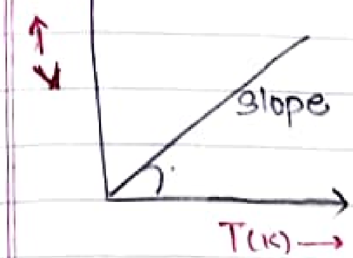
$\Rightarrow T_3 > T_2 > T_1$

Bo → $P \propto \frac{1}{V}$ | G → $P \propto T$

Ch → $V \propto T$ | A → $n \propto V$

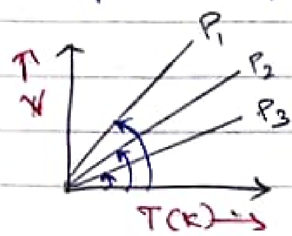
Charles law

(4)



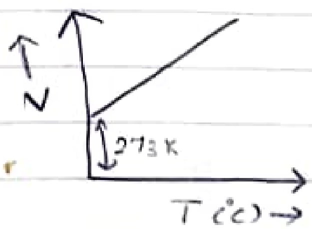
$PV = nRT$

$\frac{V}{T} = K = \frac{nR}{P}$



Slope $\propto \frac{1}{P}$

$P_3 > P_2 > P_1$



$V = K(t + 273)$

$V = Kt + K(273)$

y mx c

Ideal gas Equation

$PV = nRT = \frac{W}{M} RT$

$M = \frac{W}{PV} \times RT$

$\boxed{M = \frac{dRT}{P}}$

(d → Density, T → Temp., R → Gas cons., P → Pressure, M → Molar mass)

Case I : d → gas, P – gas } M_{wt} of Gas

Case II : d → Gas mixture, P ↗ ⟹ $(M_{wt})_{avg} = \frac{d}{P} \times RT$

Only two formula for $(M_{wt})_{avg}$

(1) $(M_{wt})_{avg} = \frac{dRT}{P}$

(2) $(M_{wt})_{avg} = \frac{\Sigma M_i x_i}{\Sigma x_i}$

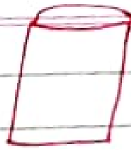
↓ for two gas ⟹ $= \frac{M_1 x_1 + M_2 x_2}{x_1 + x_2}$

Here x can be

x → mole, Mass %

Page No.:
Date: / /

Note In a Gas Mixture



Gas A	Gas B	Total in Vessel
V	V	V
T	T	T
n_A	n_B	$n_A + n_B$
P_A	P_B	$P_A + P_B$

★ If Rxn takes place, Check the no. of mole of product

★

$P_T = P_A + P_B + \ldots$

Here $\boxed{\dfrac{P_A}{P_B} = \dfrac{n_A}{n_B}}$ → jo mole ka ratio wahi pressure ka ratio hota hai

$\boxed{P_A = \chi_A P_{Total}}$

Graham's Law of Diffusion

At constant temp. & pressure

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

Rate of diffusion $= \dfrac{A \cdot P}{\sqrt{VD}}$ (A → Area of orifice, P → Pressure, VD → Vapour density)

$\Rightarrow r \propto \dfrac{1}{\sqrt{VD}}$ $V.D = 2 \times M_{wt.}$

$r \propto \dfrac{1}{\sqrt{M_{wt.}}}$

for two gas.

★ $\dfrac{r_1}{r_2} = \sqrt{\dfrac{M_2}{M_1}}$ at constant T, P, A

★ $\dfrac{r_1}{r_2} = \dfrac{P_1}{P_2}\sqrt{\dfrac{M_2}{M_1}}$ at constant T, A.

↳ ? ??? How to find.

