

Chapter 2: Stoichiometry

Q1.



Since 1 mole of $\text{CaCO}_3(\text{s})$ contains 1 moles of Ca, So

1 mole of Ca will produce 1 mole of $\text{CaCO}_3(\text{s})$.

\therefore 5 mole of Ca \longrightarrow 5 mole of CaCO_3



(moles)

5 moles of BaCl_2 contains 5 moles of Ba & 5 moles of Ba & can form 5 moles of BaSO_4 ; since 1 mole of BaSO_4 contain 1 mole of Ba.



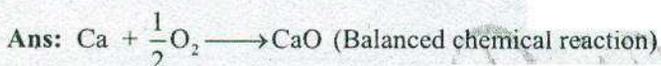
5 moles (given)

\therefore 2 moles produces 1 mole of Na_2O .

\therefore 1 \longrightarrow $\frac{1}{2}$

\therefore 5 \longrightarrow $5 \times \frac{1}{2} = 2.5$ moles of Na_2O .

Q2.



Wt. of Ca = 40 g (Given)

So, moles of Ca = $\frac{40}{40} = 1$ moles

Now from balanced chemical reaction: 1 moles of Ca reacts with $\frac{1}{2}$ moles of O_2 .

Wt of O_2 with which 40 g to Ca react = $\frac{1}{2} \times 32 = 16$ g

Ans

Q3.



50 gm

If we have not to balance the chemical equation, then we have to apply POAC rule or g-equivalence rule.

By POAC (on Cl atom)

(no. of Cl atom) before reaction = (no. of Cl atom) after reaction.

no. of moles of $\text{NaCl} \times N_A = 2 \times \text{no. of moles of } \text{Cl}_2 \times N_A$

$\frac{50}{58.5} = 2 \times \text{moles of } \text{Cl}_2$

moles of $\text{Cl}_2 = \frac{50}{117}$

$$\text{Volume of Cl}_2 \text{ at NTP} = \frac{50}{117} \times 22.4 \text{ lit} = 9.57 \text{ lit} \quad \text{Ans}$$

Q4.

$$\text{Sol: Weight of Fe}_2\text{O}_3 \text{ in iron ore} = \frac{94}{100} \times 2 \text{ tons} = \frac{94}{100} \times 2000 \text{ Kg} = 1880 \text{ kg.}$$

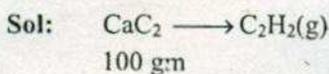
$$\therefore \text{Mol. wt of Fe}_2\text{O}_3 = 56 \times 2 + 16 \times 3 = 160 \text{ g}$$

$$\therefore 160 \text{ g of Fe}_2\text{O}_3 \text{ contains } 112 \text{ g of Fe}$$

$$\therefore 1 \text{ ————— } \frac{112}{160}$$

$$\therefore 1880 \text{ ————— } \frac{112}{160} \times 1880 = 1316 \text{ kg} \quad \text{Ans}$$

Q5.



By POAC on C-atom

(moles of C atom) before reaction = (moles of C-atom) after reaction.

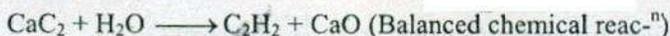
$$2 \times \text{moles of CaC}_2 = 2 \times \text{mole of C}_2\text{H}_2(\text{g})$$

$$\frac{100}{(40 + 2 \times 12)} = \text{moles of C}_2\text{H}_2(\text{g}),$$

$$1.5625 = \text{moles of C}_2\text{H}_2(\text{g}).$$

$$\text{Volume of acetylene at NTP} = 1.5625 \times 22.4 \text{ lit} = 35 \text{ lit}$$

2nd method



$$\text{moles of CaC}_2 = \frac{100}{64} = 1.5625$$

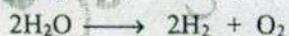
$$\therefore 1 \text{ moles of CaC}_2 \text{ gives } 1 \text{ mole of C}_2\text{H}_2$$

$$\therefore 1.5625 \text{ ————— } 1.5625 \text{ —}$$

$$\therefore \text{Volume of C}_2\text{H}_2 \text{ at NTP} = 1.5625 \times 22.4 \text{ lit} = 35 \text{ lit}$$

Q6.

Sol: Detonating gas is (2 mole H₂ + 1 mole O₂)



(Detonating gas)

$$0.1 \text{ mole} \longrightarrow 0.1 \text{ mole} + \frac{1}{2} \times 0.1 \text{ mole}$$

From reaction stoichiometry.

$$0.1 \text{ mole of H}_2\text{O produces } 0.1 \text{ mole of H}_2 + \frac{0.1}{2} \text{ mole of O}_2 = \frac{0.3}{2} \text{ mole of donating gas.}$$

$$\therefore \text{Volume of denoting gas produced} = \frac{0.3}{2} \times 22.4 \text{ lit} = 3.36 \text{ lit}$$

Ans

Q7.



By POAC (I don't like to balance equation). If you like you can have another method by balancing this equation and applying mole stoichiometric relationship)

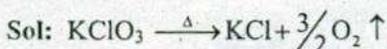
(mole of Cu) before reaction = (mole of Cu) after reaction

$$\frac{10}{63.5} = \text{mole of } \text{Cu}(\text{NO}_3)_2 \cdot 3\text{H}_2\text{O}.$$

$$\therefore \text{Wt of } \text{Cu}(\text{NO}_3)_2 \cdot 3\text{H}_2\text{O} = \frac{10}{63.5} (63.5 + 2 \times 62 + 3 \times 18) = \frac{10}{63.5} \times 241.5 = 38 \text{ g}$$

Ans

Q8.



