CHEMISTRY

11

CH#3

Gases

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Chapter 3

GASES

States of Matter:- There are four states of matter. They are solid, liquid, gas and plasma.

Properties of Gases

(i) Gases have no definite shape and volume.

(ii) Gases can diffuse نفوذ ہونا and effuse.

(iii) Gases can be compressed by applying pressure.

(iv) Gases expand on heating. (بے ترتیب حرکت)

(v) Gas molecules are always in random motion.

(vi) Gases exert pressure on walls of container.

(vii) Gases have very weak intermolecular forces.

(viii) Due to low density, gases bubble بلبلے بنانا through liquids and tend to rise up.

(ix) When a highly compressed gas suddenly expands, then cooling is produced. It is called **Joule Thomson effect**.

Properties of liquids:- (i) Liquids have definite volume but no definite shape.

(ii) Liquids can not be compressed easily.

(iii) They have high M.P, B.P and densities.
(iv) They have strong intermolecular forces.
(v) Liquids show diffusion and evaporation (تبخیر)
(vi) Liquid molecules have K.E due to their motion.

Properties of Solids:-

(i) Solids have definite shape and volume.
(ii) They are non-compressible
(iii) They can not diffuse into each other.
(iv) They have very strong intermolecular forces.
(v) The solid particles have only vibrational motion.

Units of Pressure

The pressure can be measured in following units

(i) mm Hg (ii) cm Hg (iii) torr (iv) atmosphere
(v) Pascal or Nm^{-2} (vi) PSI (Pounds per square inches)

The unit Psi is mostly used in engineering work. The unit millibar is used by meteorologists. The pressure of air which can support 760 mm Hg column at sea level is called **one** atmosphere. One atmosphere is the force exerted by 76 cm long column of Hg on an area of 1 cm^2 at $0°C$. The S.I. unit of pressure is Nm^{-2}.

one atmosphere = 760 torr = $101325\ Nm^{-2}$

one atmosphere = 101325 Pascal
= 101.325 KiloPascal
= 14.7 Pounds $inch^{-2}$

"GAS LAWS"

The relationships between volume, temperature and pressure of a gas are called GAS Laws. Here we will explain Boyle's Law, Charle's Law, Graham's Law, Dalton's Law and Avogadro's Law

BOYLE'S Law بوائل کا قانون

Boyle's Law states that volume of a given mass of gas is inversly بالعکس proportional متناسب to the pressure applied keeping the temperature constant.

So $V \propto 1/P$

OR $V = K/P$ where K is proportionality constant.

OR $PV = K$

The product حاصل ضرب of pressure and volume of given mass of a gas remains constant keeping the temperature constant.

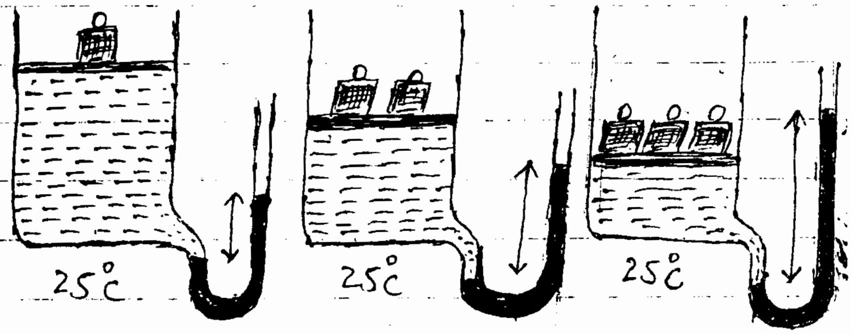
If P_1, V_1 are initial pressure and volume and P_2, V_2 are final pressure and volume, then

$$P_1V_1 = K \quad \text{and} \quad P_2V_2 = K$$

Hence $P_1V_1 = P_2V_2$

Experimental Verification of Boyle's Law

Let us take a given mass بوائل کے قانون کی of a gas in a cylinder. تجرباتی تصدیق The cylinder has a moveable piston and Connected جڑا ہوا to a manometer.



When there is one weight on the piston, then volume of a gas is $1\,dm^3$ and Pressure is 2 atmospheres. When there are two weights on the Piston, then volume of gas is $\frac{1}{2}\,dm^3$ and Pressure is 4 atm. Similarly when Piston is loaded by three equal weights, then volume is $\frac{1}{3}\,dm^3$ and Pressure is 6 atm.

$$P_1V_1 = 2 \times 1 = 2$$

$$P_2V_2 = 4 \times \frac{1}{2} = 2$$

$$P_3V_3 = 6 \times \frac{1}{3} = 2$$

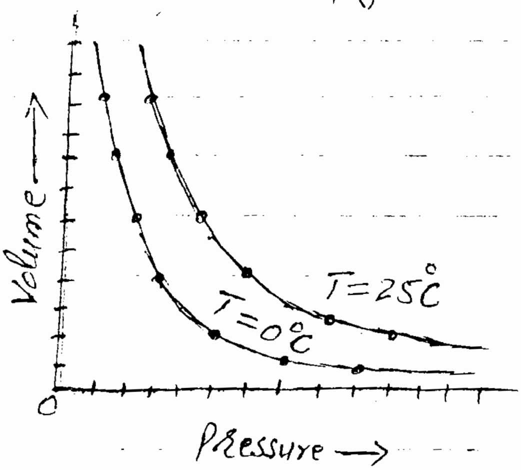
Therefore $P_1V_1 = P_2V_2 = P_3V_3 = K$ (Constant)

Hence Boyle's Law is verified.

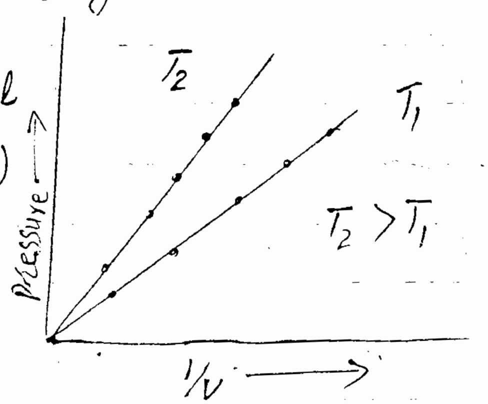
Graphical Explaination of Boyle's Law

When we plot a graph between Pressure and volume of a gas keeping temperature constant, then we get a curve. This curve is called isotherm (iso means same and therm means heat). This curve tells that volume of gas is inversly proportional to the pressure. The two curves at $0°C$ and $25°C$ are shown in figure.

The isotherm at $0°C$ is closer to the both axes. But isotherm at $25°C$ goes away from both the axes

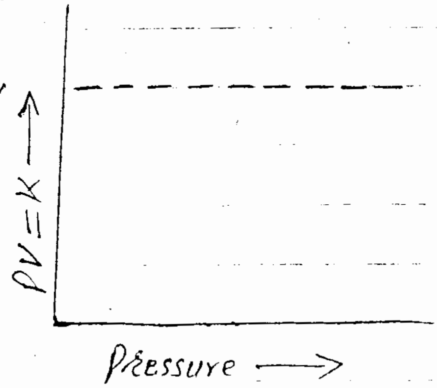


When we plot a graph between $\frac{1}{V}$ and P, then we get straight line. It means that pressure is directly proportional to $\frac{1}{V}$ (inverse of volume) OR P and V are inversly proportional to eachother.



In this graph $1/V$ is taken on x-axis and P is taken on y-axis. If $T_2 > T_1$ then graph at T_2 is closer to a x-axis.

When we plot a graph between P and PV, then we get straight line. This line is parallel متوازی to the x-axis.



In this graph Pressure is taken on x-axis and PV is taken on y-axis. The graph is a dotted line

EXAMPLE(1):- A *gas* having a volume of 10 dm^3 is enclosed in a vessel at 0^{0}C and the pressure is 2.5atm. This gas is allowed to expand until the new pressure is 2atm. What will be the new volume if the temperature is maintained at 273K.

