Chapter 9: Estimation of elements in Organic compounds

Q1.

Sol: $\underset{0.3\text{ g}}{\text{Compound}} \xrightarrow{O_2} \underset{0.88\text{ g}}{CO_2} + \underset{0.54\text{ g}}{H_2O}$

$\therefore$ Wt of carbon in CO_2 = Wt of C in 0.3 g of compare

$\Rightarrow \frac{12}{44}\times\frac{0.88}{100}$ = wt of C in 0.3 g compound = 0.24 g

$\therefore$ % of $C = \frac{0.24}{0.3}\times 100 = 80\%$

Also, Wt of H in H_2O = Wt of H in 0.3 g of compound

$\Rightarrow \frac{2}{18}\times\frac{0.54}{100}$ = Wt of H in 0.3 g of compound

$\Rightarrow$ 0.06 g = Wt of H in 0.3 g of compound.

$\therefore$ % of $H = \frac{0.06}{0.3}\times 100 = 20\%$ **Ans**

Q2.

Sol: $\underset{0.2475\text{ g}}{\text{Compound}} \longrightarrow \underset{0.4950\text{ g}}{CO_2} + \underset{0.2025\text{ g}}{H_2O}$

Mass of C in 0.2475 g of compound

= mass of C in 0.495 g of $CO_2 = \frac{12}{44}\times 0.495\text{ g}$

$\therefore$ % of $C = \frac{\frac{12}{44}\times 0.495}{0.2475}\times 100 = 54.54\%$

Again mass of H in 0.2475 g of compound

= mass of H in 0.2025 g of $H_2S = \frac{2}{18}\times 0.2025\text{ g}$

$\therefore$ % of $H = \frac{\frac{2}{18}\times 0.2025}{0.2475}\times 100 = 9.2\%$

$\therefore$ % of oxygen = 100 – (% C + % H) = 100 – (54.54 + 9.2) = 36.34% **Ans**

Q3.

Sol: $\underset{0.206\text{ g}}{\text{Substance}} \longrightarrow N_2$

V = 18.8 mL

$T = 17^0C = 290\text{ K}$

$P = 756\text{ mm of Hg} = \frac{756}{760}\text{ atm}$

Vapour tension of substance = 14.5 mm of Hg

$\therefore$ Actual pressure exerted by N_2

= 756 – 14.5 = 741.5 mm of Hg

$\therefore$ no of moles of $N_2 = \frac{PV}{RT} = \frac{\frac{741.5}{760}\times 18.8\times 10^{-3}}{0.0821\times 290} = 7.7\times 10^{-4}$

$\therefore$ Wt of $N_2 = 7.7\times 10^{-4}\times 28\ g = 0.0216\ g$

$\therefore$ % of Nitrogen $= \frac{0.0216}{0.206}\times 100 = 10.49\%$ **Ans**

Q4.

Sol: C_3H_7N ——— $\frac{1}{2}N_2$

2 g

$\frac{2}{57}$ moles ——— $\frac{1}{2}\times\frac{2}{57}$ moles

By POAC, moles of N_2 evolved $= \frac{1}{2}\times\frac{2}{57} = \frac{1}{57}$ mol

$\therefore$ Volume produced at NTP $= \frac{1}{57}\times 22400\,ml = 392.98\ mL$ **Ans**

Q5.

Sol: (1) Substance + $H_2SO_4 \xrightarrow{+NaOH\,(excess)} NH_3$

(2) $NH_3 + H_2SO_4 \longrightarrow NH_4HSO_4$

(3) H_2SO_4 (remained) + NaOH $\longrightarrow$ Na_2SO_4 + H_2O

73.7 mL

1 N

meq of NH_3 = meq of NH_3 used in reac-^{n} (2) $= (100\times 1 - 73.7\times 1)$

$\therefore$ milimole of $NH_3\times 1 = 26.3$

$\therefore$ milimole of nitrogen $= 26.3$

$\therefore$ Wt of N $= \frac{26.3}{1000}\times 14 = 0.3683g$

$\therefore$ % of N $= \frac{0.3682}{0.788}\times 100 = 46.73\%$ **Ans**

Q6.