Weight loss will be due to evolution of oxygen gas on heating.

$\therefore \frac{3}{2}$ mole of O_2 is produced from 1 mole of KClO_3

$\therefore \frac{3}{2} \times 32$ g of O_2 produced from 122.5 g of KCl .

$$\therefore 1 \text{ ————— } \frac{122.5}{48}$$

$$\therefore 0.384 \text{ ————— } \frac{122.5 \times 0.384}{48} = 0.98 \text{ g}$$

$$\therefore \% \text{ purity} = \frac{0.98}{4.9} \times 100 = 20\%$$

Q9.

Sol: $\text{MgCO}_3 + \text{CaCO}_3$. (Considered 100 g of mixture) You can actually consider any weight, but taking 100 g is easiest to solve the problems.

X g (say)

(100-x)g

Let wt of $\text{MgCO}_3 = x$ g

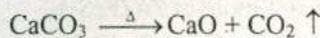
\therefore wt of $\text{CaCO}_3 = (100-x)$ g



X gm

$$\frac{x}{84} \text{ mole} \longrightarrow \frac{x}{84} \text{ mole}$$

$$\text{Wt. of } \text{CO}_2 \text{ evolved} = \frac{x}{84} \times 44 \text{ g}$$



(100-x) g

$$\left(\frac{100-x}{100} \right) \text{ mole} \longrightarrow \left(\frac{100-x}{100} \right) \text{ mole}$$

$$\text{Wt. of } \text{CO}_2 \text{ evolved} = \frac{100-x}{100} \times 44 \text{ g}$$

A/q.

Wt loss = 50% (which will be due to evolution of CO_2)

$$\frac{x}{84} \times 44 + \frac{100-x}{100} \times 44 = 50 \quad (50\% \text{ of } 100 \text{ g} = 50)$$

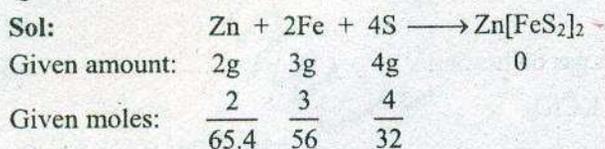
$$\frac{x}{84} + \frac{100-x}{100} = \frac{50}{44}$$

Solving for x, we have

$$X = 71.59\%$$

$$\left. \begin{aligned} \% \text{ of } \text{MgCO}_3 &= \frac{x}{100} \times 100 = 71.59\% \\ \% \text{ of } \text{CaCO}_3 &= (100 - x) = 28.41\% \end{aligned} \right\} \text{Ans}$$

Q10.



From the balanced chemical equation.

1 mole of Zn ≡ 2 mole of Fe

∴ 2 mole of Zn = 1 mole of Fe

$$2 \times \frac{2}{65.4} = \text{mole of Fe} \Rightarrow \text{Mole of Fe (required)} = \frac{4}{65.4} > \frac{3}{56} \text{ (given amount)}$$

∴ Fe will be the limiting agent between Zn & Fe ----- (1)

Further, we have to decide the limiting reagent between Fe and Sulphur

2 mole of Fe ≡ 4 mole of S

∴ 4 mole of S = 2 mole of Fe

$$2.4 \times \frac{4}{32} = 2 \times \text{mole of Fe} \Rightarrow \therefore \text{Moles of Fe (required)} = \frac{1}{4} > \frac{3}{56}$$

∴ Between Fe & sulphur, Fe is the limiting reagent. ----- (2)

(1) & (2) ⇒ Overall, Fe will be the limiting reagent

So, moles of Fe will determine the moles of Zn(FeS₂)₂ produced.

2 mole of Fe ≡ 1 mole of Zn (FeS₂)₂

∴ 1 mole of Fe = 2 × mole of Zn (FeS₂)₂

$$\therefore \text{Mole of Zn (FeS}_2)_2 = \frac{\text{mole of Fe}}{2} = \frac{3}{56 \times 2} \text{ moles}$$

$$\therefore \text{Wt of Zn (FeS}_2)_2 = \left[\frac{3}{112} \times 65.4 + 2 \times (56 + 2 \times 32) \right]$$

Q11.

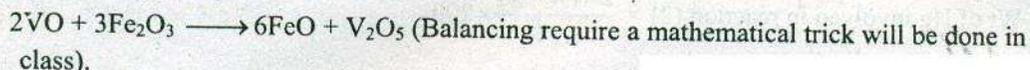


Given amount: 2 g 5.78 g

Moles: $\frac{2}{67}$ $\frac{5.78}{160}$

Before we can know the limiting reagent, either we have to balance it or we have to apply the law of equivalence in above reaction by calculating valances factor for each species.

By balancing of equation



\therefore 2 mole of VO \equiv 3 moles of Fe_2O_3

\therefore 2 moles of $\text{Fe}_2\text{O}_3 = 3$ moles of VO.

$$2 \times \frac{5.75}{160} = 3 \times \text{moles of VO}$$

Moles of VO = $\frac{12.50}{480} \times \frac{2}{67}$ (given amount)
(required)

Since given amount of VO is larger than the required amount of VO. So Fe_2O_3 will be limiting reagent.