Solution:—

$$V_1 = 10\ dm^3$$
$$T_1 = 0^\circ C + 273 = 273K$$
$$P_1 = 2.5\ atm$$
$$P_2 = 2\ atm$$
$$T_2 = 273\ K$$
$$V_2 = ?$$

Since $T_1 = T_2$, so we apply Boyle's law

$$P_1V_1 = P_2V_2$$
$$(2.5)(10) = 2(V_2)$$
$$V_2 = \frac{2.5 \times 10}{2} \quad \text{or} \quad V_2 = 12.5\ dm^3$$

CHARLE's Law (چارلس کا قانون)

Charle's (1787) gave a relation between temperature and volume of a gas.

This law states that volume of a given mass of a gas is directly proportional (راست متناسب) to the absolute temperature keeping the pressure constant.

Mathematically $V \propto T$

or $V = KT$

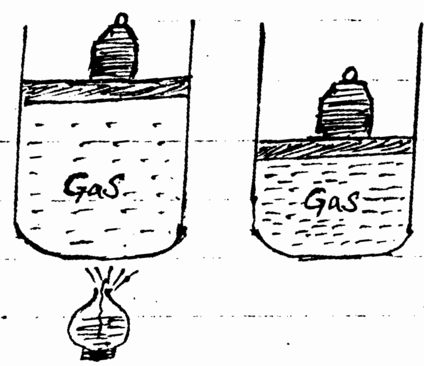
or $V/T = K$

If V_1 and T_1 are initial volume and temperature and V_2, T_2 are final volume and temperature, then

$$V_1/T_1 = K \quad \text{and} \quad \frac{V_2}{T_2} = K$$

OR $$\frac{V_1}{T_1} = \frac{V_2}{T_2}$$

Experimental Verification (تجرباتی تصدیق)



Suppose a given mass of gas in a cylinder. Let V_1 is initial volume and T_1 is initial temperature of gas. We heat the gas. After heating V_2 is final volume and T_2

is final temperature of gas. The ratios V_1/T_1 and V_2/T_2 remain constant

$$\frac{V_1}{T_1} = K \quad , \quad \frac{V_2}{T_2} = K$$

It means $\frac{V_1}{T_1} = \frac{V_2}{T_2}$

OR $\frac{V}{T} = \text{Constant}$

Hence Charle's Law is verified.

EXAMPLE(2):- 250 cm^3 of hydrogen is cooled from 127°C to −27°C by maintaining the pressure constant. Calculate the new volume of the gas at low temperature.

__Solution__ :-

$V_1 = 250\ cm^3$

$T_1 = 127°C + 273 = 400K$

$T_2 = -27°C + 273 = 246K$

$V_2 = ?$

Since Pressure is Constant. So we apply Charle's Law

$$\frac{V_1}{T_1} = \frac{V_2}{T_2}$$

$$\frac{250}{400} = \frac{V_2}{246}$$

$$V_2 = \frac{250 \times 246}{400}$$

$$V_2 = 153.75\ cm^3$$

"Absolute Zero"

The lowest (minimum) possible temperature at which volume of gas should decrease to zero is called absolute zero. It is $-273.15^\circ C$. It is also called zero of Kelvin or absolute scale مطلق سکیل

For explanation we take following statement of Charle's Law.

The volume of given mass of a gas increases or decreases by $\frac{1}{273}$ of its original volume at $0^\circ C$ for $1^\circ C$ rise or fall in temperature keeping the pressure constant. Mathematically we write

$$V_T = V_0 \left(1 + \frac{T}{273}\right)$$

where V_0 = Volume of gas at $0^\circ C$

V_T = Volume of gas at $T^\circ C$

T = Temperature on Centigrade Scale.

Let volume of a gas at $0^\circ C$ is $546\ cm^3$.

The volume of gas at $10^\circ C = 566\ cm^3$

The volume of gas at $100^\circ C = 746\ cm^3$

The volume of gas at $+273^\circ C = 1092\ cm^3$

The volume of gas at $-273^\circ C = 0\ cm^3$

Thus $-273^\circ C$ is called absolute zero.

Now we apply Charle's Law at 10°C and 100°C.

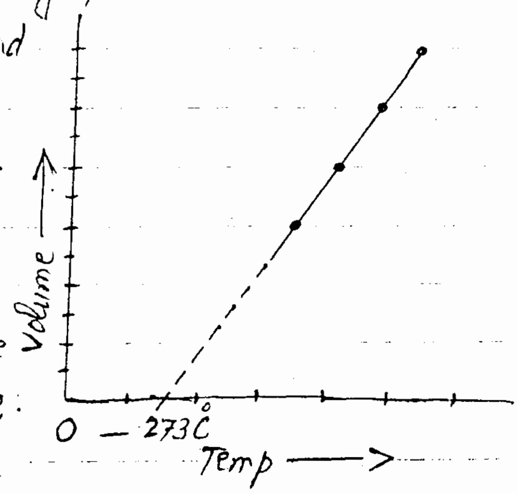
$$\frac{V_1}{T_1} = \frac{V_2}{T_2}$$

$$\frac{566}{10} \neq \frac{746}{100}$$

The two ratios are not equal. So Charle's law does not obey when temperature is taken in Centigrade scale. Hence a new temperature scale is developed. It is called Absolute scale or Kelvin scale of temperature. It starts from −273°C

Graphical Explanation :- وضاحت بذریعہ گراف

When we plot a graph between volume and temperature, we get straight line. On extrapolation, this straight line cuts the temperature axis at −273.15°C.



At −273.15°C the volume of gas should theoretically decrease to zero. In fact (دراصل) it is not possible because gas becomes liquid or solid before reaching $-273^\circ C$. This lowest possible temperature of $-273.16^\circ C$ is called absolute zero or zero of Kelvin scale

$$0\ K = -273.16^\circ C$$

Now we verify Charle's law by Kelvin scale.

$T_1 = 10^\circ C = 10 + 273 = 283K$, $V_1 = 566\ cm^3$

$T_2 = 100^\circ C = 100 + 273 = 373K$, $V_2 = 746\ cm^3$

$$\frac{V_1}{T_1} = \frac{V_2}{T_2} \text{ or } \frac{566}{283} = \frac{746}{373} = 2 = K$$

Scales of Thermometry:- There are three scales of thermometry (measurement of temperature)

(i) Centigrade Scale:- In this scale $0^\circ C$ is taken as freezing point of water and $100^\circ C$ is taken as boiling point of water. The space between two marks is divided into 100 equal parts. Each is called $1^\circ C$.

(ii) Fahrenheit Scale:- In this scale $32^\circ F$ is taken as freezing point of water and $212^\circ F$ is taken as boiling point of water. The space between these two marks is divided into 180 equal parts. Each part is called $1^\circ F$.

(iii) Kelvin Scale:- In this scale freezing point of water is 273K and boiling point of water is 373K. The space between two points is divided into equal 100 parts. Each is called 1K.

$$K = {}^\circ C + 273$$

$$^\circ C = 5/9\,(^\circ F - 32)$$

$$^\circ F = 9/5\,{}^\circ C + 32$$

"Ideal Gas Equation"
OR General Gas Equation

An equation which relates temperature, Pressure and Volume of given mass of a gas is called General Gas Equation

General gas equation is $PV = nRT$

Its derivation is as follows.

