TENDER HEART HIGH SCHOOL, SEC-33B, CHD 8.4.24

CLASS- X SUBJECT- CHEMISTRY
CHAPTER-5 TEACHER-MOHINISHA

Good morning to all the students!

Students this lesson is for class-X for the subject of chemistry, Topic :- 'Boyle's law' which is covered in chapter-5 'Mole concept and Stoichiometry' starting on page no-69 of your text-book titled -concise chemistry by 'Selina Publication' and is being submitted to you on 8April,2024

All students may now please open page no-69 of your notebook in front of you.

If all students are ready then let us start with this chapter. All students may now please listen carefully.

We have already studied Gas laws in the previous class and we know that pressure, volume and temperature of a gas are inter-dependent. The change in any one of these affects the other two.

**Boyle's Law :-** Volume of a dry gas is inversely proportional to its pressure at constant temperature.

(P.T.O)

CLASS = X SUBJECT - CHEMISTRY
CHAPTER - 5 TEACHER - MOHINISHA THAKUR

$P_1V_1 = P_2V_2 = K$ (At consistant temperature)

## Charles's law :-

Volume of a dry gas is directly proportional to its temperature at constant pressure.

$$\frac{V_1}{T_1} = \frac{V_2}{T_2} = K \quad \text{(At constant pressure)}$$

## Gas Equation :-

By combining both the above laws

$V \propto \frac{1}{P}$ and $V \propto T$ we can write $V \propto \frac{1}{P} \times T$

or $V = \frac{T}{P} \times K$ [constant]

or $\frac{PV}{T} = K$, Thus $\frac{P_1V_1}{T_1} = \frac{P_2V_2}{T_2}$

**STP** - Standard Temperature Pressure
Standard values of temperature and pressure are reffered to measure gas volume's because they change with change in temperature and pressure. So the values are
- standard Temperature = 0°C or 273 Kelvin
- standard Pressure = 760 mm or 76 cm of Hg

Now we will study some new laws.

CLASS- X SUBJECT- CHEMISTRY
CHAPTER-5 TEACHER-MOHINISHA THAKUR

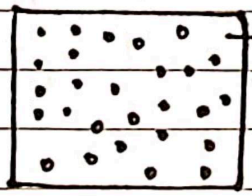
# Gay-Lussac's Law Of Combining Volumes

According to this law when gases react then their volumes are in simple ratio to one another and also with the gaseous product formed.

Let us try to understand with the help of some examples.

$$2H_2 + O_2 \longrightarrow 2H_2O \text{ (water vapour)}$$
$$2 : 1 : 2$$

This ratio is for the volume of gases. It means 2 litres of hydrogen gas will react with 1 litres of oxygen gas to form 2 litres of water vapour. If $O_2$ gas was 3 litres then it would require $3 \times 2 = 6$ litres of $H_2$ gas and will form 6 litres of $H_2O$ vapours. This 1:2 will always be followed.



→ Hydrogen and oxygen gas mixture
Hydrogen = 5 litres
Oxygen = 2 Litres

When the mixture is ignited reaction starts and water vapour is formed. We know that they will react in ratio of 1:2

1 litre of $O_2$ requires 2 litres of $H_2$
∴ 2 litres of $O_2$ requires 4 litres of $H_2$

CLASS- X SUBJECT- CHEMISTRY
CHAPTER-5 TEACHER- MOHINISHA THAKUR

But the container has 5 litres of $H_2$, it means 1 litre of $H_2$ will remain unused because $O_2$ gas is used up.
Here $O_2$ is called as → Limiting reagent
And 1 lit. of left $H_2$ is called → Residual Gas

Let us solve the Numerical problems of Ex 5(A)

Q4 a) $2CO + O_2 \rightarrow 2CO_2$
2 : 1 : 2
(100L) ?