Sol: Compound $\longrightarrow NH_3$ + $H_2SO_4 \longrightarrow NH_4HSO_4$

13.03 g 250 ml

$\frac{1}{2}$N

H_2SO_4 + NaOH $\longrightarrow$ $Na_2SO_4 + H_2O$

Remained 25.5 mL

25 mL $\frac{1}{10}$N

$\therefore$ mmoles remained in 1 lit = 40 × mmoles of H_2SO_4 in 25 mL = $40 \times \left(\frac{25.5 \times \frac{1}{10} \times 1}{2} \right) = 51$

$\therefore$ mmole of H_2SO_4 remained in original 250 mL solution = 51

$\therefore$ mmole of NH_3 = mmole of H_2SO_4 used in this reation

$$= 250 \times \frac{1}{2} \times 2 - 51 = 250 - 51 = 199$$

$\therefore$ mmole of N = m mole of NH_3 = 199

$\therefore$ Wt of $N = 199 \times 10^{-3} \times 14 = 2.786$ g

$\therefore$ Percentage of $N = \frac{2.786}{1393} \times 100 = 20\%$ **Ans**

Q7.

Sol: Compound $\longrightarrow$ CO_2 + H_2O

0.135 g 0.198 g 0.108 g

$\therefore$ Wt of C in 0.135 g of compound = Wt of C in 0.198 g of CO_2 = $\frac{12}{44} \times 0.198\,g = 0.054\,g$

$\therefore$ % of $C = \frac{0.054\,g}{0.135\,g} \times 100 = 40\%$

Wt of H in 0.135 g of compound = Wt of H in 0.108 g of $H_2O = \frac{2}{13} \times 0.108 = 0.012\,g$

$\therefore$ % of $H = \frac{0.012}{0.135} \times 100 = 8.89\%$

Compound $\longrightarrow$ N_2

0.135 g 16.8 mL

at 0^0C & 76 cm of Hg pressure

Moles of $N_2 = \frac{16.8}{22400} = 7.5 \times 10^{-4}$

$\therefore$ Wt of $N_2 = 7.5 \times 10^{-4} \times 28 = 0.021$ g

$\therefore$ % of $N_2 = \frac{0.021}{0.135} \times 100 = 15.56\%$

$\therefore$ % of oxygen = 100 – (%0 + % H_2 + % N_2) = 100 –(40+ 8.89 + 15.56) = 35.56% **Ans**

Q8.

Sol: Compound $\longrightarrow$ AgCl

0.18900 g 0.2870 g

$\therefore$ Wt of Cl in 0.1890 compound = Wt of Cl in 0.2879 g of AgCl = $\frac{35.5}{143.5} \times 0.287\,g$

Wt of Cl in 0.189 g compound = 0.071 g

$\therefore$ % of Cl in the compound = $\frac{0.071}{0.189} \times 100 = 37.56\%$ **Ans**

Q 9.

Sol: Compound $\longrightarrow$ CO_2 + H_2O

0.123 g 0.099 g 0.0507 g

Wt of C in 0.123 g in compound

$$= \text{Wt of C in 0.099 g of } CO_2 = 0.099 \times \frac{12}{44} = 0.0279\,g$$

$$\therefore \%\text{ of carbon} = \frac{0.027}{0.123} \times 100 = 21.95\%$$ **Ans**

Wt of H in 0.123 g of compound

$$= \text{wt of H in 0.05079 g of } H_2O = \frac{2}{18} \times 0.0507\,g = 5.63 \times 10^{-3}$$

$$\therefore \%\text{ of H} = \frac{5.63 \times 10^{-3}}{0.123} \times 100 = 4.48\%$$ **Ans**

Compound $\longrightarrow$ AgBr

0.185 g 0.319 g

Wt .of Br in 0.185 g of compound

$$= \text{Wt of Br in 0.319 g of AgBr} = \frac{80}{188} \times 0.319\,g = 0.1357\,g$$

$$\therefore \%\text{ of compound} = \frac{0.1357}{0.185} \times 100 = 73.36\%$$ **Ans**

Q10.

Sol: Organic compound $\longrightarrow$ $BaSO_4$

0.2595 g 0.35 g

$$\text{Wt of S in 0.2595 g of compound} = \text{Wt of S in 0.35 g of } BaSO_4 = \frac{32}{233.3} \times 0.35 = 0.048\,g$$

$$\therefore \%\text{ of S} = \frac{0.048}{0.2595} \times 100 = 18.5\%$$ **Ans**

Q11.

Sol: Organic compound $\longrightarrow$ $Mg_2P_2O_7$

1.5 g 2.509 g

Wt of P in 1.5 g of compound = wt of p in 2.509 g of $Mg_2P_2O_7$

$$= \frac{2 \times 31}{(48 + 62 + 16 \times 7)} \times 2.509 = \frac{62}{222} \times 2.509 = 0.7006\,g$$

$$\therefore \%\text{ of P} = \frac{0.7006\,g}{1.5\,g} \times 100 = 46.71\%$$ **Ans**