Now from balanced chemical equation

3 moles of $\text{Fe}_2\text{O}_3 \equiv$ 1 mole of V_2O_5

\therefore 1 mole of $\text{Fe}_2\text{O}_3 = 3 \times$ mole of V_2O_5

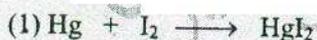
$$\therefore \text{mole of } \text{V}_2\text{O}_5 = \frac{1}{3} \times \text{mole of } \text{Fe}_2\text{O}_3 = \frac{1}{3} \times \frac{5.75}{160} = \frac{5.75}{480}$$

\therefore Wt of V_2O_5 produced = $\frac{5.75}{480} \times (182) = 2.18 \text{ gm}$

Ans

Q12.

Sol: Let W g is the weight of mercury & iodine taken, from which x g is the weight of iodine involved in HgI_2 formation, then (w-x)g will be involved in Hg_2I_2 formation.



x gm

$\frac{x}{254}$ moles

\therefore mole of Hg involved in this reacⁿ = $\frac{x}{254}$

\therefore wt of _____ = $\frac{x}{254} \times 200$



(w-x) g

$$\frac{w-x}{254} \text{ moles}$$

2 mole of Hg \equiv 1 mole of I₂

$$\therefore 1 \text{ mole of Hg} = 2 \times \text{mole of I}_2 = 2 \times \left(\frac{w-x}{254} \right)$$

$$\therefore \text{Wt of Hg involved in reaction (2)} = \frac{2 \times (w-x)}{254} \times 200$$

$$\text{A/q, } \frac{200}{254}x + \frac{2(w-x)}{254} \times 200 = w.$$

$$x + 2(w-x) = \frac{254w}{200}$$

$$2w-x = 1.27w$$

$$x = 0.73w$$

$$\text{Wt of HgI}_2 \text{ produced} = \text{mole of HgI}_2 \times (454) = \frac{x}{254} \times 454$$

$$\text{Wt of Hg}_2\text{I}_2 \text{ produced} = \text{mole of Hg}_2\text{I}_2 \times (654) = \frac{w-x}{254} \times 654.$$

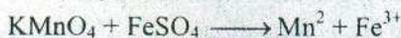
Ratio of the weight of Hg₂I₂ & HgI₂

$$= \frac{\frac{(w-x)}{254} \times 654}{\frac{x}{254} \times 454} = \frac{w-0.73w}{0.73w} \times \frac{654}{454} = \frac{0.27}{0.73} \times \frac{654}{454} = 0.532 : 1. \quad \text{Ans}$$

Q13.

Sol: $\text{W}(\text{FeSO}_4 \cdot 7\text{H}_2\text{O} + \text{Fe}_2(\text{SO}_4)_3 \cdot 9\text{H}_2\text{O}) = 5.5 \text{ g (given)}$

With KMnO_4 (a strong O.A.) only $\text{FeSO}_4 \cdot 7\text{H}_2\text{O}$ react because Fe is in lower oxidation state here only



From law of chemical-equivalence

gm equivalence of $\text{KMnO}_4 = \text{gm equivalence of FeSO}_4 \cdot 7\text{H}_2\text{O}$

$$\frac{5.4}{1000} \times 0.1 = \frac{\text{wt}}{\text{Mol.wt/v.f}} = \frac{\text{wt}}{278}$$

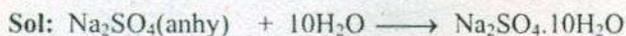
$$\text{Wt} = \frac{5.4 \times 278}{10^4} = 0.1501 \text{ g}$$

$$\therefore \text{Wt of Fe}_2(\text{SO}_4)_3 \cdot 7\text{H}_2\text{O} = 5.5 - 0.15 = 5.35 \text{ g}$$

$$\therefore \text{Moles of Ferric sulphate (hydrated)} = \frac{5.35}{562}$$

$$= 0.0095 \text{ moles; Ans}$$

Q14.



$$1 \text{ g} = \frac{1}{142} \text{ moles}$$

$$\text{moles of water with which 1 gm of } \text{Na}_2\text{SO}_4 \text{ react} = \frac{10 \times 1}{142}$$

$$\therefore \text{Wt of } \text{H}_2\text{O} = \frac{10 \times 1}{142} \times 18$$

\therefore Wt of 1 gm of Na_2SO_4 will increase by 1.27 g. Ans

Q15.

Sol: In drying only water's amount will change.

Clay	Silica	Water	Others
Original	X(say)%	12%	$100 - (12 + x)\% = 88 - x\%$
Partially dried	50%	7%	43%

Since amount of silica & other won't change

\therefore Ratio of silica to other will remain same.

$$\frac{x}{88 - x} = \frac{50}{43}$$

$$43x = 50 \times 88 - 50x$$

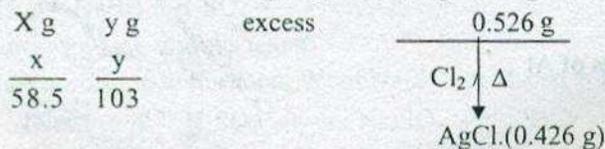
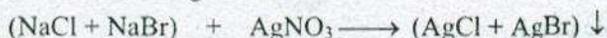
$$x = \frac{50 \times 88}{93} = 47.3\% \text{ Ans}$$

Q16.