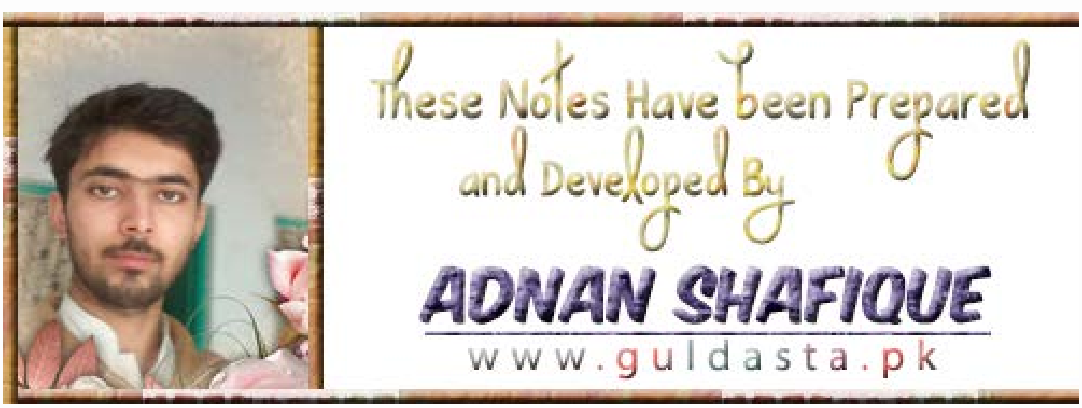
According to Boyle's Law

$V \propto 1/P$ (n, T are constant)

According to Charle's Law

$V \propto T$ (n, P are constants)

According to Avagadro's Law, volume of a gas is directly proportional to the number ... keeping P and T constant



The general gas equation shows that product of pressure and volume is equal to the product of number of moles, general gas constant and absolute temperature.

The general gas equation is

$$PV = nRT$$

If number of moles $n = 1$, then

$$PV = RT \quad \text{OR} \quad \frac{PV}{T} = R$$

Hence $\frac{P_1V_1}{T_1} = R$, $\frac{P_2V_2}{T_2} = R$

Therefore $\frac{P_1V_1}{T_1} = \frac{P_2V_2}{T_2}$ ——— (2)

Equation (2) is also called general gas equation.

The general gas equation can be reduced to Boyle's, Charle's and Avogadro's Laws

$$PV = nRT$$

When n and T are held constants, then

$PV = K$ It is Boyle's Law.

Again $PV = nRT$ OR $V = \frac{nRT}{P}$

when P and n are held constants then

$V = KT$ It is Charle's Law

Again $PV = nRT$ OR $V = \frac{nRT}{P}$

when T and P are constant, then

$V \propto n$ It is Avogadro's Law

Physical meanings of R

The physical meanings of R is given below. If we have one mole of an ideal gas at S.T.P then energy required to increase its temperature by 1K is 0.0821 dm^3 atm.

The value of R is a universal (عالمی) parameter for all gases. It tells that one mole of an ideal gas have same amount of energy.

$R = 0.0821\ dm^3\ atm\ K^{-1} mol^{-1}$

$R = 0.0821 \times 760\ dm^3\ mm\ Hg\ K^{-1} mol^{-1}$

$R = 62.4\ dm^3\ mm\ Hg\ K^{-1} mol^{-1}$

$R = 62.4\ dm^3\ torr\ K^{-1} mol^{-1}$

$R = 62400\ cm^3\ torr\ K^{-1} mole^{-1}$

Density of an Ideal gas

The general gas equation is

$PV = nRT$

But $n = \frac{m}{M}$, so $PV = \frac{m}{M} RT$ —— (1)

or $PM = \frac{m}{V} RT$

or $PM = dRT$ $\quad (d = \frac{m}{V})$

or $\frac{PM}{RT} = d$

or $d = PM/RT$ —— (2)

From this we can calculate density of gas. The density of gas is directly proportional to

General gas Constant

In equation $PV = nRT$, R is called general gas constant or ideal gas constant. It is also called Universal gas constant. We calculate its value for one mole of a gas at STP.

(i)

$n = 1 \text{ mole}$

$P = 1 \text{ atm}$

$V = 22.414 \text{ dm}^3$

$T = 0^\circ C + 273.15 = 273.15 K$

$$R = \frac{PV}{nT}$$

$$= \frac{1 \times 22.414}{1 \times 273.15}$$

$$= 0.0821 \text{ dm}^3 \text{ atm } K^{-1} \text{ mol}^{-1}$$

(ii)

$n = 1 \text{ mole}$

$T = 0^\circ C + 273.15 = 273.15 K$

$P = 101325 \text{ Nm}^{-2}$

$V = 0.0224 \text{ m}^3$

$$R = \frac{PV}{nT}$$

$$= \frac{101325 \text{ Nm}^{-2} \times 0.0224 \text{ m}^3}{1 \text{ mole} \times 273.15 K}$$

$$= 8.31 \text{ Nm } K^{-1} \text{ mol}^{-1}$$

$$= 8.31 \text{ J } K^{-1} \text{ mol}^{-1}$$

$$= \frac{8.31}{4.18} = 1.987 \text{ Cal } K^{-1} \text{ mol}^{-1}$$

molecular mass and Pressure of gas but inversly proportional to its temperature

EXAMPLE(3):- A sample of nitrogen gas is enclosed in a vessel of volume $380cm^3$ at 120^oC and pressure of $101325\ Nm^{-2}$. This gas is transferred to a $10dm^3$ flask and cooled to 27^oC. Calculate the pressure in Nm^{-2} exerted by the gas at 27^oC.

Solution:- $V_1 = 380\ cm^3 = \frac{380}{1000} = 0.38\ dm^3$

$T_1 = 120^oC = 120 + 273 = 393K\ ,\ P_1 = 101325\ Nm^{-2}$

$V_2 = 10\ dm^3\ ,\ T_2 = 27^oC + 273 = 300K\ ,\ P_2 = ?$

$$P_1V_1/T_1 = \frac{P_2V_2}{T_2} \quad \text{or} \quad \frac{101325 \times 0.38}{393} = \frac{P_2 \times 10}{300}$$

$$\text{OR} \quad P_2 = \frac{101325 \times 0.38 \times 300}{393 \times 10} = 2939.2\ Nm^{-2}$$

EXAMPLE(4):- Calculate the density of CH_4 (g) at 0^oC and 1atm pressure. What will happen to the density if (a) temperature is increased to 27^oC, (b) the pressure is increased to 2atm at 0^oC.

Solution:- $T = 0^oC + 273 = 273K\ ,\ P = 1\ atm$

$R = 0.0821\ dm^3\ atm\ K^{-1} mol^{-1}\ ,\ M = 16\ ,\ d = ?$

$$d = \frac{PM}{RT} \quad \text{or} \quad d = \frac{1 \times 16}{0.0821 \times 273}$$

$$d = 0.7138\ g\ dm^{-3}$$

Density at 27^oC:- $T = 27^oC + 273 = 300K$

$P = 1atm\ ,\ R = 0.0821\ dm^3\ atm\ K^{-1} mol^{-1}$

$M = 16\ ,\ d = ?$

$$d = \frac{PM}{RT} = \frac{1 \times 16}{0.0821 \times 300}$$

$$d = 0.649\ g\ dm^{-3}$$

So density decreases when temperature increases from 0^oC to 27^oC.

Density at 0^oC and 2 atm:-

$P = 2\ atm\ ,\ T = 0^oC + 273 = 273K$

$$d = \frac{PM}{RT} = \frac{2 \times 16}{0.0821 \times 273} = 1.427\ g\ dm^{-3}$$

So density increases when Pressure increases.

EXAMPLE(5): - Calculate the mass of $1dm^3$ of NH_3 gas at 30^0C and 1000 mm Hg pressure, considering that NH_3 is behaving ideally.

Solution:- $V = 1dm^3$, $T = 30^\circ C + 273 = 303K$

$P = 1000mmHg = \frac{1000}{760} = 1.351\ atm$, $M = 17$,

$m = ?$ $\quad PV = \frac{mRT}{M}$

or $m = \frac{PVM}{RT} = \frac{1.351 \times 1 \times 17}{0.0821 \times 303} = 0.899\ g$

Avogadro's Law

This law states that equal volumes of all ideal gases at same temperature and Pressure contain equal number of molecules. It means that one mole of an ideal gas at S.T.P has volume $22.414\ dm^3$ and 6.02×10^{23} molecules. For example,

1 mole H_2 at STP $= 22.414\ dm^3 = 6.02 \times 10^{23}$ molecules

1 mole O_2 at STP $= 22.414\ dm^3 = 6.02 \times 10^{23}$ molecules.

