

4. STATES OF MATTER-GASES & LIQUIDS

STUDY NOTES

[1VSAQ (&)1SAQ]

3 STATES OF MATTER:

(1) Gaseous state (2) Liquid state (3) Solid state

These states are due to 'Intermolecular forces' and 'thermal energies' of constituent particles.

Boyle's law (PV relation): $V \propto \frac{1}{P}$

" **Volume** of a given mass of a gas is **inversely** proportional to the **pressure** of the gas, at **constant temperature**".

Charles' law (VT relation): $V \propto T$

" **Volume** of a given mass of gas is **directly** proportional to its absolute **temperature**, at **constant pressure**".

Avogadro's law (Vn relation): $V \propto n$

"Equal volumes of all gases contain equal number of moles(n), at constant temperature and pressure"

Ideal gas equation : $PV = nRT$

Effusion:

It's the **escape of gas** through a fine hole, from a high pressure region to a low pressure region

Ex: Puncture in an inflated tube.

Diffusion:

It's the mixing up of gases against gravitational forces to form a homogeneous mixture.

Graham's law of diffusion (rd relation):

"The rate of diffusion of a gas is inversely proportional to the square root of its density at constant temperature and pressure".

Partial pressure:

Pressure exerted by an individual gas in the mixture

Dalton's law:

"The total pressure exerted by a mixture of non-reactive gases is equal to the sum of the partial pressures of all the component gases at constant temperature and pressure".

Total pressure $p_{\text{total}} = p_1 + p_2 + p_3 + \dots$

Kinetic gas equation : $PV = \frac{1}{3} mnc^2$

BULLET MASTER'S CHEM BEATS!

Which 'state' is Great ?

Each state has its own **significance**.

In the view of the LIFE of 'Human beings';

One can live 'few days' without taking **Solid** food!

One can live 'few hours' without drinking **Liquid** !!

But, one can't live 'few minutes' without inhaling **Gaseous** Oxygen!!!

More over, Our **Body** is **Solid**, Our **Blood** is **Liquid**, and Our **Breath** is **Gas**.

Imp. IPE Formulae

1. **Boyle's law:** $V \propto \frac{1}{P}$, (n, T are constant); $P_1V_1 = P_2V_2$
2. **Charles law:** $V \propto T$, (n, P are constant); $\frac{V_1}{T_1} = \frac{V_2}{T_2}$; $V_t = V_0 \left[\frac{273+t}{273} \right]$
3. **Avogadro's law:** $V \propto n$ (P, V are constants); $\frac{V_1}{n_1} = \frac{V_2}{n_2}$, No. of moles $n = \frac{m(\text{mass of gas})}{M(\text{molar mass})}$
- 4.1. **Ideal gas equation:** $PV = nRT$ 4.2. $PV = \left(\frac{m}{M} \right) RT$ 4.3. $\frac{P_1V_1}{T_1} = \frac{P_2V_2}{T_2}$
5. **Dalton's law of partial pressure:** Total pressure, $p = p_1 + p_2 + p_3 + \dots$
 Partial pressure $p_1 = \text{Mole fraction} \times \text{Total pressure (p)}$; $p_1 = \frac{n_1}{n} \times p$
6. **Graham's law of diffusion :** $\frac{r_1}{r_2} = \sqrt{\frac{d_2}{d_1}} = \sqrt{\frac{M_2}{M_1}} = \sqrt{\frac{VD_2}{VD_1}} = \frac{v_1t_2}{v_2t_1}$
7. **Kinetic gas equation:** $PV = \frac{1}{3} mnu^2$
8. **Compressibility factor:** $Z = \frac{PV}{nRT}$; For ideal gas $Z=1$
9. **Vander Waal's equation :** $\left(P + \frac{an^2}{V^2} \right) (V - nb) = nRT$ (or) $P = \frac{nRT}{V - nb}$
10. **Universal gas constant R = 8.314 JK⁻¹ mol⁻¹ (or) 0.082 Latm.mol⁻¹K⁻¹**
11. **Boltzman constant k = 1.38 x 10⁻²³ JK⁻¹ per molecule.**
12. **Avogadro number (N_A) = 6.023 x 10²³.**

**BULLET MASTER'S
CHEM BEATS!****ALL NEW GAS LAWS IN OUR EVERYDAY LIFE****Boyle's Law (Ball Pressing Law):**

Rubber Ball ని Press చేస్తూ Pressure పెంచితే దాని Volume తగ్గుతుంది.

Human Lungs Inspiration and Expiration; Syringe by taking blood sample & injecting medicine

Charles's Law (Hot Balloon Law):

Hot Balloons లో Temperature పెంచితే Volume పెరుగుతుంది!

Avogadro's Law (Ambani's Big House Law):

Ambani లా ఎక్కువ డబ్బులు ఉంటే Antilia లా పెద్ద పెద్ద భవంతులు కట్టుకోవచ్చు!!

Graham's Law of Agarbathi:

Prayer Hall లో అగరబత్తినీ వెలిగిస్తే ఆ సువాసన Prayer Hall అంతా వ్యాపిస్తుంది.

Dalton's Law (Daddy's Property Law):

Daddy తన Property మొత్తం తన పిల్లలకే పంచాలనుకొని Dalton's Law ప్రకారం పంచారు $p = p_1 + p_2 + p_3 + \dots$

Ideal Gas Equation:

In Telangana State, Ideal Leader : PV = nTR : Ideal Leader in AP.

P.V.Narasimha Rao was a Great Leader in TS; N.T.Rama Rao was a Great Leader in A.P