

Date: 11th July - 2023

Day: Tuesday

Chemistry: 1 STOICHIOMETRY

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 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 manufacturing etc.

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

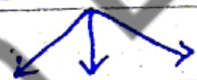
One mole of NaCl = 58.2g.

Avagadro 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) = 6.023×10^{23}



atoms / molecules / formula unit

mole \times Avagadro No.

1 mole of any gas

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

→ Temp = 0°C

→ Pressure = 1 atm.

Date: 11th July - 23

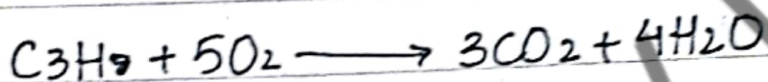
Day: Wednesday

Lecture: 02

Molar Ratios

Molar Ratio is the ratio of no. of moles reactants taking part & no. of moles of product formed.

example:



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 doesn't 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 = ?

Formula

C.O.M

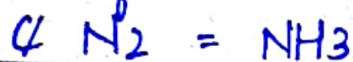
C = compare

O = make one

M = Multiply

Solve

a) Moles of $\text{NH}_3 = 5.0$

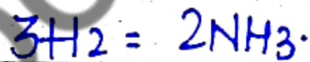


$$1 \text{NH}_3 = \frac{1 \text{N}_2}{2} \text{ g}$$

$$1 \text{NH}_3 = \frac{1 \times 5.0 \text{ g N}_2}{2}$$

$$= 2.5 \text{ moles of N}_2$$

b) Moles of $\text{NH}_3 = 5.0$



$$\text{NH}_3 = \frac{3}{2} \text{H}_2$$

$$5.0 \text{ moles of NH}_3 = \frac{3 \times 5.0 \text{ g H}_2}{2}$$

$$= 7.5 \text{ moles of H}_2$$

13th - July - 23

Thursday

Lecture : 03

mole as a bridge

"Mass to Mass Conversion"

Mass - Moles - Mass

Self-Assessment 102

Data

Mass of hydrogen = 1.02×10^5 kg

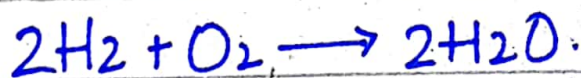
Equation



Method

COM. \therefore No. of moles = Mass / Molar mass.

Solve



→ first kg → g.

→ $1.02 \times 10^6 \text{ kg} \rightarrow 1.02 \times 10^5 \times 10^3 \rightarrow 1.02 \times 10^8 \text{ g}$

→ No. of moles of $2\text{H}_2 = \frac{\text{Mass}}{\text{Molar mass}}$

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

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

→ 2 moles of $\text{H}_2 = 1 \text{ mole of } \text{O}_2$.

→ 1 mole of $\text{H}_2 = \frac{1 \text{ mole of } \text{O}_2}{2}$

→ $5.1 \times 10^7 \text{ moles of } \text{H}_2 = \frac{1 \times 5.1 \times 10^7}{2}$

$$= 2.55 \times 10^7$$

$$= 2.55 \times 10^7 \text{ moles of } \text{O}_2$$

→ Mass = No. of moles × molar mass

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

$$= 816000000$$

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

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

$$= 8.16 \text{ kg oxygen} \cdot 8.16 \times 10^5 \text{ kg oxygen}$$

Result

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

14th July - 23

Thursday.

Lecture: 04

Self-Check Exercise 103

a) **Data**

$$\text{Volume of } O_2 = 50.0 \text{ dm}^3$$

$$\text{Standard volume} = 22.414 \text{ dm}^3$$

Required

$$\text{No. of moles} = ?$$

Solve

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

$$\begin{aligned} \text{moles} &= \frac{50}{22.414} \\ &= 2.23 \text{ dm}^3 \end{aligned}$$

b) **Data**

$$\text{No. of moles} = 0.80$$

$$\text{Standard volume} = 22.414 \text{ dm}^3$$

Required

$$\text{Volume} = ?$$

Solve

$$\text{Volume} = \text{moles} \times \text{Stand. volume}$$

$$= 0.80 \times 22.414 = 17.93 \text{ dm}^3$$

17-July-23.

Lecture : 05

Percentage Composition

When the relative amounts of each elements in a compound 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 compound & divide by molar mass, multiply by 100.

E.g.