$22.414\ dm^3$ of any gas at S.T.P $= 6.02 \times 10^{23}$ molecules

1 " " " " $= \frac{6.02 \times 10^{23}}{22.414} = 2.68 \times 10^{22}$ molecules

We may say that $1\ dm^3$ of each gas has different mass but contains 2.68×10^{22} molecules. The reason is that mass and size of molecules do not affect the volume of gas. It is necessary to note that distance between gas molecules is 300 times greater than their diameters

$$P_{CH_4} = n_{CH_4} \frac{RT}{V} \quad (\text{for methane})$$

By adding three equations we get

$$P_t = P_{H_2} + P_{O_2} + P_{CH_4}$$

$$= n_{H_2} \frac{RT}{V} + n_{O_2} \frac{RT}{V} + n_{CH_4} \frac{RT}{V}$$

$$= (n_{H_2} + n_{O_2} + n_{CH_4}) \frac{RT}{V}$$

$$P_t = n_t \frac{RT}{V}$$

OR $P_t V = n_t RT$ ——— (2)

Equation (2) tells that total pressure of a mixture of gases depends upon total moles of gases.

Partial Pressure of a gas

In the mixture of non reacting gases, each gas exerts its own pressure. It is called partial pressure of that gas.

Let two gases A and B are enclosed in a container having volume V.

$P_A V = n_A RT$ (for gas A)

$P_B V = n_B RT$ (for gas B)

$P_t V = n_t RT$ (for mixture of gases)

Divide first equation by third

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

"Kinetic Molecular theory of gases"

In 1738, Bernoulli put forward (gave) kinetic molecular theory of gases.

The fundamental postulates (points) of kinetic theory are given below.

(i) All the gases consist of very large number of very small particles called molecules.

(ii) The molecules of a gas are very far from one another and there are empty spaces خالی جگہیں among them.

(iii) The actual volume of a gas is very small (negligible) as compared to the volume of gas

(iv) The molecules of a gas move randomly. They collide (ٹکراتے) with one another and with walls of container and change their direction.

(v) The pressure of a gas is due to collisions its molecules on the walls of container.

(vi) The collisions of gas molecules are perfectly elastic لچکدار. The collision with no gain no loss of energy is called elastic collision.

Dalton's Law of Partial Pressures

This law states that total pressure exerted by (of) a mixture of non-reacting gases is equal to the sum of their partial pressures.

If P_1, P_2, P_3 are partial pressures of three gases, then total pressure of the mixture is given by

$$P_t = P_1 + P_2 + P_3 \quad \text{--- (1)}$$

Consider four cylinders each of volume $1 dm^3$. One cylinder contains H_2 having partial pressure of 100 torr. The second cylinder contains O_2 with partial pressure of 400 torr. The third cylinder contains CH_4 with partial pressure of 500 torr. The three gases are transferred to the fourth cylinder at same temperature.

According to Dalton's law

$$P_t = P_{H_2} + P_{O_2} + P_{CH_4}$$

$$= 100 + 400 + 500$$

$$= 1000 \text{ torr}$$

Now we apply general gas equation

$$PV = nRT \quad \text{OR} \quad P = n\frac{RT}{V}$$

$$P_{H_2} = n_{H_2}\frac{RT}{V} \quad \text{(for Hydrogen)}$$

$$P_{O_2} = n_{O_2}\frac{RT}{V} \quad \text{(for oxygen)}$$

OR $P_A / P_t = n_A / n_t$

OR $P_A = \frac{n_A}{n_t} P_t$

OR $P_A = x_A P_t$ where x_A is called mole fraction of gas A.

Similarly $P_B = x_B P_t$

Applications of Dalton's Law of Partial Pressure

i) When we collect a gas over water, then some water vapours mix with gas and gas becomes moist (wet). So pressure of moist gas is given as

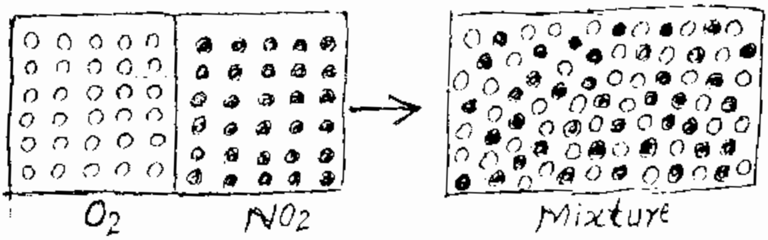
$$P_{moist} = P_{dry} + P_{H_2O\ vapour}$$

$$P_{moist} = P_{dry} + \text{Aqueous Tension}$$

$$P_{dry\ gas} = P_{moist} - \text{Aqueous Tension}$$

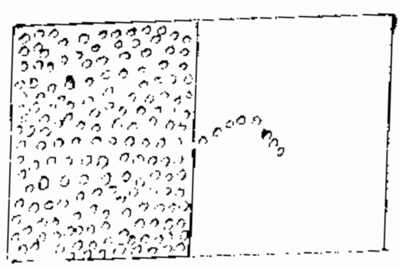
(ii) The respiration (breathing) of animals depends upon partial pressure of gases. The partial pressure of oxygen in the air is 159 torr and in the lungs partial pressure of oxygen is 116 torr. It is the reason that oxygen moves into the lungs. Similarly CO_2 comes out of the lungs because its pressure inside the lungs is

Diffusion:- The spontaneous intermixing of different gases to give homogeneous mixture is called diffusion. For example spreading of scent and spreading of fragrance of rose. The diffusion of gases is due to collisions and random motion of their molecules. The diffusion of NO_2 (a brown coloured gas) and O_2 (a colourless gas) takes place when partition between them is removed. It is shown below in figure.

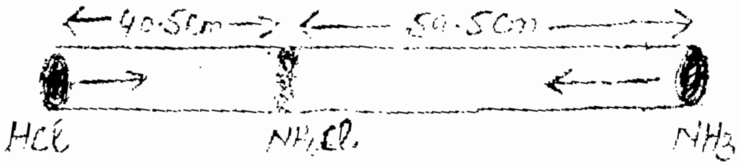


Effusion

The escape نکل جانا of gas molecules through an extremely (very) small hole is called Effusion. For example Leakage نکل جانا of Sui gas in our kitchen. In effusion gas molecules donot collide but come out one by one from high pressure to low pressure. It is shown in figure.



Demonstration of Graham's Law



A 100 cm long glass tube is taken. Two cotton plugs soaked in HCl and NH_3 solutions are fitted at two ends of tube. HCl travels 40.5 cm distance and NH_3 covers 59.5 cm distance in same time. At the point of junction they produce white fumes سفید دھواں of NH_4Cl.

$$NH_3 + HCl \longrightarrow NH_4Cl$$

$$r_{NH_3}/r_{HCl} = \sqrt{M_{HCl}}/\sqrt{M_{NH_3}}$$

OR $\quad 59.5/40.5 = \sqrt{36.5}/\sqrt{17}$

OR $\quad 1.46 = 1.46$

Hence Graham's Law verified.

EXAMPLE(7):- 250cm³ of the sample of Hydrogen effuses four times as rapidly as 250cm³ of an unknown gas. Calculate the molar mass of unknown gas.

