Date: 11th July-2023 Day: Tuesday

# Chemistry: 1 STOICHIOMERRY

## Lecture: 01

## Stoichiometry

derived from a greek words stoicheion (elements) and metry (measurement)

The study of relative amounts of substances involved in a chemical reactions.

## Stoichiometric Amounts

The amounts of el reactants & products in a balanced chemical equation are called stoichiometric Amounts.

## Assumptions:

→ Reactant molecules are completely converted into product.

→ The reaction is irreversible.

→ No Side Reactions.

## Uses

- Solving Probs in Labs.
- Chemical industries
- engineering
- food manfacturing etc.

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**Mole:** The atomic mass, formula mass and molecular mass of a substance expressed in grams is called Mole.

Atoms.

One mole of Na = 23g

Molecule

One mole of $H_2$ = 2g

Formula unit

One mole of NaCl = 58.2g.

## Avagrdro Number

The number of atoms, ions, molecules present in one mole of a substance is Avagadro No.

$6.022 \times 10^{23}$

→ 1 mole (Particle) = $6.023 \times 10^{23}$

atoms/molecules/formula unit

mole ∝ Avagadro No.

~~1 mole of any gas~~

→ Volume occupy by 1 mole = $22.414 dm^3 = 6.022 \times 10^{23}$ of any gas (STP)

→ Temp = 0°c

→ Presure = 1 atm.

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Date: 11th-July-23 Day: Wednesday

# Lecture: 02

## Molar Ratios

Moles Ratio is the ratio of no. of moles reactant taking part & no. of moles of product formed.

example:

$$C_3H_8 + 5O_2 \longrightarrow 3CO_2 + 4H_2O$$

coefficient determines moles.

1 mole of Propane & 5 moles of oxygen are used to form 3 moles of $CO_2$ & 4 Moles of water.

It is balanced so propane dont effect the ratio.

## How "Mole to Mole"

## Self-Check Exercise 101

### Data

1 mole of nitrogen

3 moles of Hydrogen.

2 moles of Ammonia.

5.0 moles of $NH_3$ (Alternation).

### Find

a) Nitrogen = ?

b) Hydrogen = ?

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## Formula

C.O.M

C = Compare

O = make one

M = Multiply

## Solve

a) Moles of $NH_3 = 5.0$

$N_2 = NH_3$

$1N_2 = 2NH_3$.

$1NH_3 = \frac{1N_2}{2}$ of.

$1NH_3 = \frac{1 \times 5.0}{2}$ of $N_2$

$= 2.5$ moles of $N_2$

b) Moles of $NH_3 = 5.0$.

$H_2 = NH_3$.

$3H_2 = 2NH_3$.

$NH_3 = \frac{3}{2} H_2$.

$5.0$ moles of $NH_3 = \frac{3 \times 5.0}{2}$ of $H_2$

$= 7.5$ moles of $H_2$.

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13th-July-23 Thursday

# Lecture : 03

mole as a bridge

## "Mass to Mass Conversion"

Mass - Moles - Mass

## Self-Assessment 10

### Data

Mass of hydrogen = $1.02 \times 10^5$ kg

### Equation

$2H_2 + O_2 \longrightarrow 2H_2O$.

### Method

COM. & No. of moles = Mass / Molar mass.

### Solve

$2H_2 + O_2 \longrightarrow 2H_2O$.

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→ first kg → g.

→ $1.02 \times 10^{5}$ kg. → $1.02 \times 10^{5} \times 10^{3}$ → $1.02 \times 10^{8}$ g

→ No. of moles of $2H_2$ = $\frac{\text{Mass}}{\text{Molar mass}}$

$= \frac{1.02 \times 10^{8}}{2}$

$= 5.1 \times 10^{7}$ moles.

→ 2 moles of $H_2$ = 1 moles of $O_2$.

→ 1 moles of $H_2$ = $\frac{1 \text{ moles of } O_2}{2}$

→ $5.1 \times 10^{7}$ moles of $H_2$ = $\frac{1 \times 5.1 \times 10^{7}}{2}$

$= 25500000$

$= 2.55 \times 10^{7}$ moles of $O_2$.

→ Mass = No. of moles × molar mass

$= 2.55 \times 10^{7} \times (16 \times 2)$

$= 816000000$

$= 8.16 \times 10^{8}$ g

$= 8.16 \times 10^{3} \times 10^{5}$ g

= ~~8.16 kg oxygen.~~ $8.16 \times 10^{5}$ kg oxygen.