Sol: $W(\text{NaCl} + \text{NaBr} + \text{inert substance}) = 1 \text{ g}$

Let wt of NaCl is x g

& wt of NaBr is Y g.



$$\frac{x}{58.5} \text{ moles of NaCl will produce } \frac{x}{58.5} \text{ moles of AgCl}$$

$$\therefore \frac{x}{58.5} \times 143.5 \text{ g}$$

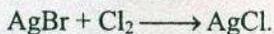
$$\frac{y}{103} \text{ moles of NaBr will produce } \frac{y}{103} \text{ mole of AgBr}$$

$$\therefore \frac{y}{103} \times 183 \text{ g}$$

A/q,

$$\frac{x}{58.5} \times 143.5 + \frac{y}{103} \times 183 = 0.526 \text{ g} \quad \text{--- (1)}$$

Now when Cl_2 gas is passed over ($\text{AgCl} + \text{AgBr}$) mixture then AgBr will convert into AgCl .



$$\therefore \text{Wt of AgCl produce from AgBr} = \frac{y}{103} \times 143.5 \text{ g}$$

$$\therefore \text{A/q, Total wt. of AgCl} = 0.426 \text{ g}$$

$$\therefore \frac{x}{58.5} \times 143.5 + \frac{y}{103} \times 143.5 = 0.426 \text{ g} \quad \text{--- (2)}$$

Solving (1) & (2), we have

$$X = 0.0425 \text{ g}$$

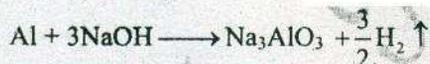
$$Y = 0.232 \text{ g}$$

$$\therefore \% \text{ of NaCl} = \frac{x}{1} \times 100 = 4.25\%$$

$$\% \text{ of NaBr} = \frac{y}{1} \times 100 = 23.2\% ; \quad \text{Ans}$$

Q17.

Sol: $W(\text{Al} + \text{Al}_2\text{O}_3) = 3.9 \text{ g}$



Volume of H_2 produced = 840 ml (at NTP)

$$\text{moles of H}_2 = \frac{840}{22400} = 0.0375$$

$$\therefore \frac{3}{2} \text{ moles of H}_2 \text{ is produced by 1 mole of Al}$$

$$\therefore 1 \times \frac{1}{\frac{3}{2}} = \frac{2}{3} \text{ moles of Al}$$

$$\therefore 0.0375 \times \frac{2}{3} \times 0.0375 = 0.025$$

$$\therefore \text{Wt of Al} = 0.025 \times 27 = 0.675 \text{ g}$$

$$\therefore \% \text{ of Al} = \frac{0.675}{3.9} \times 100 = 17.3\%$$

Ans

Q18.

Ans: $W(\text{NaCl} + \text{NaOH}) \rightarrow 2 \text{ g}$

Let x g of NaCl is present in 2 g of commercial NaOH



$$\text{X g} \qquad \qquad \qquad 0.287 \text{ g}$$

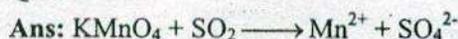
$$\frac{x}{58.5} \text{ moles} \longrightarrow \frac{x}{58.5} \text{ moles}$$

$$\begin{aligned} \therefore \text{Wt of AgCl produced} &= \text{mole of AgCl} \times \text{Mol. wt} \\ &= \frac{x}{58.5} \times 143.5 \end{aligned}$$

$$\text{A/q, } \frac{x}{58.5} \times 143.5 = 0.287 \text{ g}$$

$$x = 0.117 \text{ g; Ans}$$

Q19.



$$15.8 \text{ g} \quad \text{v.f}=2$$

$$\text{v.f}=5$$

gm eq. of $\text{KMnO}_4 = \text{gm eq. of SO}_2$

$$\frac{15.8}{158/5} = \frac{\text{wt}}{64/2}$$

$$\text{Wt of SO}_2 = \frac{1}{2} \times 32 = 16 \text{ g}$$



By POAC; mole of S in $\text{FeS}_2 = \text{mole of S in SO}_2$

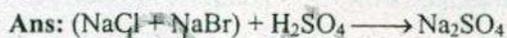
$$2 \times \text{mole of FeS}_2 = \text{mole of SO}_2$$

$$= \frac{16}{64}$$

$$\text{Mole of FeS}_2 = \frac{1}{8} \therefore \text{wt} = \frac{1}{8} \times 120 = 15 \text{ g}$$

Ans

Q20.



