EXERCISE-S-II

1. A solution containing 4.2g of KOH and $Ca(OH)_2$ is neutralized by an acid. It consumes 0.1 equivalent of acid, calculate the percentage composition of the sample.

$KOH + Ca(OH)_2$

$\downarrow$ $\quad$ $\downarrow$

x g $\quad$ $(4.2-x)$ g

eq. of base = eq. of acid

$$\text{or, } \frac{x}{56}\times 1 + \frac{(4.2-x)}{74}\times 2 = 0.1$$

$$\text{or, } \frac{x}{56} + \frac{4.2}{37} - \frac{x}{37} = 0.1$$

$$\text{or, } \frac{x}{37} - \frac{x}{56} = \frac{4.2}{37} - 0.1$$

$$\Rightarrow \text{or, } x\left[\frac{56-37}{56\times 37}\right] = \frac{4.2-3.7}{37}$$

$$\text{or, } x = \frac{0.5\times 56}{19} = 1.474 \text{ g}$$

$$\therefore \%.\text{of KOH} = \frac{1.474}{4.2}\times 100 = \boxed{35\%}$$

$$\%.\text{of } Ca(OH)_2 = \boxed{65\%}$$

2. Calculate volume of 0.4 M $KMnO_4$ required to react with following in acidic medium

$$KHC_2O_4(1\ mol) + H_2C_2O_4(2\ mol)$$

(+7) (+3) (+4)

$KMnO_4 + C_2O_4^{2-} \longrightarrow Mn^{2+} + CO_2$

V Liter (1+2) = 3 mole

V.f = 5 V.f = 2(4-3) = 2

0.4M

eq. of $KMnO_4$ = eq of $C_2O_4^{2-}$

or, $0.4 \times V \times 5 = 3 \times 2$

or, $V = \frac{6}{2} =$ **3L** Ans.

3. 520 gm mixture of Fe_2O_3 and FeO reacts completely with 158 gm $KMnO_4$ in acidic medium Calculate the mole % of Fe_2O_3 in mixture.

Let Fe_2O_3 and FeO

↓ x mole ↓ y mole

$\therefore x \times 160 + y \times 72 = 520$ — (1)

$KMnO_4 = 158\,g = 1$ mole

$KMnO_4$ will oxidise FeO to Fe^{3+}.

$KMnO_4 + FeO \rightarrow Fe^{3+} + Mn^{2+}$

1 mole y mole

V.f = 5 V.f = 1

eq. of FeO = eq. of $KMnO_4$

or, $y \times 1 = 1 \times 5 \Rightarrow y = 5$ mole

$\therefore$ from (1), $x \times 160 + 360 = 520 \Rightarrow x = 1$ mole

$\therefore$ mole% of $Fe_2O_3 = \frac{x}{(x+y)} \times 100 = \frac{1}{(1+5)} \times 100 = \frac{50}{3} =$ **16.67%**

4. One gm of impure sodium carbonate is dissolved in water and the solution is made up to 250 ml. To 50 ml of this made up solution, 50 ml of 0.1N – HCl is added and the mix after shaking well required 10 ml of 0.16 N – NaOH solution for complete titration. Calculate the % purity of the sample.

Na_2CO_3 sample = 1g

↳ x gram pure.

$\therefore \frac{x}{106}$ mole. (in 250ml)

$\therefore \frac{x \times 50}{106 \times 250}$ mole (in 50ml)

eq. of HCl = eq. of Na_2CO_3 (v.f=2) + eq. of NaOH

or, $0.1 \times 50 \times 10^{-3} = \frac{x \times 50}{106 \times 250} \times 2 + 0.16 \times 10 \times 10^{-3}$

or, $0.005 - 0.0016 = \frac{x}{53 \times 5} \Rightarrow x = 0.901g$

$\therefore$ % purity = $\frac{0.901}{1} \times 100 =$ **90.1%**

5.. Mg can reduce NO_3^- to NH_3 in basic medium.

$NO_3^- + Mg\,(s) + H_2O \rightarrow Mg\,(OH)_2\,(s) + OH^-\,(aq.) + NH_3(g)$

A 25.0 mL sample of NO_3^- solution was treated with Mg. The NH_3 (g) was passed into 100 mL of 0.15 N HCl. The excess of HCl required 32.10 mL of 0.10 N NaOH for neutralization. What was the molarity of NO_3^- ions in the original sample ?

Let molarity of NO_3^- = M. Vol = 25 ml.

$\therefore NO_3^-$ = 25M mmole $\Rightarrow$ NH_3 = 25M mmole (By applying POAC on N atom)

$\rightarrow$ V.f = 1

meq. of HCl = meq. of NH_3 + meq. of NaOH

or, $0.15 \times 100 = 25M \times 1 + 0.1 \times 32.1$

or, $15 = 25M + 3.21 \Rightarrow 25M = 11.79 \Rightarrow M = \frac{11.79}{25} =$ **0.4716M**

6. An aqueous solution containing 0.10 g KIO_3 (formula wt. 214.0) was treated with an excess of KI solution. The solution was acidified with HCl. The liberated I_2 consumed 45.0 mL of thiosulphate solution to decolourise the blue starch – iodine complex. Calculate the molarity of the sodium thiosulphate solution. **[JEE 1998]**

$1\,KIO_3 + 5KI \longrightarrow 3I_2$

excess

v.f = 5 v.f = 1

$I_2 + 2Na_2S_2O_3 \longrightarrow 2NaI + Na_2S_4O_6$

$KIO_3 = \frac{0.1}{214}$ mole $\therefore$ moles of I_2 formed $= \frac{3\times0.1}{214}$ (from 1st rel^n)

$\therefore$ $Na_2S_2O_3$ required $= \frac{2\times3\times0.1}{214}$ mole

or, $45\times M\times10^{-3} = \frac{0.6}{214} \Rightarrow M = \frac{600}{214\times45} = \boxed{0.0623\,M}$

Ans.