Solution:- Rate of effusion of H_2, $r_{H_2} = 4$

Rate of effusion of unknown gas, $r_x = 1$

$$M_{H_2} = 2\ g\ mol^{-1},\ M_x = ?$$

$$r_{H_2}/r_x = \sqrt{M_x}/\sqrt{M_{H_2}}$$

$$4/1 = \sqrt{M_x}/\sqrt{M_{H_2}} \quad \text{or} \quad \frac{M_x}{2} = 16$$

$$\text{or} \quad M_x = 16 \times 2 \quad \text{or} \quad M_x = 32\ g\ mol^{-1}$$

(vii) The molecules of a gas have no forces of attractions

(viii) Force of gravity has no effect on the gas molecules. It is due to their continued collisions between them.

(ix) The average kinetic energy of gas molecules is directly proportional to its absolute temperature

Importance of Kinetic theory:- With help of kinetic theory of gases, Clausius (1857) derived kinetic equation of gases. From kinetic equation, gas laws are derived. Maxwell explained kinetic theory and gave law of distribution of velocities. Boltzmann gave distribution of energies among the molecules. The Van der Waal's equation is also the result of kinetic theory of gases.

Kinetic Equation of gases

The gas molecules collide with one another and with the walls of container. In this way gas molecules exert force on the walls. The force exerted by gas molecules on unit area is called Pressure of gas. R.J Clausius gave an expression for the Pressure of a gas. It is called kinetic equation of gases. It is given below

$PV = \frac{1}{3} m N \bar{C^2}$ where P is Pressure, V is volume, m is mass of one molecule, N is number of molecules in a vessel and $\bar{C^2}$ is the mean square velocity

Law of distribution of velocities:- Maxwell gave the law of distribution of velocities. This law states that gas molecules are in a form of group having definite velocity ranges.

Mean Square Velocity

We know that all the molecules of a gas donot have same velocities. So we use the term mean square velocity. The average of the squares of all the possible velocities is called mean square velocity. It is denoted by $\overline{c^2}$.

It is given below.

$$\overline{c^2} = \frac{n_1 c_1^2 + n_2 c_2^2 + n_3 c_3^2 + \cdots\cdots}{n_1 + n_2 + n_3 + \cdots\cdots}$$

where n_1 is the number of molecules moving with velocity c_1, n_2 is the number of molecules moving with velocity c_2 and so on.

Here $n_1 + n_2 + n_3 + \cdots\cdots = N$

Root mean Square Velocity

When we take the square root (جذر) of $\overline{c^2}$, then it is called root mean square velocity. It is denoted by C_{rms}. It is given as

$$C_{rms} = \sqrt{\overline{c^2}}$$

The equation for root mean square velocity is derived from Kinetic equation

$$C_{rms} = \sqrt{3RT/M}$$

where C_{rms} is root mean square velocity, M is molar mass of gas, T is absolute temperature

Avogadro's Law:-

Consider two gases 1 and 2 at same temperature and pressure having same volume. Their kinetic equations are

$$PV = \frac{1}{3} m_1 N_1 \overline{C_1^2} \quad \text{for gas (1)}$$

$$PV = \frac{1}{3} m_2 N_2 \overline{C_2^2} \quad \text{for gas (2)}$$

By comparing above equations

$$\frac{1}{3} m_1 N_1 \overline{C_1^2} = \frac{1}{3} m_2 N_2 \overline{C_2^2}$$

or $$m_1 N_1 \overline{C_1^2} = m_2 N_2 \overline{C_2^2} \quad \text{——— (1)}$$

Because both are at same temperature, so K.E per molecule will be same

$$\frac{1}{2} m_1 \overline{C_1^2} = \frac{1}{2} m_2 \overline{C_2^2} \quad \text{——— (2)}$$

By dividing eq (1) by (2)

$$\frac{m_1 N_1 \overline{C_1^2}}{\frac{1}{2} m_1 \overline{C_1^2}} = \frac{m_2 N_2 \overline{C_2^2}}{\frac{1}{2} m_2 \overline{C_2^2}}$$

OR $N_1 = N_2$ It is Avogadro's Law.

Graham's Law of diffusion:-

The kinetic equation of gases is

$$PV = \frac{1}{3} m N \overline{C^2}$$

for one mole of gas $N = N_A$

So $$PV = \frac{1}{3} m N_A \overline{C^2}$$

or $$PV = \frac{1}{3} M \overline{C^2} \quad (m N_A = M)$$

"Kinetic theory and gas laws"

We can derive گیسی gas laws from Kinetic theory of gases.

Boyle's Law:- According to Kinetic theory of gases, kinetic energy is directly proportional to absolute temperature.

The K.E of N molecules is $\frac{1}{2}mN\bar{C}^2$

$$\frac{1}{2}mN\bar{C}^2 \propto T$$

$$\text{OR } \frac{1}{2}mN\bar{C}^2 = KT \quad \text{——— (1)}$$

According to Kinetic equation of gases

$$PV = \frac{1}{3}mN\bar{C}^2$$

$$= \frac{2}{3}\left(\frac{1}{2}mN\bar{C}^2\right) \quad \text{—— (2)}$$

Putting eq (1) into (2) we get

$$PV = \frac{2}{3}KT \quad \text{—— (3)}$$

If Temperature is constant, then right hand side of eq (3) is constant

So $PV = K'$ It is Boyle's Law

Charle's Law:-

We know that $PV = \frac{2}{3}KT$

$$\text{or } V = \frac{2}{3}\frac{KT}{P} \quad \text{——— (1)}$$

If pressure is constant then,

$$\frac{2}{3}\frac{K}{P} = K' \quad (\text{Constant})$$

Therefore eq (1) becomes $V = K'T$

or $V \propto T$ It is Charle's law.

OR $\overline{c^2} = \frac{3PV}{M}$

OR $\sqrt{\overline{c^2}} = \sqrt{3PV/M}$

OR $C_{rms} = \sqrt{3P/M/V}$

OR $C_{rms} = \sqrt{\frac{3P}{d}}$ $(M/V = d)$

Since C_{rms} (root mean square velocity) is equal to rate of diffusion of gas

So rate of diffusion $= \sqrt{\frac{3P}{d}}$

or $r \propto \sqrt{1/d}$ when P is constant

It is Graham Law of diffusion.

"Kinetic Interpretation of Temperature"

The Kinetic equation of gases is

$$PV = \frac{1}{3} mN\overline{C^2}$$

OR $PV = \frac{2}{3}N(\frac{1}{2}m\overline{C^2})$

OR $PV = \frac{2}{3}N E_K$ where $E_K = \frac{1}{2}m\overline{C^2}$

For one mole of gas $N = N_A$

So $PV = \frac{2}{3}N_A E_K$ ——— (1)

The general gas equation is

$$PV = nRT$$

$PV = RT$ —(2) for one mole

Comparing eq (1) and (2)

$$\frac{2}{3} N_A E_K = RT$$

OR $$E_K = \frac{3RT}{2N_A}$$

OR $$E_K \propto T$$

We ~~may~~ say that absolute temperature is directly proportional to the average kinetic energy of gas molecules.

When heat flows from hot body to cold body then high energy molecules collide with low energy molecules. This process continues until the average K.E of all molecules become equal. Thus temperature of both bodies becomes equal.

For gases and liquids the temperature is directly proportional to average translational K.E of molecules.

For solids temperature is directly proportional to vibrational kinetic energy.

(Principle of Liquefaction of gases)

A gas can be changed into liquid by applying high pressure and low temperature. It is called Liquefaction of gases. The liquefaction of a gas depends upon Joule Thomson effect and Critical temp.

Critical Temperature:- The highest temperature at which a substance can exist as a liquid is called critical temperature (T_c) OR The temperature above which a gas can not be liquified, no matter how much pressure is applied is called critical temperature. For example T_c of CO_2 is 31.1°C (304.3K) and that of NH_3 is 132.44°C (405.6K). The critical temperature of a gas depends upon its size, shape and intermolecular forces. The non-polar gases have low critical temperature and polar gases have high T_c values. The pressure required to liquify a gas at its critical temperature is called critical pressure. For example P_c of CO_2 is 73 atm and that of NH_3 is 111.5 atm. The volume occupied by one mole of a gas at critical temperature and pressure is called critical volume. It is denoted by V_c. For example V_c of O_2 is 74.4 $cm^3 mol^{-1}$, V_c of CO_2 is 95.65 $cm^3 mol^{-1}$ and V_c of H_2 is 64.51 $cm^3 mol^{-1}$.