MgO

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

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

OR

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

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

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

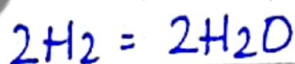
The limiting can stop a reactions.

examples:



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

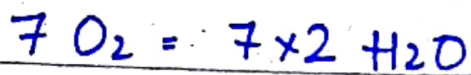
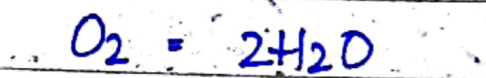
COM:



$$\text{H}_2 = \frac{2}{2} \text{ moles of } \text{H}_2\text{O}$$

$$10 \text{ H}_2 = \frac{2}{2} \times 10$$

$$= 10 \text{ moles of } \text{H}_2\text{O}.$$



$$= 14 \text{ moles of } H_2O$$

H_2 is limiting Reactant.

O_2 is Non-Limiting Reaction.

How many mass H_2O ?

$$\text{Mass} = 10 \times 18$$

$$= 1800 \text{ g.}$$

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

18-July-2023

How

Tuesday

Lecture: 06

Self-Check 104

Q1.

a) Mass of Zn = 6g.

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

$$= 0.091 \text{ moles of Zn.}$$

Mass of S = 4g.

$$\text{No. of moles} = \frac{4}{32}$$

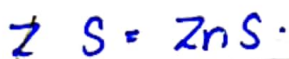
$$= 0.125 \text{ moles of S.}$$

COM:



$$1 \text{ mole of Zn} = 1 \text{ mole of ZnS}$$

$$0.091 \text{ moles} = 0.091 \text{ moles of ZnS}$$

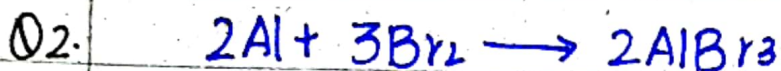


$$1 \text{ mole of S} = 1 \text{ mole of ZnS}$$

$$0.125 \text{ moles of S} = 0.125 \text{ moles of ZnS}$$

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

$$\begin{aligned} \text{b) Mass of ZnS} &= 0.091 \times 97.3 \\ &= 8.85 \text{ g of ZnS.} \end{aligned}$$



$$\text{a) Mass of Al} = 15.8 \text{ g}$$

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

$$= 0.585 \text{ moles of Al}$$

$$\text{Mass of Br}_2 = 55.6 \text{ g}$$

$$\text{Moles of Br}_2 = \frac{55.6}{160}$$

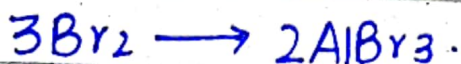
$$= 0.347 \text{ moles of Br}_2$$

CDM



$$\text{Al} = \frac{2\text{AlBr}_3}{2}$$

$$0.585 \text{ moles of Al} = 0.585 \text{ moles of AlBr}_3$$



$$\text{Br}_2 = \frac{2\text{AlBr}_3}{3}$$

$$0.347 \text{ moles of Br}_2 = \frac{2 \times 0.347 \text{ moles of AlBr}_3}{3}$$

$$= 0.231 \text{ moles of AlBr}_3$$

Bromine is limiting reactant.

$$\begin{aligned} \text{b) Mass} &= 0.231 \times 187.267 \\ &= 61.9 \text{ g of AlBr}_3. \end{aligned}$$

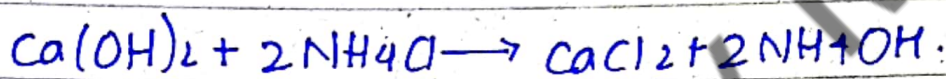
19/07/23

wednesday

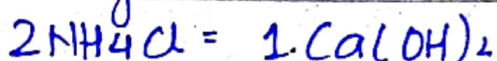
lecture: 07

Ex 108

- 1- 1.87 moles of NH_4Cl .
1.35 moles of $\text{Ca}(\text{OH})_2$



during reaction $\text{Ca}(\text{OH})_2$ moles?



$$\text{NH}_4\text{Cl} = \frac{1\text{Ca}(\text{OH})_2}{2}$$

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

$$= 0.935 \text{ moles of } \text{Ca}(\text{OH})_2$$

$$\text{R-left} = \text{initial moles of } \text{Ca}(\text{OH})_2 - \text{final moles of } \text{Ca}(\text{OH})_2$$

$$= 1.35 - 0.935$$

$$= 0.415$$

$$\text{Mass} = 0.415 \times 74$$

$$= 30.71 \text{ g of } \text{Ca}(\text{OH})_2$$

Unreacted $\text{Ca}(\text{OH})_2$ is 30.71g.

ideal (No loss) real (loss)

Theoretical Yield, Actual yield, And Percentage Product/output

→ Work yield job ap Paper & Pen pe karne hie hie.

