STATES OF MATTER

GASES

Intermolecular Forces

LONDON DISPERSION FORCES

The weakest intermolecular forces present among non polar atom and molecules.

DIPOLE-DIPOLE FORCES

Forces act between the molecules possessing permanent dipole.

DIPOLE-INDUCED DIPOLE FORCES

The attractive forces operates between polar molecules having permanent dipole.

Physical properties

- Gases are highly compressible.
- Gases exert pressure equally in all direction.
- Gases have much lower density than liquids.
- Volume and shapes of gases are not fixed
- They mix evenly and completely in all proportions.

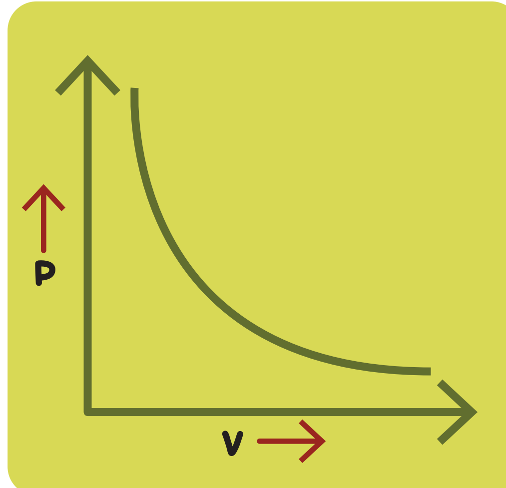
Gas Law

BOYLE'S LAW (PRESSURE-VOLUME RELATIONSHIP)

At Constant Temperature.

$\text{Volume} \propto \frac{1}{\text{Pressure}} \Rightarrow \text{Volume} \times \text{Pressure} = \text{Constant}$

i.e $P_1V_1 = P_2V_2$ or $\frac{P_1}{P_2} = \frac{V_2}{V_1}$

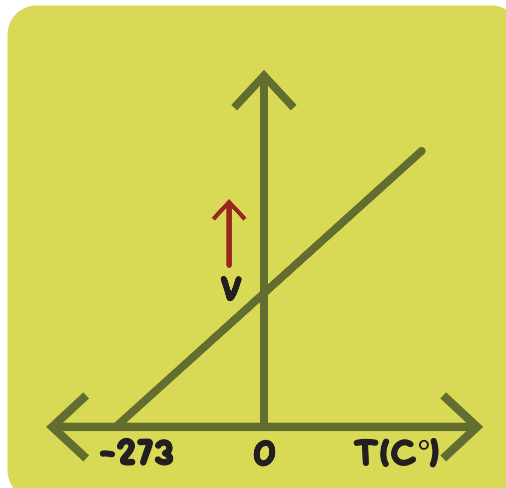


CHARLES LAW (TEMPERATURE-VOLUME RELATIONSHIP)

At Constant Pressure.

$\text{Volume} \propto \text{Temperature} \Rightarrow \frac{V}{T} = \text{Constant}$

i.e $\frac{V_1}{T_1} = \frac{V_2}{T_2}$ or $V_1T_2 = V_2T_1$

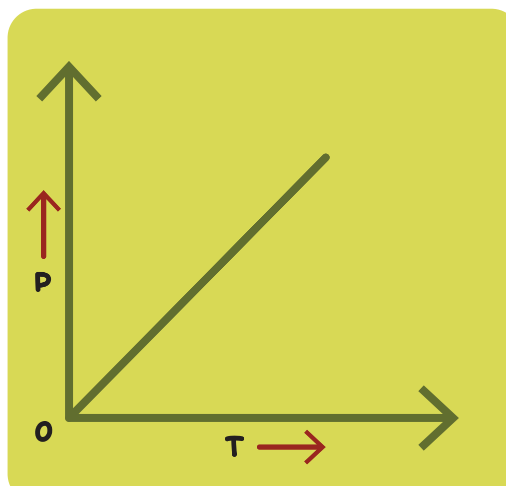


GAY LUSSAC'S LAW (PRESSURE - TEMP RELATIONSHIP)

At Constant volume

$\text{Pressure} \propto \text{temperature} \rightarrow \frac{P}{T} = \text{Constant}$

i.e $\frac{P_1}{T_1} = \frac{P_2}{T_2}$ or $P_1T_2 = P_2T_1$

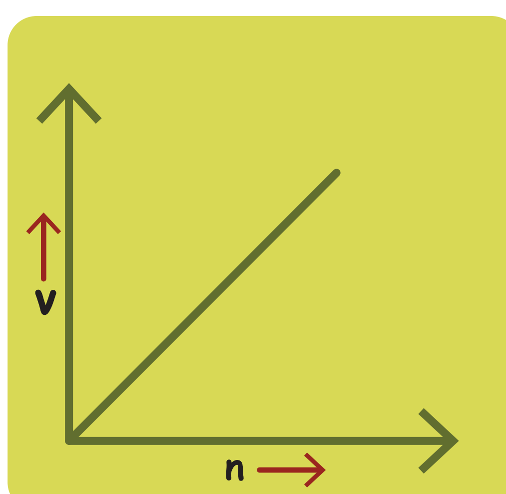


AVAGADRO LAW (VOLUME-AMOUNT RELATIONSHIP)

At Constant Pressure and temperature.

$\text{Volume} \propto \text{No. of Moles} \Rightarrow \frac{V}{N} = \text{Constant}$

i.e $\frac{V_1}{n_1} = \frac{V_1}{n_2}$ or $V_1N_2 = V_2N_1$



IDEAL GAS EQUATION

Combining above all.

$V \propto \frac{1}{P} \times T \times n \Rightarrow PV \propto nt \Rightarrow \boxed{PV = nRT}$

Here 'R' is gas constant

$R = 8.31\ JK^{-1}mol^{-1}$

$R = 0.08\ L\ atm\ k^{-1}mol^{-1}$

$R = 2 \times 10^{-3}\ K\ cal\ K^{-1}mol^{-1}$

Deviation from ideal gas equation (Real gases)

Real gases show deviations from ideal gas law because molecules interact with each other.

Pressure exerted the gas is lower than the pressure exerted by the ideal gas.

$$\boxed{P_{Ideal} = P_{real} + \frac{aN^2}{V^2}}$$

Compressibility factor $(Z) = \frac{PV}{nRT}$

Dalton's Law of Partial Pressure

Total pressure exerted by the mixture of non-reactive gases in equals to the sum of partial pressures of individual gases.

$\boxed{P_{Total} = P_1 + P_2 + P_3 \text{(At constant T. V)}}$

Kinetic-Molecular Theory of Gases

A gas contains a long no of small particles called molecules.

Size and mass of all molecules of each gas are identical

Particles of a gas are always in constant and random motion.

Particles of a gas move in all possible directions in straight line.

Collisions of gas molecules are perfectly elastic.

LIQUID

Liquification of gases

Volume of one mole of gas at critical temperature is called critical volume (V_c) and pressure at this temperature is called critical pressure (P_c)

Surface Tension

It the force acting per unit length perpendicular to the line drawn on the surface of liquid denoted by gamma (γ) unit: Nm-1

Viscosity

Viscosity coefficient (N) is the force when velocity gradient is unity and the area of contact is unit area.

SI Unit: Newton Second per square metre

(NsM^{-2}) = Pas (Pascal Second)