Let $(x + y) \text{ g} = 1 \text{ gm}$ is taken

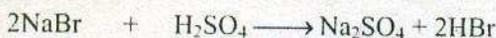
Then according to question, Wt of Na_2SO_4 produced = 1 g



$$\text{X g} = \frac{x}{58.5} \text{ moles}$$

$$\therefore \text{Mole of Na}_2\text{SO}_4 \text{ (produced)} = \frac{1}{2} \times \left(\frac{x}{58.5} \right)$$

$$\therefore \text{Wt of Na}_2\text{SO}_4 \text{ produced from NaCl} = \frac{x}{117} \times 142 \text{ g}$$



$$y \text{ g} = \frac{y}{103} \text{ moles}$$

$$\text{Moles of Na}_2\text{SO}_4 \text{ (Produced)} = \frac{1}{2} \times \frac{y}{103} = \frac{y}{206}$$

$$\therefore \text{Wt of Na}_2\text{SO}_4 \text{ Produced from NaBr} = \frac{y}{206} \times 142 \text{ g}$$

$$\text{A/q, } \frac{x \times 142}{117} + \frac{y}{206} \times 142 = 1 \text{ g}$$

$$\therefore \frac{x}{117} + \frac{1-x}{206} = \frac{1}{142} \quad (x+y=1)$$

$$\frac{206x + 117 - 117x}{206 \times 117} = \frac{1}{142}$$

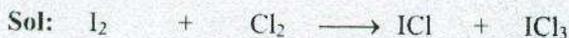
$$89x = 169.732 - 117 \Rightarrow x = \frac{52.732}{89} = 0.59 \text{ g}$$

$$\therefore \text{Wt of NaBr} = 1 - x = 0.41 \text{ g}$$

$$\therefore \text{Ratio of the wt.} = \frac{0.59}{0.41} = 1.45:1$$

Ans

Q21.



$$25.4 \text{ g} \quad 14.2 \text{ g}$$

$$\frac{254}{254} = 0.1 \quad \frac{142}{710} = 0.2$$

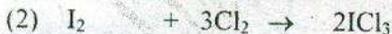
Let x moles of I₂ involved in ICl formation

\therefore moles of Cl₂ involved in ICl formation = x



$$x \text{ mole} \rightarrow x \text{ moles} \rightarrow 2x \text{ moles}$$

The remaining (0.1 - x) moles of I₂ will be involved in ICl₃ formation.



$$(0.1 - x) \rightarrow 3(0.1 - x)$$

\therefore Moles of Cl₂ involved = 3(0.1 - x)

Now x + 3(0.1 - x) = 0.2 (moles of Cl₂ given)

\Rightarrow

$$x + 0.3 - 3x = 0.2$$

$$2x = 0.1 \Rightarrow x = \frac{0.1}{2}$$

(1) \Rightarrow moles of ICl formed = 2x = 0.1 moles

(2) \Rightarrow moles of ICl₃ formed = (0.1 - x) \times 2 = 0.1 moles. Ans

Q22.



Nobel metals (Ag, Au, Pt, Hg Cu) doesn't react with acid/H₂O to produce H₂.

Volume of H₂ produced = 415 cm³ ∴ moles of H₂ produced = $\frac{415}{22400}$

From balanced chemical reacⁿ

∴ $\frac{3}{2}$ mole of H₂ produced by 1 mole of Al

∴ $1 \frac{2}{3}$

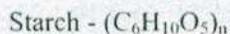
∴ $\frac{415}{22400} \frac{2}{3} \times \frac{415}{22400} = 0.01235$

∴ Wt. of Al = 0.01235 × 27 g = 0.3335 g

∴ % of Al = $\frac{0.3335}{0.35} \times 100 = 95.3\%$ Ans

Q23.

Ans: Absorption rate of CO₂ = 4.7 × 10⁻³ moles of CO₂ / hr by 1 gm green algae



∴ For doubling the mass of green algae (1 g), it must form 1 gm of starch.

∴ Wt of (C₆H₁₀O₅)_n = 1g



moles of in CO₂ = moles of C in (C₆H₁₀O₅)_n

moles of CO₂ = 6n × mole of (C₆H₁₀O₅)_n = $6n \times \frac{1}{n(162)}$

∴ Mole of CO₂ required = $\frac{6}{162}$

Rate of absorption = 4.7 × 10⁻³ moles/hr

Time(hr) = $\frac{6/162}{4.7 \times 10^{-3}}$ = 7.88 hrs Ans

Q24.



Let x g is the weight of CaO taken, from which Y g of CaO reacts with carbon to produce CaC₂,

∴ So. Wt. of CaO remained = (x-y) g

Wt of CaC₂ produced = mole of CaC₂ × Mol. wt CaC₂

= mole of CaO reacted × M.w. CaC₂ = $\frac{y}{56} \times 64 = \frac{8y}{7}$

∴ Total weight now, $(x-y) + \frac{8y}{7} = \left(x + \frac{y}{7}\right)$ g

(Wt of CaC₂ produced remained + Wt of CaO produced)

A/q, Wt of $\text{CaC}_2 = 85\%$

$$\Rightarrow \frac{\frac{8y}{7}}{x + \frac{y}{7}} \times 100 = 85 \Rightarrow \frac{8y}{7x + y} = \frac{85}{100} = \frac{17}{20}$$

$$\Rightarrow 160y = 119x + 17y \Rightarrow 143y = 119x$$

$$\Rightarrow y = \frac{119}{143}x = 0.832x$$

(a) Pure wt of CaC_2 , $\frac{8y}{7} = 1000 \text{ kg (given)} \Rightarrow y = \frac{7000}{8} \text{ Kg}$

$$\therefore x \text{ (wt of CaO have to take)} = \frac{y}{0.832} = \frac{7000}{8 \times 0.832} \text{ Kg} = \frac{7000}{6.657} = 1051.5 \text{ Kg}$$

(b)- Crude product = $(x - y) + \frac{8y}{7} = x + \frac{y}{7} = 1000 \text{ Kg}$.

$$x + \frac{0.832x}{7} = 1000 \Rightarrow \frac{7.832x}{7} = 1000 \text{ Kg}$$

$$\Rightarrow x = \frac{7000}{7.832} = 893.7 \text{ Kg} \quad \text{Ans}$$

Q25.

