CHAPTER : 1
STOICHIOMETRY

EXERCISE

Q3) How many covalent bonds are present in 9g of H_2O?

ANS :- Mass of H_2O = 9g

Molar mass of H_2O = 18g.

No. of moles = $\frac{9}{18}$ = 0.5 moles

No of molecules = 0.5 moles × N_A

= 0.5 moles × 6.023×10^{23}

= 3.01×10^{23} molecules

No of bonds in 1 molecule of H_2O = 2 covalent bonds

Total bonds in 9g = $2 \times 3.01 \times 10^{23}$

= 6.02×10^{23} Covalent bonds

Answer = 6.02×10^{23} bonds

Q5) How many molecules of water are there in 12g of ice?

ANS:-

→ **GIVEN**

Given mass of ice = 12g

→ **TO FIND**

Number of molecules = ?

→ **FORMULA**

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

Particles = moles × NA

→ SOLUTION / CALCULATIONS

Moles = $\frac{12}{18}$ = 0.7

Molecules = $0.7 \times 6.023 \times 10^{23}$

= 4.21×10^{23} molecules Ans

Q 4) Differentiate between limiting & non-limting reactant.

Sol:-

	Limiting Reactant	Non-limiting Reactant
AMOUNT	It is taken in lesser quantity.	It is in excess
DEFINITION	It controls the quantity of product or produces least moles of product.	It remains unreacted after the completion of a reaction
PRICE/COST	It is usually expensive	It is usually cheaper
CONSUMPTION	It is consumed completely in a chemical reaction	It is not consumed completely in a chemical reaction
PRODUCTS	limits the amount of product that is formed from a reaction	has no effect on the product formed from the chemical reaction
END OF REACTION	Not present at the end	It is present in the end

Q 9) Calculate the weight of oxygen evolved when 5.0g of $KClO_3$ are completely decomposed?

Ans:- → GIVEN

Mass of $KClO_3$ = 5g

→ TO FIND

weight of oxygen = ?

→ CALCULATIONS

Formula mass of $KClO_3$ = 122.5 g/mol

→ Equation = $2KClO_3 \rightarrow 2KCl + 3O_2$

$$\text{No of moles} = \frac{\text{Mass}}{\text{Molar mass}} = \frac{5g}{122.5}$$

$$= 0.04 \text{ moles}$$

→ According to equation.

2 moles of $KClO_3$ = 3 moles of O_2

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

0.04 moles of $KClO_3$ = $\frac{3}{2} \times 0.04$ moles of O_2

= 0.06 moles of O_2

→ Mass/Weight of O_2 =

1 mole of O_2 = 32 g

0.06 moles = 0.06 × 32

= 1.92 g

→ Answer:- 1.92 g of O_2

Q no 3) (b)

→ GIVEN

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

Molecules = 4.8×10^{24} Molar mass = 252.7

→ TO FIND

Volume = ?

→ CALCULATION

As, Molecules = Moles × N_A

$$\text{Molecules} = \frac{\text{Mass}}{\text{Molar mass}} \times N_A$$

$$\text{Mass} = \frac{\text{Molar mass}}{N_A} \times \text{Molecules}$$

$$= \frac{252.7}{6.022 \times 10^{23}} \times 4.8 \times 10^{24}$$

= 2014.2 grams

→ $$\text{Volume} = \frac{\text{Mass in grams}}{\text{Density}}$$

$$= \frac{2014.2}{2.89}$$

= 696.8 dm^3

Volume = 696.8 dm^3 Ans

Q no: 4 (b):

→ GIVEN

Mass of H_2 gas = 42 g

Actual yield = 120 g

→ **TO FIND**

Theoratical yield = ?

Percentage yield = ?

→ **EQUATION/REACTION**

$N_2 + 3H_2 \rightarrow 2NH_3$

→ **FORMULAS**

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

→ **CALCULATIONS**

Moles of H_2 = $\frac{\text{Mass}}{\text{Molar mass}} = \frac{42}{2}$

= 21 moles

→ **According to reaction,**

3 moles of H_2 = 2 moles of NH_3

1 mole of H_2 = $\frac{2}{3}$ moles of NH_3

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

= 14 moles

Mass of NH_3 prod = 14×17

= 238 g

→ So, **theoratical yield = 238g**

Percentage yield = $\frac{\text{Actual yield}}{\text{theoratical yield}} \times 100$

$= \frac{120}{238} \times 100$

$= 50.4\ \%$

→ RESULT

Percentage yield of NH_3 is 50.4%.

Qno:5

(b) → GIVEN

Glucose = $(C_6H_{12}O_6)$

→ TO FIND

%age composition of C, H & O

→ CALCULATIONS

Molar mass of glucose = (12×6) + (12×1) + (16×6)

= (72) + (12) + (96)

= 180 g

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

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

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

→ RESULT

C = 40%, H = 6.66%, O = 53.3%

Qno 6 (b)

→ **GIVEN**

Volume of Al = $2.50\ cm^3$

Density of Al = $2.70\ g\ cm^3$

$$2Al + 6HCl \rightarrow 3H_2 + 2AlCl_3$$

→ **TO FIND**

Weight of H_2 gas = ?

→ **FORMULA**

$$\text{Density} = \frac{\text{Mass}}{\text{Volume}}$$

$$\text{Moles} = \frac{\text{Mass}}{\text{Molar mass}}$$

→ **CALCULATIONS**

Mass = Density × Volume

= 2.70 × 2.50

= 6.75 g

Moles of Al = $\frac{6.75}{27}$ = 0.25 moles

→ **According to equation/Reaction,**

2 moles of Al = 3 moles of H_2

1 mole of Al = $\frac{3}{2}$ moles of H_2

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

= 0.375 moles

Mass of H_2 in grams = 2×0.375

= 0.752 g

→ **RESULT**

The mass of H_2 in grams is 0.752 g

Q no 7

Ans:- → **GIVEN**

$AgNO_3$ = 120 g

NaCl = 52 g

→ **TO FIND**

AgCl = Silver Chloride = ?

→ **Solution**

Molar mass of $AgNO_3$ = (108) + (14) (3×16)

= 170 g

Molar mass of NaCl = (23) + (35.5)

= 58.5 g

Moles of $AgNO_3$ = $\frac{120}{170}$ = 0.71 moles

Moles of NaCl = $\frac{52}{58.5}$ = 0.89 moles

As, $AgNO_3 + NaCl \rightarrow AgCl + NaNO_3$

As, 0.71 moles of $AgNO_3$ = 0.71 moles of AgCl

0.89 moles of NaCl = produce 0.89 moles of AgCl

As, $AgNO_3$ is the limiting reactant

mass of Silver Chloride =

Moles = Mass / Molar mass

Moles = 0.71

Mass = ?

Molar mass = (107.87) + (35.5)

= 143.37 g/mol

hence mass = 143.37 × 0.71

= 101.7 g

→ RESULT

101.7 g of AgCl is produced.