

3<sup>rd</sup> August, 2023

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## 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  $\times N_A$   
= 0.5 moles  $\times 6.023 \times 10^{23}$   
=  $3.01 \times 10^{23}$  molecules

No of bonds in 1 molecule of  $H_2O$  = 2 covalent bonds  
Total bonds in 9g =  $2 \times 3.01 \times 10^{23}$   
=  $6.02 \times 10^{23}$  Covalent bonds

Answer =  $6.02 \times 10^{23}$  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 =  $\frac{\text{Mass}}{\text{molar mass}}$

$$\text{Particles} = \text{moles} \times N_A$$

→ SOLUTION / CALCULATIONS

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

$$\begin{aligned} \text{Molecules} &= 0.7 \times 6.023 \times 10^{23} \\ &= 4.21 \times 10^{23} \text{ molecules} \end{aligned} \underline{\underline{\text{Ans}}}$$

Q4) Differentiate between limiting & non-limiting reactant.

Sol- Limiting Reactant

It is taken in lesser quantity.

It controls the quantity of product or produces least moles of product.

It is usually expensive

It is consumed completely in a chemical reaction

Limits the amount of product that is formed from a reaction

Not present at the end

Non-limiting Reactant

It is in excess

It remains unreacted after the completion of a reaction

It is usually cheaper

It is not consumed completely in a chemical reaction

has no effect on the product formed from the chemical reaction

It is present in the end

AMOUNT  
DEFINITION  
PRICE/COST  
CONSUMPTION  
PRODUCTS  
END OF REACTION

Q 9) Calculate the weight of oxygen evolved when 5.0g of  $\text{KClO}_3$  are completely decomposed?

Ans: → GIVEN

Mass of  $\text{KClO}_3 = 5\text{g}$

→ TO FIND

weight of oxygen = ?

→ CALCULATIONS

Formula

Mass

mass of  $\text{KClO}_3 = 122.5 \text{ g/mol}$

→ Equation =  $2\text{KClO}_3 \rightarrow 2\text{KCl} + 3\text{O}_2$

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

$$= 0.04 \text{ moles}$$

→ According to equation

2 moles of  $\text{KClO}_3 = 3$  moles of  $\text{O}_2$

1 mole of  $\text{KClO}_3 = \frac{3}{2}$  moles of  $\text{O}_2$

$$0.04 \text{ moles of } \text{KClO}_3 = \frac{3 \times 0.04}{2} \text{ moles of } \text{O}_2$$

$$= 0.06 \text{ moles of } \text{O}_2$$

→ Mass/Weight of  $\text{O}_2$  =

$$1 \text{ mole of } \text{O}_2 = 32 \text{ g}$$

$$0.06 \text{ moles} = 0.06 \times 32$$

$$= 1.92 \text{ g}$$

→ Answer: - 1.92 g of  $\text{O}_2$

### Q no 3) (b)

→ GIVEN

$$\text{Density of } \text{CHBr}_3 = 2.89 \text{ g cm}^{-3}$$

$$\text{Molecules} = 4.8 \times 10^{24}$$

$$\text{Molar mass} = 252.7$$

→ TO FIND

$$\text{Volume} = ?$$

→ CALCULATION

$$\text{As, Molecules} = \text{Moles} \times N_A$$

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

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

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

$$= 2014.2 \text{ grams}$$

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

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

$$= 696.8 \text{ dm}^3$$

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$$\text{Volume} = \underline{\underline{696.8 \text{ dm}^3}}$$

### Q no: 4 (b)

→ GIVEN

$$\text{Mass of } \text{H}_2 \text{ gas} = 42 \text{ g}$$

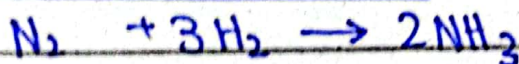
$$\text{Actual yield} = 120 \text{ g}$$

→ TO FIND

Theoretical yield = ?

Percentage yield = ?