Sol: $\text{W (BaO + CaO)} = 2.5 \text{ g}$

Let $x \text{ g}$ of BaO is present

Then wt of CaO = $(2.5 - x) \text{ g}$



$x \text{ g}$

$$\frac{x}{153} \text{ moles} \longrightarrow \frac{x}{153} \text{ moles} = \frac{x}{153} \times 233 = 1.523x$$



$(2.5 - x) \text{ g}$

$$\frac{(2.5 - x)}{56} \text{ moles} \longrightarrow \left(\frac{2.5 - x}{56} \right) \text{ moles} = \frac{(2.5 - x)}{56} \times 136 = (2.5 - x) 2.43 \text{ g}$$

A/q, wt of CaSO_4 + wt of $\text{BaSO}_4 = 4.713 \text{ g}$

$$(2.5 - x) 2.43 + 1.523x = 4.713$$

$$6.07 - 2.43x + 1.523x = 4.713$$

$$1.358 = 0.907x$$

$$x = \frac{1.358}{0.907} = 1.497 \text{ g} = 1.5 \text{ g}$$

$$\therefore \% \text{ of BaO} = \frac{x}{2.5} \times 100 = \frac{1.5}{2.5} \times 100 = 60\% \quad \text{Ans}$$

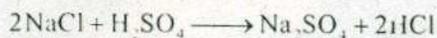
Q26.



Let 1 g of (NaCl + NaI) is taken, in which x g of NaI is present & (1-x) g of NaCl is Present



$$\begin{aligned} \frac{x}{150} \text{ moles} &\longrightarrow \frac{1}{2} \times \frac{x}{150} \text{ moles} \\ &= \frac{1}{2} \times \frac{x}{150} \times 142 = \frac{71x}{150} \text{ g} \end{aligned}$$



$$\begin{aligned} \frac{(1-x)}{58.5} \text{ moles} &\longrightarrow \frac{1}{2} \times \frac{(1-x)}{58.5} \\ &= \frac{1}{2} \times \frac{1-x}{58.5} \times 142 = \frac{71}{58.5} (1-x) \text{ g} \end{aligned}$$

A/q, Wt of Na_2SO_4 produced = 1 g

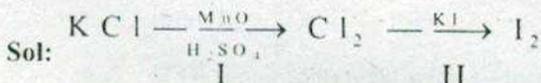
$$\frac{71x}{150} + \frac{71(1-x)}{58.5} = 1 \Rightarrow \frac{58.5x + 150 - 150x}{150 \times 58.5} = \frac{1}{71}$$

$$150 - 91.5x = 123.6$$

$$91.5x = 26.4 \Rightarrow x = \frac{26.4}{91.5} = 0.2885$$

$$\therefore \% \text{ of NaI} = \frac{x}{1} \times 100 = \frac{0.2885}{1} \times 100 = 28.85\% \quad \text{Ans}$$

Q27.



7.46 g

By POAC (in reaction I)

mole of Cl in KCl = moles of Cl atom in Cl_2

mole of KCl = 2 × moles of Cl_2

$$\frac{7.46}{74.6} = 2 \times \text{moles of } \text{Cl}_2$$

$$\frac{1}{10} = 2 \times \text{mole of } \text{I}_2 \quad (\text{mole of } \text{Cl}_2 = \text{mole of } \text{I}_2 \text{ from IInd reac}^{\text{on}})$$

$$\text{mole of } \text{I}_2 = \frac{1}{20} \Rightarrow \text{Wt of } \text{I}_2 = \frac{1}{20} \times 258 = 12.7 \text{ g}$$

Ans

Q28.

Sol: Let us consider 100 g of Carnalite

Wt of water = 38.86 g

\therefore Wt of KCl + MgCl_2 = (100 - 38.86) g = 61.14 g

Let wt of KCl = x gm

∴ Wt of MgCl₂ = (61.14 - x) g



By POAC

mole of Cl atom before reaction = mole of Cl atom reaction

mole of Cl in KCl + mole of Cl in MgCl₂ = mole of Cl in AgCl

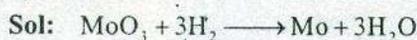
mole of KCl + 2 × mole of MgCl₂ = mole of AgCl

$$\frac{0.458 \times x}{100 \times 74.5} + 2 \times \frac{(61.14 - x)}{100 \times 95} \times 0.458 = \frac{0.71}{143.5}$$

$$\Rightarrow \frac{x}{74.5} + \frac{(61.14 - x)2}{95} = \frac{700}{143.5 \times 0.458} = \frac{700}{65.72}$$

Calculating x = 26.46% **Ans**

Q29.



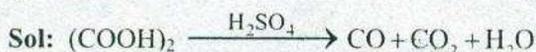
125 g

$\frac{125}{144}$ moles

Moles of H₂ reacts with $\frac{125}{144}$ moles of MoO₃ = $3 \times \frac{125}{144}$

∴ Volume of H₂ required = $\frac{375}{144} \times 22.4 \text{ lit} = 58.33 \text{ lit}$ **Ans**

Q30.