2 Volumes of CO will require 1 volume of $O_2$
∴ 100 lit of CO will require 50 lit of $O_2$

b) $2H_2 + O_2 \rightarrow 2H_2O$
2 : 1 : 2
($200cm^3$) ($150cm^3$)

200 $cm^3$ of $H_2$ will require 100 $cm^3$ of $O_2$.
Therefore Unused $O_2 = 150 - 100 = 50 cm^3$

Q5 $CH_4 + 2O_2 \rightarrow CO_2 + 2H_2O$
1 : 2 : 1
(24cc) (106cc)

24 cc of $CH_4$ will require $24 \times 2 = 48$ cc of $O_2$
24 cc of $CH_4$ will produce 24 cc of $CO_2$

CLASS- X SUBJECT- CHEMISTRY

CHAPTER- 5 TEACHER- MOHINISHA THAKUR

($CH_4$ and $CO_2$ have same ratio)

Result :- 24cc of $O_2$ + 106 - 48 = 58cc of unused $O_2$.

This experiment supports Gay Lussac's law

Students now, we will discuss the next topic which is 'Atomicity'

## Atomicity :-

The number of atoms in a molecule of an element is called its atomicity.

It has various types :-

### (a) Monoatomic :-

It is a type molecule which is composed of only one atom. Examples :- Inert gases like Helium, Neon, Argon etc.

### (b) Diatomic :-

It is a type of molecule which is composed of two atoms. Examples :- $H_2$, $O_2$, $Cl_2$, $N_2$, etc.

### (c) Triatomic :-

It is a type of molecule which composed of three similar atoms. Examples :- Ozone gas ($O_3$).

(P, T, O)

CLASS- X SUBJECT- CHEMISTRY
CHAPTER- 5 TEACHER- MOHINISHA THAKUR

(d) Tetratomic :-

It is a type of molecule which composed of four similar atoms. Example :- Phosphorus ($P_4$).

(e) Octatomic :-

It is a type of molecule which composed of eight similar atoms. Example :- $S_8$

Students, note it

Molecules made up of same type of atoms are homoatomic molecules, e.g, phosphorus ($P_4$), Ozone ($O_3$) etc. while molecules made up of different types of atoms are hetero-atomic molecules, e.g, HCl, $NH_3$ etc.

Students let us move on the next topic of this Chapter which is 'Avogadro's Law'

Avogadro's law :-

According to this law equal volumes of all gases under similar conditions of temperature and pressure contain same number of molecules.

Example :- At STP if x number of molecules are present in 2 litres of $H_2$ gas then in 2 litres (P, T, O)

CLASS- X SUBJECT- CHEMISTRY
CHAPTER- 5 TEACHER- MOHINISHA THAKUR

of $CO_2$ x number of molecules will be present

If at same temperature and pressure we have

$O_2 = 10L$ AND $N_2 = 20L$, and molecules in $O_2$ Molecules = X Then in $N_2$ molecules will be 2x

let us solve Q19 and Q21 of Exercise -5A

Q19 $CO_2$ = 2 litres, $Cl_2$ = 3 litres, $H_2$ = 5 litres $N_2$ = 4 litres, $SO_2$ = 1 litre [At same temp and Pressure]

a) Greatest number of molecules will be in 5 litres of $H_2$
b) Least number of molecules will be in 1 litre of $SO_2$

Q21 (i) 150 cc of gas A = x molecules

$\therefore$ 1 cc of gas A = $\frac{x}{150}$ molecules

$\therefore$ 75 cc of gas A = $\frac{x}{150} \times 75 = \frac{x}{2}$ molecules

Since gas A and B are at same temperature and pressure, so 75 cc of gas A and B will contain same number of molecules which is $\frac{x}{2}$.

(ii) Avogadro's law.

(P.T.O.)

DOMS Page No. 8
Date 3/4/23

CLASS- X SUBJECT- CHEMISTRY
CHAPTER- 5 TEACHER- MOHINISHA THAKUR

Students, now I will give you three a very short Questions. You will get a three minutes break to write the answers.

The Questions are :-

Q1 :- Write the equation for charles's law.
Q2 :- What is the full form of S.T.P?
Q3 :- Give an example of octatomic molecule.

I hope you all have written the answers by now. Let us check the answers now.

Ans1 :- $\frac{V_1}{T_1} = \frac{V_2}{T_2} = K$ (At constant pressure).

Ans2 :- S.T.P stands for Standard Temperature Pressure.

Ans3 :- $S_8$.

Students, Now I am ending the lesson for today by giving 'Instructions' and 'Homework'. You all are required to read the lesson again and revise all the topics which we have done today. and Homework is Do Question-7, 9, 11, 13, 14, 17, 18 of Exercise-5A of your chemistry note book.

(End)