**Result**

→ The Mass of $O_2$ is ~~8.16 kg.~~ $8.16 \times 10^{5}$ kg.

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14th July-23 Thursday.

# Lecture: 04

## Self-Check Exercise 1.3

a) **Data**

Volume of $O_2$ = 50.0 $dm^3$

Standard volume = 22.414 $dm^3$

**Required**

No. of moles = ?

**Solve**

$$\text{moles} = \frac{\text{given volume}}{\text{stand. volume}}$$

$$\text{moles} = \frac{50}{22.414}$$

$$= 2.23\ dm^3$$

b) **Data**

No. of moles = 0.80.

Standard volume = 22.414 $dm^3$

**Required**

Volume = ?

**Solve**

Volume = moles × Stand. volume

$$= 0.80 \times 22.414 = 17.93\ dm^3$$

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17-July-23.

# Lecture : 05

## Percentage Composition

When the relative amounts of each elements in a compomd is expressed in percentage is Percentage composition.

### How to Calculate

We need to find:

→ Calculate molar mass

→ Then for percentage. Calculate the mass of element in 1 mole of compomd & divide by molar mass, multiply by 100.

Eog

MgO

$$\% = \frac{24}{40} \times 100$$

$$= 60\% \text{ of Mg.}$$

OR

$$\% = \frac{16}{40} \times 100$$

$$= 40\% \text{ of O.}$$

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# Limiting Reaction/Reactant

## Limiting

That The reactant that is completely consumed in chemical reactions or reactant which produces the least number of moles of reactant in a chemical Reaction.

## Non-Limiting

The reactant that is left unchecked, unused, unreacted after completion of reactions in Non-limiting.

## Power of Limiting

The limiting can stopes a reactions.

examples:

$$2H_2 + O_2 \longrightarrow 2H_2O$$

10 moles of $H_2$ & 7 moles of $O_2$. How many $H_2O$?

COM:

$$2H_2 = 2H_2O$$

$$H_2 = \frac{2}{2} \text{ moles of } H_2O$$

$$10\,H_2 = \frac{2}{2} \times 10$$

$$= 10 \text{ moles of } H_2O.$$

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$O_2 = 2H_2O$

$7\ O_2 = 7 \times 2\ H_2O$

$= 14$ moles of $H_2O$

$H_2$ is limiting Reactant.

$O_2$ is Non-Limiting Reaction.

How many mass $H_2O$?

Mass = $10 \times 18$

$= 1800g$.

→ 10 moles of $H_2$ but not $O_2$ because $H_2$ is limited, it will be finished. No further reaction would be proceeded.

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# Lecture: 06

## Self-Check 104

01.

a) Mass of Zn = 6g.

No. of moles = $\frac{6}{65.3}$

= 0.091 moles of Znc.

Mass of S = 4g.

No. of moles = $\frac{6.4}{32}$

= 0.0125 moles of S.

COM:

Zn = ZnS.

1 mole of Zn = 1 mole of ZnS.

0.091 moles = 0.091 moles of ZnS.

& S = ZnS.

1 mole of S = 1 mole of ZnS.

0.0125 moles of S = 0.0125 moles of ZnS.

→ Zn is 0.091 thee 0.1 that means it is limiting reactant.

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b) Mass of ZnS = 0.091 × 97.3

= 8.85g of ZnS.

Q2. $2Al + 3Br_2 \longrightarrow 2AlBr_3$

a) Mass of Al = 15.8g

Moles of Al = $\frac{15.8}{27}$

= 0.585 moles of Al

Mass of $Br_2$ = 55.6g

Moles of $Br_2$ = $\frac{55.6}{160}$

= 0.347 moles of $Br_2$.

COM

$2Al \longrightarrow 2AlBr_3$.

$Al = \frac{2AlB_3}{2}$.

0.585 moles of Al = 0.585 moles of $AlBr_3$.

$3Br_2 \longrightarrow 2AlBr_3$.

$Br_2 = \frac{2AlBr_3}{3}$.

0.347 moles of $Br_2 = \frac{2}{3} \times 0.347$ moles of $AlBr_3$

= 0.231 moles of $AlBr_3$

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Bromine is limiting reactant.

b) Mass = $0.231 \times \cancel{187}\ 267$

= 61.9g g $AlBr_3$.