The critical temperatures and pressures of some gases are given below.

Substance	Critical Temperature	Critical Pressure
Water vapours, H_2O	647 6K (374 44°C)	217 0atm
Amonia NH_3	405.6K (132 44°C)	111 5atm
Freon - 12, CCl_2F_2	384.7K (111 54°C)	39.6atm
Carbon dioxide, CO_2	304.3K (31 142C°C)	73 0atm
Oxygen, O_2	154 4K(-118.75°C)	49.7atm
Argon, Ar	150.9K (-122 26°C)	48 atm
Nitrogen, N_2	126 1K (-147 06°C)	33 5 atm

Comparing eq (1) and (2)

$$\frac{2}{3} N_A E_K = RT$$

or $$E_K = \frac{3RT}{2N_A}$$

or $$E_K \propto T$$

We ~~may~~ say that absolute temperature is directly proportional to the average kinetic energy of gas molecules.

When heat flows from hot body to cold body then high energy molecules collide with low energy molecules. This process continues until the average K.E of all molecules become equal. Thus temperature of both bodies becomes equal.

For gases and liquids the temperature is directly proportional to average translational K.E of molecules.

For solids temperature is directly proportional to vibrational kinetic energy.

(Principle of Liquefaction of gases)

A gas can be changed into liquid by applying high pressure and low temperature. It is called Liquefaction of gases. The liquefaction of a gas depends upon Joule Thomson effect and Critical temp.

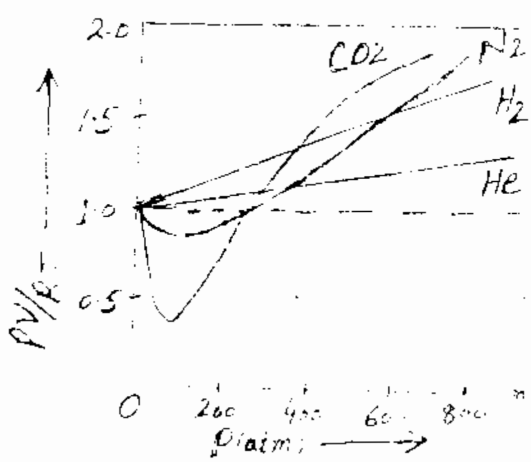
is repeated again and again till the air is completely liquefied.

Real gases ← Non ideal gases

"Non Ideal behaviour of gases"

A gas which obeys gas laws (Boyle's, Charle's and general gas equation) at all temperatures and pressures is called an ideal gas e.g H_2, He, N_2 are ideal at low pressure and high temperature. A gas which does not obey gas laws at all temperatures and pressures is called non Ideal gas. The real gases do not obey gas laws at all temperatures and pressures. It is called Non ideal behaviour of gases. We plot a graph between $\frac{PV}{RT}$ and pressure. The graph is a straight for an ideal gas but the graph shows deviation for real gases.

The graph plotted at 0°C is shown in figure. It tells that N_2 and CO_2 show negative deviation at low pressure



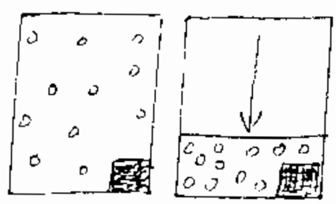
Causes of deviations :- It was Van der Waal (1873) who determined that real gases show deviation from ideal behaviour at low temperature and high pressure. It is due to two false points of Kinetic molecular theory of gases.

(i) The molecules of a gas have no force of attraction

(ii) The actual volume of gas is negligible (very small) as compared to volume of the vessel (برتن کا حجم)

Very Low Temperature :- At very low temperature the K.E and velocity of gas molecules decreases. Thus forces of attraction become significant. So point of Kinetic theory does not hold. Therefore gas shows non ideal behaviour.

Very High Pressure :- Under normal Conditions, the actual volume of a gas is negligible as compared to volume of Container. But at very high pressure it does not hold because actual volume becomes significant. Thus point of Kinetic theory becomes false. Therefore gas shows non ideal behaviour.

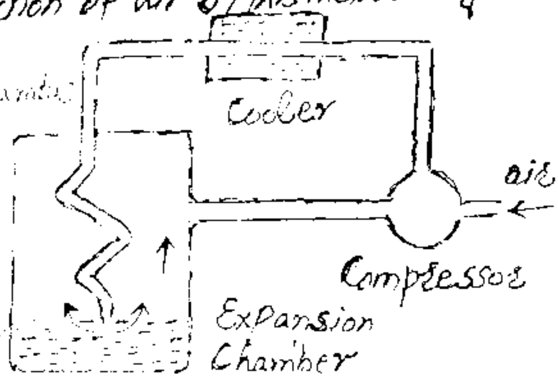


Joule Thomson Effect

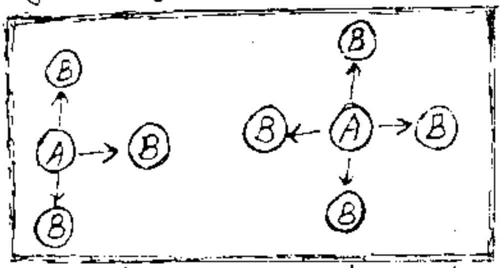
When a highly compressed gas show sudden expansion then cooling is produced. It is called Joule Thomson effect. A highly compressed gas has very close molecules and strong intermolecular forces. When gas suddenly expands, the molecules move apart and energy is required to break intermolecular forces. This energy is taken from the gas itself. Thus gas cools.

Linde's Method of Liquefaction:- Linde's method is used for liquefaction of all gases except H_2 and He. The liquefaction of air by this method is given below

The apparatus consists of a Compressor, Cooler, Spiral pipe and expansion Chamber



The air is compressed to 200 atm by a Compressor. Some heat is produced in this Compression. This heat is removed by cooler. Then air passes through a spiral pipe having a jet at the end. At the jet gas (air) expands freely. The pressure decreases from 200 atm to 1 atm. Thus air is cooled. This cooled air goes up again. This process not exert full Pressure due to backward attraction of neighbouring molecules. It is shown in figure



Thus observed Pressure is less than the actual Pressure P_i by an amount P'.

$$P = P_i - P'$$

$$\text{or} \quad P_i = P + P'$$

The value of P' is given as

$$P' = \frac{a}{V^2}$$

where "a" is called Coefficient of attraction or attraction Per unit volume. Therefore

$$P_i = P + \frac{a}{V^2} \quad \text{------} (2)$$

After making volume and Pressure corrections, the Kinetic equation for one mole of gas is

$$\left(P + \frac{a}{V^2}\right)(V - b) = RT \quad \text{---} (3)$$

For n moles of gas

$$\left(P + \frac{a n^2}{V^2}\right)(V - nb) = nRT \text{---} (4)$$

It is called Vander waal's equation and a, b are called Vander waal's Constants

How to Prove $P' = \frac{a}{V^2}$

we find the value of P' as follows.