→ 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.”

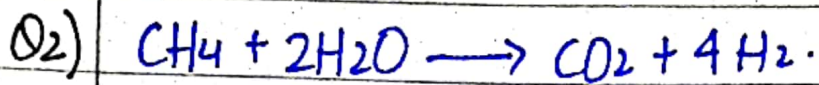
“ The quantity of Product obtained/ Produced by chemical reaction/ chemical process is Actual yield.”

“ The ratio of actual yield & Theoretical yield is Percentage Yield.

Percentage yield measures efficiency 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, filtration, separation, washing, crystallization.)

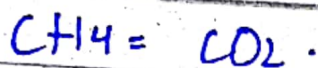


a) mass of methane = 1250g

$$1 \text{ mole} = 16 \text{ g.}$$

$$1250 \text{ g} = \frac{1}{16} \times 1250 \text{ mole of CH}_4$$

$$= 78.125 \text{ moles of CH}_4.$$



$$78.125 = 78.125 \text{ moles of CO}_2.$$

$$\text{Mass} = 78.125 \times 44$$

$$= 3437.5 \text{ mass of CO}_2.$$

$$\text{Theoretical mass of CO}_2 = 3437.5 \text{ g.}$$

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

$$= \frac{3000}{3437.5} \times 100\% \text{ of CO}_2$$

$$= 87.27\% \text{ of CO}_2.$$

21/07/23

How

Friday

Review Questions

Q2i) 58.5 amu 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

58.5 amu 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,

$$\begin{aligned}\text{formula mass of NaCl} &= \text{Na} + \text{Cl} \\ &= 23 + 35.5 \\ &= 58.5 \text{ amu}\end{aligned}$$

Conclusion

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

ii) Concept of limiting react^{ant} is not applicable for reverse reaction. Explain?

Answer

Product is not prominent.

Explanation

Limiting Reactant

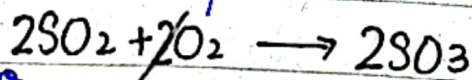
The Reactant that is present in small amount & thus produces less product.

Non-Limiting Reactant

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

Reasons (In this Dir heading) Reversible & irreversible

Now in it reversible reaction, not a stable ^{be} _{adder} condition is present. Reactant & product are continuously reacting that \rightleftharpoons does not produces a prominent & proper product. As reversible reaction never stops, therefore no limiting react would be present in it.



Conclusion

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

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 $\times N_A$.

No. of moles = ?

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

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

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

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

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

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



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

Statement / Result

So No. of bonds in 9g of H_2O are 6.022×10^{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.

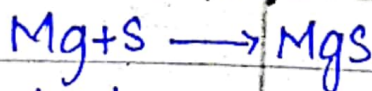
It is quite cheaper.

Consumption

It is consumed completely & stops the reaction.

It is not consumed completely & does not stop the reaction.

Example



S is limiting reactant.

Mg is non-limiting reactant.

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 = $\frac{\text{Particle (atoms, molecules)}}{\text{NA}}$

Solve

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

$$= 0.666 \text{ moles of ice.}$$

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

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

Result

The molecules of H_2O in 12g of ice are 4.011×10^{23} .

vii) 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.

The comparison between Fe & H₂ is not same. This is because Fe is an atom whereas H₂ is a molecule. So, Fe contain 6.022×10^{23} atoms. But in H₂, two H combines to form the molecules. Hence $2 \times 6.023 \times 10^{23} = 1.2046 \times 10^{24}$.

Conclusion

H₂ 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 6.023×10^{23} . It is direct relation between moles & NA. The diff. compound have different mass, atomic mass, molecules mass, But when it comes to 1 mole of any substance, the mass doesn't depend on effect. it must be equal to 6.023×10^{23} .

Eog

18g of H₂O = 6.023×10^{23} molecules = 1 mole
32g of O₂ = 6.023×10^{23} molecules = 1 mole

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 Avogadro Number.

The Number of atoms, molecules, ions 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 \times Avogadro.

1 mole of every substance = 6.023×10^{23} (atoms, molecules...)