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19/07/23 wednesday

# Lecture: 07

## Ex 10.8

1- 1.87 moles of $NH_4Cl$.
1.35 moles of $Ca(OH)_2$

$$Ca(OH)_2 + 2NH_4Cl \longrightarrow CaCl_2 + 2NH_4OH$$

during reaction $Ca(OH)_2$ moles?

$2NH_4Cl = 1.Ca(OH)_2$

$NH_4Cl = \frac{1 Ca(OH)_2}{2}$

$1.87 = \frac{1}{2} \times 1.87$ moles of $Ca(OH)_2$

$= 0.935$ moles of $Ca(OH)_2$

R-left = Initial moles of $Ca(OH)_2$ - final moles of $Ca(OH)_2$

$= 1.35 - 0.935$

$= 0.415$

Mass $= 0.415 \times 74$

$= 30.71$g of $Ca(OH)_2$

Unreacted $Ca(OH)_2$ is 30.71g.

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ideal (No loss) real (loss)

# Theoretical Yield, Actual yield, And Percentage

Product/ output

- Woh yield joh ap Paper & Pen pr kartey hy.
- Actual yield through experiment. & errors also occur.
- Percent yield me actual yield divide by Theoretical yield multiply by 100.

"The quantity of Product obtained by balance chemical equation. is Theoretical yield."

"The quantity of Product obtained/ Produced by chemical reaction/ chemical process is Actual yield."

"The ratio of actual yield & Theoretical yield is Percentage Yield. Percentage yield measures effencicy of reaction."

## Reasons of loss in Actual Yield

- Side reaction may produce side product.
- Reversible reaction. (Product not completely formed)
- Mechanical loss. (due to distillation, fraction, filteration, separation, washing, crystallization.).

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Q2) $CH_4 + 2H_2O \longrightarrow CO_2 + 4H_2$.

a) mass of methane = 1250g

1 mole = 16g.

1250g = $\frac{1}{16} \times 1250$ mole of $CH_4$

= 78.125 moles of $CH_4$.

$CH_4 = CO_2$.

78.125 = 78.125 moles of $CO_2$.

Mass = $78.125 \times 44$

= 3437.5 ~~mass~~ g of $CO_2$.

Theoretical mass = 3437.5g. of $CO_2$

b) Percentage yield = $\frac{\text{Actual yield}}{\text{Theoretical yield}}$

= $\frac{3000}{3437.5} \times 100\%$ of $CO_2$

= 87.27% of $CO_2$.

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21/07/23 HoW Friday

# Review Questions

Q2i) 58.5amu are term as formula mass and not molecular mass of NaCl. Why?

## Answer

formula mass is used for ionic compounds.

## Reason

### NaCl as an ionic compound

58.5amu is formula mass of NaCl & not molecular mass because formula mass is meant for ionic compound & molecular mass is meant for covalent compound. Since NaCl is an ionic compound & thus form crystals, so its classified into formula mass. They did not exist as molecules, independent molecules. So,.

formula mass of NaCl = Na + Cl

= 23 + 35.5

= 58.5amu

## Conclusion

Thus, we conclude that NaCl is ionic compound & for ionic compound formula mass is used.

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ii) Concept of limiting reactant is not applicationble for reverse reaction. Explain?

**Answer**

Product is not prominent.

**Explanation**

**Limiting Reactant**

The Reactant that is present in small amount & thus produces less product.

**Non-Limiting Reactant**

That reactant present in large amount & thus produces more product.

**Reasons** (In this Q's heading of Reversible & irreversible c

Now in it reversible reaction, not a stable condition is present. Reactant & product are continously reacting that p does not produces a prominent & proper product. As reversible reaction never stops, therefore no limiting react would be present in it. be adde

$$2SO_2 + 2O_2 \longrightarrow 2SO_3$$

**Conclusion**

Thus limiting reactant is only meant for irreversible reactant & not for reversible reaction.

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iii) How many covalent bonds are present in 9g of $H_2O$.

Covalent bond consists of molecules. In order to find bond, we need to find that how many molecules is present in 9g of $H_2O$ so,


**Data**

Mass of $H_2O$ = 9g

**Find**

Bonds = ?

**Calculation**

first no. of molecules.

No. of moles = $\frac{\text{Particles (ions, atoms, molecules)}}{N_A}$

Molecules = No. of moles × $N_A$.

No. of moles = ?