10 g = $\frac{10}{90}$ moles

moles of CO produced = $\frac{10}{90} = \frac{1}{9} \Rightarrow$ mole CO₂ produced = $\frac{10}{90} = \frac{1}{9}$

∴ Volume of gases produced at 0°C & 760 mm of Hg (at NTP)

$$\left(\frac{1}{9} + \frac{1}{9}\right) = \frac{2}{9} \times 22.4 \text{ lit} = 4.96 \text{ lit} \quad \text{Ans}$$

Q31.

Sol: $\text{W}(\text{CH}_4 + \text{C}_2\text{H}_6 + \text{C}_3\text{H}_8 + \text{N}_2)100\text{g}$

$\begin{array}{cccc} \downarrow & \downarrow & \downarrow & \downarrow \\ \text{\% by volume} & 84\% & 10\% & 3\% & 3\% \end{array}$

We know, volume % = mole % (at constant temp. and pressure)

mole % of CH₄ = 84% & mole % of C₂H₆ = 10%

mole % of C₃H₈ = 3% & mole % of N₂ = 3%

By POAC

mole of C before reaction = mole of c after reaction

mole of C (in CH_4 + in C_2H_6 + in C_3H_8) = mole of C in C_4H_6

mole of CH_4 + 2 mole of C_2H_6 + 3 × mole of C_3H_8 = 4 × mole of C_4H_6

$$84 + 2 \times 10 + 3 \times 3 = 4 \times \text{mole of } \text{C}_4\text{H}_6$$

$$84 + 20 + 9 = 4 \times \text{mole of } \text{C}_4\text{H}_6$$

$$\text{mole of } \text{C}_4\text{H}_6 = \frac{213}{4} = 28.25 \text{ moles}$$

mole of ($\text{CH}_4 + \text{C}_2\text{H}_6 + \text{C}_3\text{H}_8 + \text{N}_2$) taken (in 100 g of mixture)

$$= \frac{\text{wt}}{\text{Mol. wt}} = \frac{100}{\frac{84 \times 16 + 10 \times 30 + 3 \times 44 + 3 \times 28}{100}} = \frac{10000}{1860} = 5.376$$

∴ 100 moles of mixture produces 28.25 moles

$$\therefore 1 \text{ ————— } \frac{28.25}{100}$$

$$\therefore 5.376 \text{ ————— } \frac{5.376 \times 28.25}{100}$$

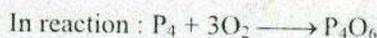
∴ Wt of C_4H_6 produced = mole × Mol. Wt = $1.518 \times 54 = 82 \text{ g.}$ **Ans**

Q32.



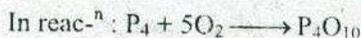
2 g 2 gm

$\frac{2}{124}$ moles $\frac{2}{32}$ moles



moles of O_2 required to react with $\frac{1}{62}$ moles of P_4 Completely

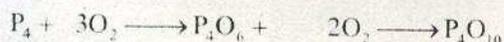
$$= \frac{1}{62} \times 3 = \frac{3}{62} < \frac{1}{16}$$



mole of O_2 required to react completely with

$$\frac{1}{62} \text{ moles of } \text{P}_4 = \frac{1}{62} \times 5 = \frac{5}{62} > \frac{1}{16}$$

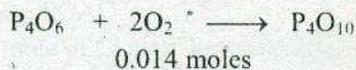
SO, P_4 will first react with O_2 to produce P_4O_6 & then the remaining O_2 will react with P_4O_6 to produce P_4O_{10}



$$\frac{1}{62} \longrightarrow \frac{3}{62} \text{ moles } \quad \frac{1}{62} \text{ mole } \quad \left(\frac{1}{16} - \frac{3}{62} \right)$$

$$\text{Wt of P}_4\text{O}_6 \text{ produced} = \frac{1}{62} \times 220 \text{ g} = 3.55 \text{ g}$$

$$\text{moles of O}_2 \text{ (remaining)} = \frac{1}{16} - \frac{3}{62} = \frac{62-48}{62 \times 16} = 0.014133$$



$$\therefore \text{moles of P}_4\text{O}_6 \text{ (reacted)} = \frac{0.014}{2} = 0.00706$$

$$\therefore \text{moles of P}_4\text{O}_6 \text{ (remained)} = \frac{1}{62} - 0.00706 = 0.00907$$

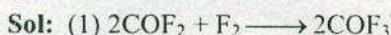
$$\text{moles of P}_4\text{O}_{10} \text{ (produced)} = \frac{0.014113}{2} = 0.00706$$

$$\text{Wt of P}_4\text{O}_{10} \text{ (produced)} = 0.00706 \times 284 = 2.004 \text{ g} \quad \text{Ans}$$

$$\text{Wt of P}_4\text{O}_6 \text{ (Produced)} = 0.00906 \times 220 = 1.996 \text{ g} \quad \text{Ans}$$

[Note → Please don't approximate the calculation]

Q33.