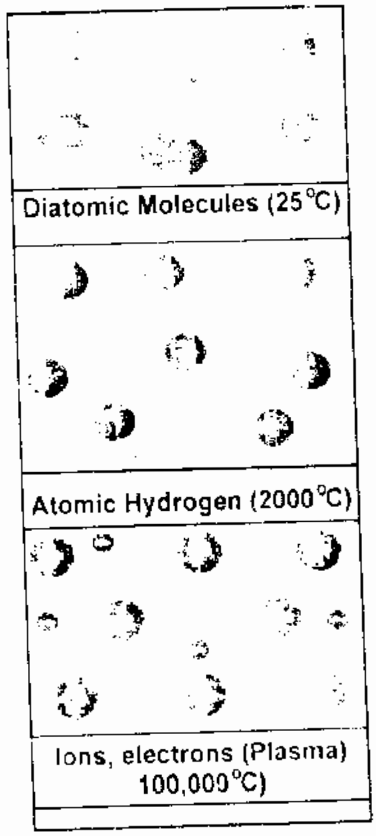
We take a gas in a container. There

Plasma State

What is Plasma? Plasma is called "Fourth state of matter". It was identified by the English Scientist William Crookes in 1879. About 99% of our visible Universe consists of Plasma. An ionized gas mixture which consists of ions, electrons and neutral atoms is called Plasma. The man-made examples of Plasma are neon signs and fluorescent bulbs.

How is Plasma formed?

Plasma is formed after the ionization of atoms or molecules. When more heat is given to a substance, then many of its atoms or molecules are ionized. For example a highly heated gas produces clouds of free electrons, ions and neutral atoms. This ionized gas mixture which consists of ions, electrons and neutral atoms is called Plasma. In the figure the formation of Plasma is shown. At 25°C hydrogen is in molecular state, at 2000°C hydrogen is in atomic state and at 100000°C hydrogen is in plasma state.



The auroras are the bands of coloured light seen on the night sky in the most northern or Southern Parts.

Applications of Plasma :-

(i) Plasmas light up our offices and homes.
(ii) Our Computers and electronic devices work on the basis of Plasma.
(iii) Plasmas are used to drive lasers and Particle accelerators.
(iv) They are used to Pasteurize foods.
(V) They are used for generation of electrical energy and removal of hazardous chemicals.
(Vi) They are used in lasers, lamps, diamond coated films and Semiconductors etc.
(Vii) Neon signs work on basis of Plasma. A neon sign is a glass tube filled by neon gas. By Passing electricity atoms are charged, excited and ionized. Thus a glowing Plasma is Produced in tube.
(Viii) A Fluorescent light bulb also works on the basis of Plasma. It contains a gas which Produces glowing Plasma

Future Horizons:- The scientists are trying to creat metastable molecules by using low energy Plasma. The metastable molecules are used for many specific Purposes. For example the Problem of radioactive Contamination will be solved.

EXERCISE

Q1. Select the correct answer out of the following alternative suggestions.

(i) Pressure remaining constant, at which temperature the volume of a gas will become twice of what it is at 0°C.

a. 546°C b. 200°C c. 546K d. 273K

(ii) Number of molecules in one dm^3 of water is close to

a. $\frac{6.02}{22.4} \times 10^{23}$ b $\frac{12.04}{22.4} \times 10^{23}$ c $\frac{18}{22.4} \times 10^{23}$

d. $55.6 \times 6.02 \times 10^{23}$

(iii) Which of the following will have the same number of molecules at STP?

a. 280 cm^3 of CO_2 and 280 cm^3 of N_2O

b. 11.2dm^3 of O_2 and 32g of O_2

c. 44g of CO_2 and 11.2dm^3 of CO

d. 28g of N_2 and 5.6 dm^3 of oxygen

(iv) If absolute temperature of a gas is doubled and the pressure is reduced to one half, the volume of the gas will:

a. remain unchanged b. increase four times

c. reduce to 1/4 d. be doubled

(v) How should the conditions be changed to prevent the volume of a given gas from expanding when its mass is increased?

a. Temperature is lowered and pressure is increased.

b. Temperature is increased and pressure is lowered.

c. Temperature and pressure both are lowered.

d. Temperature and pressure both are increased.

(vi) The molar volume of CO_2 is maximum at

a. STP b. 127 °C and 1 atm c. 0°C and 2 atm d. 273 °C and 2 atm

(vii) The order of the rate of diffusion of gases NH_3, SO_2, Cl_2 and CO_2 is:

a. $NH_3 > SO_2 > Cl_2 > CO_2$ b. $NH_3 > CO_2 > SO_2 > Cl_2$

c. $Cl_2 > SO_2 > CO_2 > NH_3$ d. $NH_3 > CO_2 > Cl_2 > SO_2$

(viii) Equal masses of methane and oxygen are mixed in an empty container at 25°C. The fraction of total pressure exerted by oxygen is

a. $\frac{1}{3}$ b. $\frac{8}{9}$ c. $\frac{1}{9}$ d. $\frac{16}{17}$

(ix) Gases deviate form ideal behaviour at high pressure. Which of the following is correct for non-ideality?

a. At high pressure, the gas molecules move in one direction only.

b. At high pressure, the collisions between the gas molecules are increased manifold.

Answer:- a see page No. 67-68 (b) see page No. 69

(C) When pressure of gas is plotted against inverse of volume ($1/V$), we get straight line. The reason is that P and $1/V$ are directly proportional.

(d)(i) In Boyle's law, the product PV increases by increasing the temperature. It is due to increase of volume by increase of temperature.

(ii) When quantity (mass) of gas increases, then product PV increases. It is due to increase in volume by increasing the mass of gas.

Q5 (a) What is the Charles's law? Which scale of temperature is used to verify that $V/T = k$ (pressure and number of moles are constant)?

(b) A sample of carbon monoxide gas occupies 150.0 ml at 25.0°C. It is then cooled at constant pressure until it occupies 100.0 ml. What is the new temperature?

(c) Do you think that the volume of any quantity of a gas becomes zero at - 273.16 °C. Is it not against the law of conservation of mass? How do you deduce the idea of absolute zero from this information?

Answer:- see page No 71. 74. 75

(b) $V_1 = 150\,ml$, $V_2 = 100\,ml$

$T_1 = 25^\circ C + 273 = 298\,K$, $T_2 = ?$

$$\frac{V_1}{T_1} = \frac{V_2}{T_2} \quad \text{or} \quad \frac{150}{298} = \frac{100}{T_2}$$

$$\text{or } T_2 = \frac{100 \times 298}{150} = 198.66\,K$$

$$\text{or } T_2 = 198.66 - 273 = -74.34^\circ C$$

(C) We think that volume of gas does not become zero at $-273.16^\circ C$. It is against the law of conservation of mass. All gases become liquids or solids to liquid or solid [illegible] in gcm^{-3} then its value may go to [illegible] of decimal. But when density is expressed in $g\,dm^{-3}$ then its value is accurately expressed [illegible]able

Q8. Derive the units for gas [illegible] gas equation:

(a) when the pressure is in atmosphere [illegible] in dm^3

(b) when the pressure is in Nm^{-2} and volume in m^3

(c) when energy is expressed in [illegible]

Answer:- see page No. 79

Q9. (a) What is Avogadro's law of gases?

(b) Do you think that 1 mole of [illegible] NH_3 at 0°C and 1 atm pressure will have Avogadro's [illegible]

(c) Justify that 1 cm^3 of H_2 [illegible] STP will have same number of molecules, [illegible] CH_4 is 8 times heavier than that of hydrogen.

Answer: (a) see page No. 81

(b) We know that NH_3 [illegible] and H_2 is non-polar. So molecules of NH_3 [illegible] by H-bonding. Thus number of [illegible] in one mole of NH_3 will be [illegible] 0°C and 1 atm

(c) According to Avogadro's [illegible] equal volumes of all gases contain equal [illegible] at same temperature and pressure [illegible] and size of molecules do not affect [illegible] thus we may say that $1cm^3$ of H_2 and [illegible] CH_4 at STP will have same number of molecules.

Q10. (a) Dalton's law of partial pressures is only obeyed by those gases which don't have attractive forces among their molecules. Explain it.

(b) Derive an equation to find out the partial pressure of a gas knowing the individual moles of component gases and the total pressure of the mixture.

(c) Explain that the process of respiration obeys the Dalton's law of partial pressures.