$\therefore$ No. of moles = $\frac{\text{Mass}}{\text{Molar mass}}$

Molecules = $\left(\frac{\text{mass}}{\text{molar mass}}\right) \times N_A$

$= \left(\frac{9}{18}\right) \times 6.022 \times 10^{23}$

$= 3.011 \times 10^{23}$ molecules

Since in 1g of $H_2O$ two bonds are present. So how many will be present in 9g.

Bonds = $2 \times 3.011 \times 10^{23}$

$= 6.022 \times 10^{23}$ bonds of $H_2O$.

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## Statement / Result

So No. of bonds in 9g of $H_2O$ are $6.022 \times 10^{23}$.

iv)

| Limiting Reactant | Non-Limiting Reactant |
|---|---|
| **Definition** | |
| The reactant that is present in lesser amount & produces less product. | The reactant that is present in excess amount & produces more product. |
| **Cost** | |
| It is expensive. | It is quite cheaper. |
| **Consumption** | |
| It is consumed completely & stops the reaction. | It is not consumed completely & doesn't stops the reaction. |
| **Example** | |
| $Mg + S \longrightarrow MgS$ | |
| S is limiting reactant. | Mg is non-limiting reactant. |

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v) How many molecules of water are there in 12g of ice.

**Data**

Mass of ice = 12g

**Find**

No. of molecules = ?

**Formula**

No. of moles = $\frac{\text{Mass}}{\text{molar mass}}$ , No. of moles = $\frac{\text{Particle (atoms, molecules)}}{N_A}$

**Solve**

No. of moles of ice = $\frac{12}{18}$

= 0.666 moles of ice

Molecules = $0.666 \times 6.023 \times 10^{23}$

= $4.011 \times 10^{23}$ molecules of ice

**Result**

The Molecules of $H_2O$ in 12g of ice are $4.011 \times 10^{23}$.

vi) Which contain more atoms, 1 mole of Fe or 1 mole of $H_2$? Justify.

**Answer**

The $H_2$ contain more atoms.

**Explanation**

The atomic mass, formula mass, ions present in 1 mole is 1 mole.

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The compaision between Fe & $H_2$ is not same. This is because Fe is an atom whereas $H_2$ is a molecule. So, Fe contain $6.022 \times 10^{23}$ atoms. But in $H_2$, two H combines to form the molecules. Hence $2 \times 6.023 \times 10^{23} = 1.2046 \times 10^{24}$.

**Conclusion**

$H_2$ contains more atoms.

vii) **Answer**

Molecules of 1 mole does not depend on mass.

~~Conclusion~~

**Explanation**

The 1 mole of any substance will be equal to Avagadro Number $6.023 \times 10^{23}$. It is direct relation between moles & NA. The diff compond have different mass, atomic mass, molecules mass, But when it comes to 1 mole of any substance, the mass doesn't depend or effect. it ~~mus~~ must be equal to $6.023 \times 10^{23}$.

**Eog**

18g of $H_2O$ = $6.023 \times 10^{23}$ molecules = 1 mole
32g of $O_2$ = $6.023 \times 10^{23}$ molecules = 1 mole

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## Conclusion

No. of molecules are independent of mass.

viii) ## Answer

23g of Na & 238g uranium have equal number of atoms.

## Explanation

23g of Na = 1 mole & 238g uranium = 1 mole.

The atomic mass, formula mass, molecular mass expressed in g is 1 mole. Therefore, they all are equal to 1 mole. Now 1 mole is equal to Avagadro Number.

The Number of atoms, molecules, ions is in 1 mole of substance is $N_A$.

Therefore, when both atoms are equal to 1 mole, they both will have same no. of atoms.

moles $\propto$ Avagadro.

1 mole of every substance = $6.023 \times 10^{23}$ (atoms, molecules---)

## Conclusion

It can be concluded, they had equal no. of atoms.

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ix) **Mass to Mass**

**Data**

Mass of $KClO_3$ = 5.0g.

**Find**

Mass of $O_2$ = ?

**Equation**

$$2KClO_3 \longrightarrow 2KCl + 3O_2$$

**Solve**

No. of moles of $KClO_3$ = $\frac{\text{mass}}{\text{molar mass}}$

$= \frac{5.0}{39 + 35.5 + 16 \times 3}$

$= 0.040$ moles of $KClO_3$.

COM Method:

2 moles of $KClO_3$ = 3 moles of $O_2$.

reacts to produce

1 mole of $KClO_3$ = $\frac{3}{2}$ moles of $O_2$

0.040 moles of $KClO_3$ = $\frac{3}{2} \times 0.040$ moles of $O_2$

$= 0.06$ moles of $O_2$.