Page No.:
Date: / /

Note ⇒ Yadi question me
mole of gas
mass of gas
mole ratio
mass ratio
→ Pressure variable $\frac{n_1}{n_2} = \frac{P_1}{P_2}$

★ Rate of diffusion in terms of ~~length~~ length

length ⇒ $\frac{l_1}{t_1} \times \frac{t_2}{l_2} = \sqrt{\frac{M_2}{M_1}}$

mole ⇒ $\frac{n_1}{t_1} \times \frac{t_2}{n_2} = \sqrt{\frac{M_2}{M_1}}$

vol ⇒ $\frac{V_1}{t_1} \times \frac{t_2}{V_2} = \sqrt{\frac{M_2}{M_1}}$

mass ⇒ $\frac{W_1}{t_1} \times \frac{t_2}{W_2} = \sqrt{\frac{M_1}{M_2}}$ ← see Here

Kinetic Theory Of Gases

KE per molecule $= \frac{3}{2} K_B T$ $\quad K_B = \frac{R}{N_A}$

KE per mole $= \frac{3}{2} RT$

Note: KE of ideal gas only depend upon temp.

Pressure, Volume ⊗ KE — constant

K.E of n mole $= \frac{3}{2} nRT$

$V_{rms} = \sqrt{\frac{3RT}{M}} = \sqrt{\frac{3PV}{M}} = \sqrt{\frac{3P}{d_{molar}}}$

d_{molar} → Molar density

$$V_{avg} = \sqrt{\frac{8RT}{\pi M}} = \sqrt{\frac{8PV}{\pi M}} = \sqrt{\frac{8P}{\pi d_{molar}}}$$

$$V_{mp} = \sqrt{\frac{2RT}{M}} = \sqrt{\frac{2PV}{M}} = \sqrt{\frac{2P}{d_{molar}}}$$

Here $V_{rms} > V_{avg} > V_{mp}$

Real Gas Equation

If $PV = nRT \rightarrow$ Ideal gas

$\frac{PV}{nRT} = 1 \rightarrow$ Ideal gas

If $\frac{PV}{nRT} \neq 1 \rightarrow$ Real gas.

↳ $Z \neq 1 \rightarrow$ Real gas

$Z = \frac{PV}{nRT}$

↳ compressibility factor → Measure the deviation of Ideal gas.

Case (i) $Z > 1$

Repulsive force dominate

$V_m > 22.4\ L$

Case (ii) $Z < 1$

Attractive force dominate.

$V_m < 22.4\ L$

$Z = \frac{PV}{nRT}$ (nRT ↓ Conc), $Z \propto PV$

If $PV \uparrow$ $Z \uparrow 1$

Vanderwaal's Gas Equation

$$\left(P + \frac{n^2 a}{V^2}\right)(V - nb) = nRT$$ for n mole of gas.

Boyle pt Temp → Real G → Ideal G
eq.

$(P + \frac{n^2a}{V^2})(V - nb) = nRT$ for n mole of gas

Correction in pressure → force of attraction/ Repulsion b/w molecule

Correction in Volume. → Very small size vessel used (or) gas bahut jyada

where b → excluded volume for 1 mole of gas.

$b = 4 \times$ Actual vol. of gas $\times N_A$

$= 4 \times \frac{4}{3}\pi r^3 \times N_A$ → Radius of Atom/ molecule.

$b = 4 \times V_{Actual} \times N_A$ → One mole of gas.

Note:
→ b represent the size of atom/Molecule

where a → represent the Force → Attraction, Repulsion.

a ∝ Attraction force b/w two molecule/Atom
a ∝ easily liquified.

$(P + \frac{a}{V^2})(V - b) = RT$

Jo Jyada hai unka correction term neglect kar dena hai.

low Pressure	high Pressure	high temp. & low pressure
jyada → volume	$P(V-b) = RT$	high temp → high KE → Attractive force ↓
$(P + \frac{a}{V^2})V = RT$	$PV = RT + Pb$	$P + \frac{a}{V^2} \approx P$
$PV + \frac{a}{V} = RT$	$\frac{PV}{RT} = 1 + \frac{Pb}{RT}$	low pressure ⇒ jyada vol.
$\frac{PV}{RT} = 1 - \frac{a}{VRT}$	$Z = 1 + \frac{Pb}{RT}$	$V - b \approx V$
$Z = 1 - \frac{a}{VRT}$	$Z > 1$	$Z = 1$
$Z < 1$	repulsive force	∴ $PV = RT$ → Ideal gas.
Attractive force		