(1) $\Rightarrow \{1 \text{ mole of F}_2 \equiv 2 \text{ mole of COF}_3\} \times 2n$

(2) $\Rightarrow 4n \text{ mole of COF}_3 \equiv 1 \text{ mole of } (\text{CF}_2)_n$

$\therefore 2n \text{ mole of F}_2 \equiv 1 \text{ mole of } (\text{CF}_2)_n$

$1 \times \text{mole of F}_2 = 2n \times \text{mole of } (\text{CF}_2)_n$

$$= 2n \times \frac{1000 \text{ g}}{50n} = 40 \text{ mole}$$

$\therefore \text{Wt of F}_2 \text{ required} = 40 \times 38 \text{ g} = 1529 \text{ g} = 1.52 \text{ Kg} \quad \text{Ans}$

Q34.



$$\text{Wt of H}_2\text{O} \text{ (produced)} = \frac{1.8}{18} = 0.1 \text{ moles}$$

(2) Moles of $\text{KHCO}_3 = 0.1 \times 2 = 0.2$

Wt of $\text{KHCO}_3 = 0.2 \times 100 = 20 \text{ g} \quad \text{Ans}$

Also mole O_2 produced = $\frac{4}{32} = \frac{1}{8}$

(1) 2 moles of $\text{KClO}_3 \equiv 3 \text{ moles of O}_2$

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

$$\text{Moles of KClO}_3 = \frac{2}{3} \times \frac{1}{8} = \frac{1}{12} \text{ mole}$$

$$\therefore \text{Wt of KClO}_3 = \frac{1}{12} \times (39 + 35.5 + 3 \times 16) = \frac{1}{12} \times 122.5 = 10.2 \text{ g}$$

Ans

$$\text{Also moles of CO}_2 \text{ produced} = \frac{13.2}{44}$$

(2) & (3)

$$\text{Moles of CO}_2 \text{ produced} = \text{Mole of KHCO}_3 + \text{Mole of K}_2\text{CO}_3$$

$$\frac{13.2}{44} = 0.2 + \text{mole of K}_2\text{CO}_3$$

$$\text{Mole of K}_2\text{CO}_3 = \frac{13.2}{44} - 0.2 = 0.3 - 0.2 = 0.1 \text{ moles}$$

$$\therefore \text{Wt of K}_2\text{CO}_3 = 0.1 \times 138 = 13.8 \text{ g.} \quad \text{Ans}$$

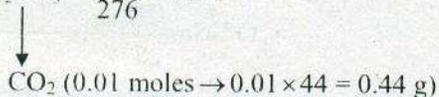
Objection Problems

Q1. Ans:(c) Stoichiometry tells about moles or volume for gases not directly about mass.

Q2. Ans:(d)

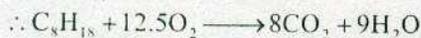
Q3. Ans:(b) Volume of O₂ produced per volume of H₂O₂ = $\frac{50}{5} = 10$

Q4. Ans:(c) mole of Ag₂CO₃ = $\frac{2.76}{276} = 0.01$



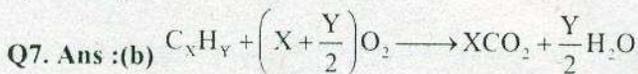
Q5. Ans:(c) Wt of C₈H₁₈ = 800/g × 1.425/g = 1140g

$$\text{mole of C}_8\text{H}_{18} = \frac{1140}{114} = 10$$



$$\therefore \text{Moles of O}_2 \text{ (required)} 10 \times 12.5 = 125 \text{ mole}$$

Q6. Ans:(b)



$$10 \text{ ml} \longrightarrow 40 \text{ ml} \quad 50 \text{ ml}$$

$$x = 4, \frac{y}{2} = 5, y = 10 \quad \therefore \text{C}_4\text{H}_{10}$$

Q8. Ans:(c) $\text{CO} + \frac{1}{2}\text{O}_2 \longrightarrow \text{CO}_2$

$$4 \text{ lit} \rightarrow 2 \text{ lit (required)}$$

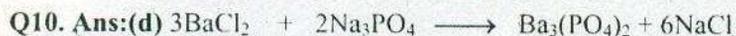


63.5 g

$$\frac{63.5}{63.5} = 1 \text{ mole}$$

mole of H_2S required = 1 moles

$$\therefore \text{Wt} = 1 \times 34 \text{ g} = 34 \text{ g}$$



0.5 moles 0.2 moles

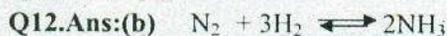
3 mole of $\text{BaCl}_2 = 2$ moles of $\text{Na}_3\text{PO}_4 \Rightarrow 2 \times \text{mole of BaCl}_2 = 3 \times \text{moles of Na}_3\text{PO}_4$

$$\text{mole of Na}_3\text{PO}_4 = \frac{2}{3} \times 0.5 = \frac{1}{3} > 0.2$$

$\therefore \text{Na}_3\text{PO}_4$ is the limiting reagent

$$\therefore \text{moles of Ba}_3(\text{PO}_4)_2 = \frac{0.2}{2} = 0.1 \text{ moles}$$

Q11. Ans: (b)



Initially moles A B 0

At eq^b A-x B-x 2x

$$2x=2 \Rightarrow x=1$$

$$A-x=2 \Rightarrow A-1=2 \Rightarrow A=3$$

$$B-3x=2, \Rightarrow B-3=2, \Rightarrow B=5$$

$$C_v = \frac{R \left(\frac{8}{2} + 3 \right)}{3} = \frac{7}{3} R$$

$$\frac{R}{Y-1} = \frac{7}{3} R \Rightarrow Y-1 = \frac{3}{7} \Rightarrow Y = \frac{3}{7} + 1 = \frac{10}{7} = 1.428$$