Mass = mole × molar mass

$= 0.06 \times 32$

$= 1.92$g of $O_2$

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**Result**

The mass of $O_2$ is 1.92g.

x) **Answer**

No relation exists between mass & volume.

**Explanation**

**Relations**

There exists a relation between mole & volme.

That 1 mole of any gas occupies 22.414 $dm^3$ of volme at S.T.P. That is known as Molar volme relation.

But there's no relation b/w mass & ~~of~~ volme.

**Conclusion**

Relation exists b/w ~~mass~~ mole & volme Not b/w mass & volme.

xi) Refer to pg 14.

xii) **Representation of Particles in 1 mole of Gas**

The Molar Volme Relation tell us that :-

One of any gas at S.T.P occupies 22.414 $dm^3$ of space.

Therefore any gas at S.T.P (Temp = 0°C, Pressure =

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180/1atm) will occupy 22.414 $dm^3$ space.

**Examples**

- Volume of one mole of $H_2$ = 22.414 $dm^3$
- Volume of one mole of $NH_3$ = 22.414 $dm^3$
- Volume of one mole of $Cl_2$ = 22.414 $dm^3$

Q3b)

**Data**

Density of $CHBr_3$ = 2.89 $gcm^{-3}$

No. of molecules of $CHBr_3$ = $4.8 \times 10^{24}$

**Find**

Volume = ?

**Solve**

$$d = \frac{m}{V}$$

$$V = \frac{m}{d}$$

we need to find ~~molecules~~ mass.

No. of moles = $\frac{\text{No. of Particles (molecules, atoms ...)}}{N_A}$

No. of moles = $\frac{4.8 \times 10^{+24}}{6.023 \times 10^{23}}$

= 7.970 moles of $CHBr_3$.

Mass = moles × molar mass

= 7.970 × ~~283~~ 253.

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$= 2016.4g$

$V = \frac{m}{d}$

$= \frac{2016.4g}{2.89 g\,cm^{-3}}$

$= 697.7\,cm^3$ of $CHBr_3$.

Q40)

| Actual yield | Theoretical yield |
|---|---|
| **Definition** | |
| The quantity of product obtained from balanced chemical equation. | The quantity of product that produced by a chemical reaction. |
| **Amount** | |
| It is present in lesser amount. | It is present in greater amount. |
| **Experiment** | |
| It is actual experiment. | It is an ideal experiment |
| **Eog** | |
| $Zn + CuSO_4 \rightarrow ZnSO_4 + Cu$. | |
| Actual yied is 0.9392g Cu. | Theoretical yield is 0.5072 g. |

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b) **Data**

Mass of $H_2$ = 42.0g

Actual yield of $NH_3$ = 120.02g.

**find**

percentage yield = $NH_3$ = ?

**Solve**

$$N_2 + 3H_2 \longrightarrow 2NH_3.$$

No. of moles of $H_2$ = $\frac{\text{mass}}{\text{molar mass}}$

= $\frac{42.0}{2.}$

= 21 moles of $H_2$.

COM.

No. of moles of $H_2$ : No of moles of $NH_3$

3 moles of $H_2$ = 2 moles of $NH_3$.

= $\frac{2}{3}$ moles of $NH_3$.

21 moles of $H_2$ = $\frac{2}{3} \times 21$ moles of $NH_3$.

= 14 moles of $NH_3$

Mass = mole × molar mass

= 14 × 17

= 238 g of $NH_3$.

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Percentage yield of $NH_3 = \frac{120.62}{238} \times 100$

$= 50.5\%$

95a) Refer to pg # 11.

b) **Data**

$C_6H_{12}O_6$

Mass of C = 72 g

Mass of H = 12 g

Mass of O = 96 g

Molar mass = 180 g

**Formula**

$\% = \frac{\text{mass of 1 element}}{\text{molar mass of compound}} \times 100$

**Find**

% of each element.

**Solve**

| | | |
|---|---|---|
| $\% \text{ of } C = \frac{72 \times 100}{180}$ | $\% \text{ of } H = \frac{12 \times 100}{180}$ | $\% \text{ of } O = \frac{96 \times 100}{180}$ |
| $= 40\%$ | $= 6.66\%$ | $= 53.3\%$ |

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Q6a) Pg # 14.

Q6b)

**Data**

Volume of Al = $250\ cm^3$

density of Al = $2.70\ g\ cm^{-3}$

**Find**

mass of H = ?