Q14. (a) Derive van der Waal's equation for real gases.

(b) What is the physical significance of van der Waal's constants. 'a' and 'b'? Give their units.

Answer:- (a) see page No 101, 102 (b) see page No 103

Q15. Explain the following facts.

i). The plot of PV versus P is a straight line at constant temperature and with a fixed number of moles of an ideal gas.

ii). The straight line in (a) is parallel to pressure-axis and goes away from the pressure axis at higher pressures for many gases.

iii). Pressure of NH_3 gas at given conditions (say 20 atm pressure and room temperature) is less as calculated by van der Waal's equation than that calculated by general gas equation.

iv). Water vapours donot behave ideally at 273K.

v). SO_2 is comparatively non-ideal at 273K but behaves ideally at 327 °C.

Answer:- (i) According to Boyle's law, the product of pressure and volume of a given mass of a gas remains constant at constant temperature. When we change pressure on a gas, then its volume also changes such that the product PV remains constant. It is the reason that plot of PV versus P is always straight line. This straight line is parallel to the x-axis (pressure axis)

(ii) According to boyle's law the product of P and V remains constant at constant temperature But at high pressure, the molecules of a gas come very close and their inter-molecular forces become strong. So they show deviation from ideal behaviour. Hence straight line is not obtained in the plot of PV versus P.

Q 16. Helium gas in a 100 cm^3 container at a pressure of 500 torr is transferred to a container with a volume of 250 cm^3. What will be the new pressure (a) if no change in temperature occurs (b) if its temperature changes from 20 °C to 15 °C ?

Solution:-(a)

$V_1 = 100\ cm^3$

$P_1 = 500$ torr

$V_2 = 250\ cm^3$

$P_2 = ?$

$$P_1V_1 = P_2V_2 \quad or \quad P_2 = \frac{P_1V_1}{V_2}$$

$$P_2 = \frac{500 \times 100}{250} \quad or \quad \boxed{P_2 = 200\ torr}$$

(b) $V_1 = 100\ cm^3$, $P_1 = 500$ torr

$V_2 = 250\ cm^3$, $P_2 = ?$

$T_1 = 20°C + 273 = 293K$, $T_2 = 15°C + 273 = 288K$

$$\frac{P_1V_1}{T_1} = \frac{P_2V_2}{T_2} \quad OR \quad \frac{500 \times 100}{293} = \frac{P_2 \times 250}{288}$$

$$P_2 = \frac{500 \times 100 \times 288}{293 \times 250} = \boxed{196.58\ torr}$$

Q17. What are the densities in kg/m^3 of the following gases at STP ($P = 101325\ Nm^{-2}$, T=273 K, molecular mass is in kg mol^{-1}) Methane, oxygen, hydrogen.

Solution:-(i) Density of methane, d = ?

$P = 101325\ Nm^{-2}$

$T = 273K$

$M = 16\ g\ mol^{-1} = 16 \times 10^{-3}\ kg\ mol^{-1}$

$R = 8.31\ J K^{-1} mol^{-1}$

$$d = \frac{PM}{RT} = \frac{101325 \times 16 \times 10^{-3}}{8.31 \times 273}$$

$d = 0.714\ Kg\ m^{-3}$

Solution:- $V = 255\,cm^3 = \frac{255}{1000} = 0.255\,dm^3$

$P = 10\,torr = \frac{10}{760} = 0.013\,atm$

$T = 25^{\circ}C + 273 = 298\,K \quad , \quad M = ?$

$m = 12.1\,mg = \frac{12.1}{1000} = 0.0121\,g$

$PV = nRT$

$PV = \frac{m}{M}RT \quad or \quad M = \frac{mRT}{PV}$

$$M = \frac{0.0121 \times 0.0821 \times 298}{0.013 \times 0.255}$$

$$\boxed{M = 89.7\ g\ mol^{-1}}$$

Q20. What pressure is exerted by a mixture of 2.00 g of H_2 and 8.00 g if N_2 at 273 K in a 10 dm^3 vessel?

Solution:- mass of $H_2 = 2.00\,g$

moles of $H_2 = \frac{2.00}{2.00} = 1$

mass of $N_2 = 8\,g$

moles of $N_2 = 8/28 = 0.286$

Total moles $= 1 + 0.286 = 1.286$

$T = 273\,K$, Volume of mixture $= 10\,dm^3$

Pressure of mixture $= ?$

$PV = nRT \quad or \quad P = \frac{nRT}{V}$

$or\ P = \frac{1.286 \times 0.0821 \times 273}{10} \quad or\ P = 2.88\,atm$

Q21. a. The relative densities of two gases A and B are 1:1.5. Find out the volume of B which will diffuse in the same time in which 150 dm^3 of A will diffuse?

b. Hydrogen (H_2) diffuses through a porous plate at a rate of 500 cm^3 per minute at $0^{\circ}C$. What is the rate of diffusion of oxygen through the same porous plate at $0\,^{\circ}C$.

c. The rate of effusion of an unknown gas A through a pinhole is found to be 0.279 times the rate of effusion of H_2 gas through the same pinhole. Calculate the molecular mass of the unknown gas at STP.

گلدستہ ڈاٹ پی کے کی جانب سے خوش آمدید

السلام علیکم ورحمتہ اللہ وبرکاتہ

مختصر تعارف

کافی عرصہ سے خواہش تھی کہ ایک ایسی ویب سائٹ بناؤں جس پر طالب العلموں کیلئے کچھ تعلیمی مواد جمع کر سکوں۔ اللہ تعالیٰ نے توفیق دی اور میں نے ایک سال کی محنت کے بعد ایک سائٹ "گلدستہ ڈاٹ پی کے" کے نام سے بنائی جو کہ قرآن و حدیث، اصلاحی، دلچسپ، تاریخی قصے واقعات، اُردو انگلش تحریریں، شاعری و اقوالِ زریں، F.Sc اور B.Sc کے مضامین کے آن لائن نوٹس، اسلامک، تفریحی، معلوماتی وال پیپرز، حمد و نعت، فرقہ واریت سے پاک اسلامی بیانات، پنجابی نظمیں و ترانے اور کمپیوٹر و انٹرنیٹ کی دنیا کے بارے میں ٹپس، آن لائن کمائی کرنے کے مستند طریقہ کار۔
کے ساتھ ساتھ اور بھی بہت سی چیزوں پر مشتمل ہے۔ اور انشاء اللہ میں مزید وقت کے ساتھ ساتھ اضافہ کرتا جاؤں گا۔ آپ کی قیمتی رائے کی ضرورت ہے۔ عرنان شفیق

اہم نوٹ

ذیل میں جو نوٹس مہیا کیے گئے ہیں وہ کئی گھنٹوں کی لگاتار محنت کے مرتب ہوئے ہیں۔ اور آپ کو بالکل مفت مہیا کر رہے کیے جا رہے ہیں۔آپ سے ان کی قیمت صرف اتنی سی متوقع ہے کہ ایک بار درودِ ابراھیمی اپنی زبان سے ادا کر دیں۔

بِسمِ اللّٰہِ الرَّحمٰنِ الرَّحیم

اَللّٰھُمَّ صَلِّ عَلٰی مُحَمَّدٍ

وَّعَلٰی اٰلِ مُحَمَّدٍ کَمَا صَلَّیتَ

عَلٰی اِبرَاھِیمَ وَعَلٰی اٰلِ اِبرَاھِیمَ

اِنَّکَ حَمِیدٌ مَّجِیدٌ ؕ

اَللّٰھُمَّ بَارِک عَلٰی مُحَمَّدٍ وَّعَلٰی

اٰلِ مُحَمَّدٍ کَمَا بَارَکتَ عَلٰی

اِبرَاھِیمَ وَعَلٰی اٰلِ اِبرَاھِیمَ

اِنَّکَ حَمِیدٌ مَّجِیدٌ ؕ