Conclusion

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

ix) Mass to Mass

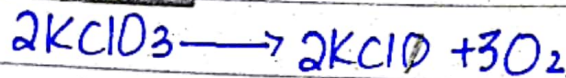
Data

Mass of $\text{KClO}_3 = 5.0 \text{ g}$.

find

Mass of $\text{O}_2 = ?$

Equation



Solve

No. of moles of $\text{KClO}_3 = \frac{\text{mass}}{\text{molar mass}}$

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

$= 0.040$ moles of KClO_3 .

COM Method:

2 moles of KClO_3 = 3 moles of O_2 .

reacts to produce

1 mole of $\text{KClO}_3 = \frac{3}{2}$ moles of O_2

0.040 moles of $\text{KClO}_3 = \frac{3}{2} \times 0.040$ moles of O_2

$= 0.06$ moles of O_2 .

Mass = moles \times molar mass

$= 0.06 \times 32$

$= 1.92 \text{ g of } \text{O}_2$

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 & volume.

That 1 mole of any gas occupies $22.414 dm^3$

of volume at S.T.P. That is known as Molar volume relation.

But there's no relation b/w mass & volume.

Conclusion

Relation exists b/w mass, mole & volume Not b/w mass & volume.

xi) Refer to pg 14.

xii) Representation of Particles in 1 mole of Gas

The Molar Volume 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 = $0^\circ C$, Pressure =

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

Example 1

- Volume of one mole of $\text{H}_2 = 22.414 \text{ dm}^3$
- Volume of one mole of $\text{NH}_3 = 22.414 \text{ dm}^3$
- Volume of one mole of $\text{Cl}_2 = 22.414 \text{ dm}^3$

Q3b) Data

Density of $\text{CHBr}_3 = 2.89 \text{ gm}^{-3}$.

No. of molecules of $\text{CHBr}_3 = 4.8 \times 10^{24}$

Find

Volume = ?

Solve

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

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

we need to find molecular mass.

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

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

$$= 7.970 \text{ moles of } \text{CHBr}_3.$$

Mass = moles \times molar mass

$$= 7.970 \times 283.253$$

$$= 2016.4 \text{ g}$$

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

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

$$= 697.7 \text{ cm}^3 \text{ of CCl}_4$$

Q4a) **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 experimenter

Eq



Actual yield is 0.9392 g Cu.

Theoretical yield is 0.5072 g.

b) Data

Mass of $H_2 = 42.0g$

Actual yield of $NH_3 = 120.02g$.

find

percentage yield = $NH_3 = ?$

Solve



$$\begin{aligned} \text{No. of moles of } H_2 &= \frac{\text{mass}}{\text{molar mass}} \\ &= \frac{42.0}{2} \end{aligned}$$

$$= 21 \text{ moles of } H_2.$$

COM.

No. of moles of H_2 = No. of moles of NH_3

$$3 \text{ moles of } H_2 = 2 \text{ moles of } NH_3.$$

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

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

$$= 14 \text{ moles of } NH_3$$

$$\text{Mass} = \text{mole} \times \text{molar mass}$$

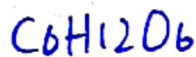
$$= 14 \times 17$$

$$= 238g \text{ of } NH_3.$$

$$\text{Percentage yield of NH}_3 = \frac{120.62}{238} \times 100 \\ = 50.5\%$$

95a) Refer to pg # 11.

b) Data



$$\text{Mass of C} = 72 \text{ g}$$

$$\text{Mass of H} = 12 \text{ g}$$

$$\text{Mass of O} = 96 \text{ g}$$

$$\text{Molar mass} = 180 \text{ g}$$

Formula

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

Find

% of each element.

Solve

$$\% \text{ of C} = \frac{72 \times 100}{180} \\ = 40\%$$

$$\% \text{ of H} = \frac{12 \times 100}{180} \\ = 6.66\%$$

$$\% \text{ of O} = \frac{96 \times 100}{180} \\ = 53.3\%$$

06a) Pg # 14.

06b) Data

$$\text{Volume of Al} = 2.50 \text{ cm}^3$$

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

Find

mass of H = ?

Solve

Moles of Al.