**Solve**

Moles of Al.

So first we'll find the mass.

$m = d \times v$.

$m = 250 \times 2.70$

$= 6.75\ g$.

No. of moles $= \frac{6.75}{27}$

$= 0.25$ of Al.

C.O.M.

$2Al + 6HCl \longrightarrow AlCl_3 + 3H_2$.

$2Al \longrightarrow 3H_2$.

$Al = \frac{3}{2} H_2$.

$0.25$ moles of $Al = \frac{3}{2} \times 0.25$ moles of $H_2$.

$= 0.375$ moles of $H_2$.

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Mass of $H_2 = 0.375 \times 2$.
$= 0.75g$.

Q7) **Data**

Mass of $AgNO_3 = 120.0g$
Mass of $NaCl = 52.0g$

**find**

$AgCl = ?$

**Solve**

No. of moles $= \frac{120}{107.8 + 14 + 16 \times 3}$ $(AgNO_3)$
$= 0.7067$

No. of moles $= 0.888$ $(NaCl)$.

C.O.M.

→ $AgNO_3 = AgCl$
0.7067 moles of $AgNO_3$ = 0.7067 moles of $AgCl$.

→ $NaCl = AgCl$
0.888 moles of $NaCl$ = 0.888 moles of $AgCl$.

So, $AgNO_3$ is limiting reactant & $NaCl$ is non-limiting reactant.

Mass of $AgCl = 0.7067 \times 143.3$
$= 101.27g$ of $AgCl$.

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Friday "Single Page Note" Date 21st July - 23

# Unit 1 Stoichiometry

**Stoichiometry** (Greek word) element measurements
The study of relative amount of Product and reactant in a chemical Reaction.

**Stoichiometric Amount**
The amount of reactant and product in balance chemical eq.

**Mole** basic unit of chemistry
The atomic mass, formula mass, molecular mass of substance expressed in grams | e.g: 1g H = 1 mole.

**Avagadro No.** $N_A$
The no. of atoms, molecules, ions & formula of 1 mole of substance.
Numerically, $6.023 \times 10^{23}$ (particles)

**Mole Ratio** -/-
Ratio of no. moles of reactant to no. of moles of product.
e.g $C_3H_8 + 5O_2 \longrightarrow 3CO_2 + 4H_2O$
1 mole of $C_3H_8$ + 5 mole of $O_2$ eq. 3 mole of $CO_2$ + 4 mole of $H_2O$

**Molar Volume**
1 mole of any gas at S.T.P is $22.414\ dm^3$ (T = 0°C & P = 180, 760 torr, 1 atm)
e.g 1 mole of $O_2 = 22.414\ dm^3$ occupies $\rightarrow 6.023 \times 10^{23}$ molecule

Types Of problems.
- Mole to Mole.
- Mole to Mass
- Mass to particle
- Mole ⇌ volume

**Percentage Composition** When relative amount of any element in a compound expressed in %.
$\%\ \text{of element} = \frac{\text{mass of element} \times 100}{\text{molar mass of compound}}$
In $CO_2$ = C = 27.2% $O_2$ = 72.7%

| Limiting Reactant | Non-Limiting R. | Theoretical yield | Actual yield |
|---|---|---|---|
| 1- The reactant present in less quantity. | The reactant present in excess quantity. | • The quantity calculated by a chemical eq. | The quantity took by analytical proces. |
| 2- Produce less product. | Can Produce more Product | • It is ideal. | It is real. |
| | | • More quantity | less quantity. |
| 3- Stops the reactant. | Donot do so. | Reason of Actual yield less theoretical. | |
| e.g $2H_2 + O_2 \longrightarrow 2H_2O$ | | • Side product formed. | |
| $H_2$ = produce 10 moles of $H_2O$. | | • Reversible reaction. | |
| $O_2$ = produce 14 moles of $H_2O$. | | • Mechanical loss due to natural conditions | |
| $H_2$ = limiting, $O_2$ = non-limiting. | | | |

**Solution for Every Prob.**
COM
C = compare
O = make one
P = multiple.

**Formulas**
6- % = mass of element / M.M of compound
6- % yield = Actual yield / Theoretical yield
1- No. of mole (i) = Mass / molar mass
2- No. of moles (ii) = Particles / NA
3- no. of moles = Volume of gas / volume at S.T.P
4- Combine eq (i) & (ii). mass in g = no. of particles × molar mass / NA

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