→ EQUATION/REACTION



→ FORMULAS

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

→ CALCULATIONS

$$\begin{aligned} \text{Moles of H}_2 &= \frac{\text{Mass}}{\text{Molar mass}} = \frac{42}{2} \\ &= 21 \text{ moles} \end{aligned}$$

→ According to reaction,

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

1 mole of  $\text{H}_2$  =  $\frac{2}{3}$  moles of  $\text{NH}_3$

$$\begin{aligned} 21 \text{ moles of H}_2 &= \frac{2}{3} \times 21 \text{ of NH}_3 \\ &= 14 \text{ moles} \end{aligned}$$

$$\begin{aligned} \text{Mass of NH}_3 &= 14 \times 17 \\ \text{prod} &= 238 \text{ g} \end{aligned}$$

→ So, theoretical yield = 238g

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

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

$$= 50.4\%$$

→ RESULT

Percentage yield of  $\text{NH}_3$  is 50.4%.

Qno: 5

(b) → GIVEN

Glucose =  $(\text{C}_6\text{H}_{12}\text{O}_6)$

→ TO FIND

%age composition of C, H & O

→ CALCULATIONS

$$\begin{aligned} \text{Molar mass of glucose} &= (12 \times 6) + (12 \times 1) + (16 \times 6) \\ &= (72) + (12) + (96) \\ &= 180 \text{ g} \end{aligned}$$

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

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

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

→ RESULT

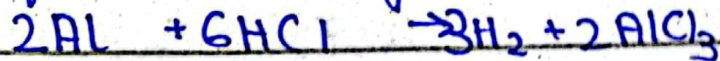
C = 40%, H = 6.667%, O = 53.3%

## Q no 6 (b)

### → GIVEN

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

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



### → TO FIND

Height of  $\text{H}_2$  gas = ?

### → FORMULA

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

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

### → CALCULATIONS

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

$$= 2.70 \times 2.50$$

$$= 6.75 \text{ g}$$

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

### → According to equation/Reaction,

$$2 \text{ moles of Al} = 3 \text{ moles of H}_2$$

$$1 \text{ mole of Al} = \frac{3}{2} \text{ moles of H}_2$$

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

$$= 0.375 \text{ moles}$$

$$\text{Mass of H}_2 \text{ in grams} = 2 \times 0.375 \\ = 0.752 \text{ g}$$

→ RESULT

The mass of H<sub>2</sub> in grams is 0.752 g

Q no 7

Ans: → GIVEN

$$\text{AgNO}_3 = 120 \text{ g}$$

$$\text{NaCl} = 52 \text{ g}$$

→ TO FIND

AgCl = Silver Chloride = ?

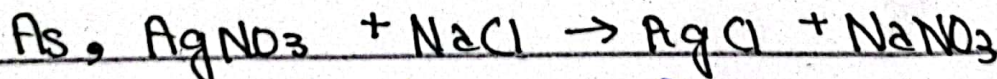
→ Solution

$$\text{Molar mass of AgNO}_3 = (108) + (14) + (3 \times 16) \\ = 170 \text{ g}$$

$$\text{Molar mass of NaCl} = (23) + (35.5) \\ = 58.5 \text{ g}$$

$$\text{Moles of AgNO}_3 = \frac{120}{170} = 0.71 \text{ moles}$$

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



As, 0.71 moles of AgNO<sub>3</sub> = 0.71 moles of AgCl

0.89 moles of NaCl = produce 0.89 moles of AgCl

As, AgNO<sub>3</sub> is the limiting reactant



mass of Silver Chloride =

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

$$\text{Moles} = 0.71$$

$$\text{Mass} = ?$$

$$\begin{aligned}\text{Molar mass} &= (107.87) + (35.5) \\ &= 143.37 \text{ g/mol}\end{aligned}$$

$$\begin{aligned}\text{hence mass} &= 143.37 \times 0.71 \\ &= 101.7 \text{ g}\end{aligned}$$

→ RESULT

101.7g of AgCl is produced.