So first we'll find the mass.

$$m = d \times v.$$

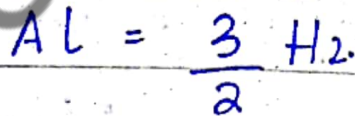
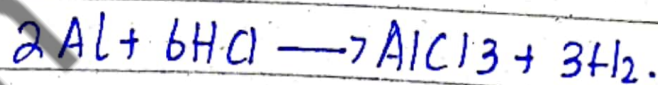
$$m = 2.50 \times 2.70$$

$$= 6.75 \text{ g.}$$

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

$$= 0.25 \text{ of Al.}$$

C.O.M.



$$0.25 \text{ moles of Al} = \frac{3}{2} \times 0.25 \text{ moles of H}_2.$$

$$= 0.375 \text{ moles of H}_2.$$

$$\begin{aligned}\text{Mass of H}_2 &= 0.375 \times 2 \\ &= 0.75 \text{ g.}\end{aligned}$$

Q7) Data

$$\text{Mass of AgNO}_3 = 120.0 \text{ g}$$

$$\text{Mass of NaCl} = 52.0 \text{ g}$$

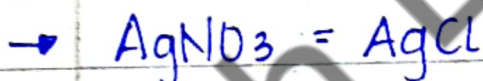
find

AgCl = ?

Solve

$$\begin{aligned}\text{No. of moles} &= \frac{120}{107.8 + 14 + 16 \times 3} \quad (\text{AgNO}_3) \\ &= 0.7067\end{aligned}$$

$$\begin{aligned}\text{No. of moles} &= 0.888 \quad (\text{NaCl}). \\ \text{C.O.M.}\end{aligned}$$



$$0.7067 \text{ moles of AgNO}_3 = 0.7067 \text{ moles of AgCl.}$$



$$0.888 \text{ moles of NaCl} = 0.888 \text{ moles of AgCl.}$$

So, AgNO₃ is limiting reactant & NaCl is non-limiting reactant.

$$\begin{aligned}\text{Mass of AgCl} &= 0.7067 \times 143.3 \\ &= 101.27 \text{ g of AgCl.}\end{aligned}$$

Friday

Single Page Note

Date 21st July - 23

Unit 1 Stoichiometry

Solution for Every Prob.

Stoichiometry ² Greek word

Mole basic unit of chemistry

element measurements

The atomic mass, formula mass, molecular mass of substance expressed in grams e.g: 1g H = 1 mole.

COM

C = compare

O = make one

P = multiple

The study of relative amount of product and reactant in a chemical reaction.

Avagadro No. - N_A

Formulas

Stoichiometric Amount

The no. of atoms, molecules, ions & formula of 1 mole of substance.

The amount of reactant and product in balance chemical eq.

Numerically, 6.023×10^{23} (particles)

Mole Ratio -/-

Molar Volume

Types of problems.

Ratio of no. moles of reactant to no. of moles of product.

1 mole of any gas at S.T.P. is 22.414 dm^3 ($T=0^\circ\text{C}$ & $P=100,760 \text{ torr}$, 1 atm atp)

Mole to Mole

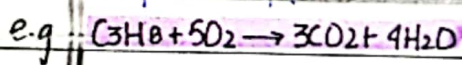
Mole to Mass

Mass to particles

Mole \rightleftharpoons volume

5-/- = mass of element / M.M of compound

6-/- = Actual yield / Theoretical yield



1 mole of C_3H_8 + 5 mole of O_2 eg 3 mole of CO_2 + 4 mole of H_2O

1 mole of $\text{O}_2 = 22.414 \text{ dm}^3$ occupies 6.023×10^{23} molecule

Percentage Composition

When relative amount of any element in a compound expressed in %.

In CO_2 = C = 27.2% O_2 = 72.7%

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

Volume of gas volume at S.T.P

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

2- No. of moles = $\frac{\text{particles}}{\text{NA}}$

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. It is ideal.

The quantity took by analytical process. It is real.

2- Produce less product.

Can produce more product

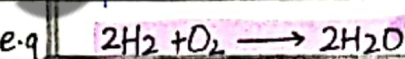
More quantity

less quantity.

3- Stops the reactant.

Donot do so.

Reason of Actual yield less theoretical.



H_2 = produce 10 moles of H_2O .

O_2 = produce 4 moles of H_2O .

H_2 = limiting O_2 = non-limiting.

Side product formed.

Reversible reaction.

Mechanical loss due to natural conditions

3- no. of moles = $\frac{\text{Volume of gas}}{\text{volume at S.T.P}}$

1- No. of moles = $\frac{\text{Mass}}{\text{molar mass}}$

2- No. of moles = $\frac{\text{particles}}{\text{NA}}$

4- Combine eq (i) & (ii) mass in g = $\text{No. of particles} \times \text{molar mass}$

NA

NA

NA

NA