Daily Tutorial Sheet-14	Level-3

153. $O_3 + 2KI + H_2O \rightarrow 2KOH + I_2 + O_2$

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

Millimoles of O_3 = Millimoles of $I_2 = \frac{1}{2} \times$ Millimoles of $Na_2S_2O_3$

$= \frac{1}{2} \times 40 \times 1/10 = 2$ millimoles = 0.002 moles

Total moles of O_3 and O_2 in the mixture: PV = n RT

$1 \times 1 = n \times 0.0821 \times 273$

$\therefore$ n = 0.044

Moles of $O_2 = 0.044 - 0.002 = 0.042$

$W_{O_2} = 0.042 \times 32$ g = 1.344 g

$W_{O_3} = 0.002 \times 48$ g = 0.096 g

$\therefore$ % of $O_3 = \frac{0.096}{1.144} \times 100 = 6.7\%$

No. of photons required for decomposition of ozone molecules = $0.002 \times 6.023 \times 10^{23} = 1.2 \times 10^{21}$

154. Equivalents of dichromate initially = $\frac{1.25 \times 6 \times 100}{1000} = 0.75$

Equivalents of Fe^{2+} in 25 ml = $\frac{0.875 \times 5 \times 20}{1000} = 0.0875$

Equivalents of Fe^{2+} in 50 ml = $0.0875 \times 2 = 0.175$

Equivalents of excess dichromate = 0.175

$\therefore$ Equivalents of dichromate consumed by (CuS and Cu_2S) = 0.75 – 0.175 = 0.575

If x g is the mass of CuS, the mass of Cu_2S is (10 – x) g

$$\frac{x}{95.5} \times 6 + \frac{(10-x)}{159} \times 8 = 0.575$$

$\therefore$ x = 5.74 gm

% CuS = $\frac{5.74}{10} \times 100 = 57.4\%$

% Cu_2S = 42.6%

155. Let, weight of $BaCO_3$, $CaCO_3$ and CaO are x, y and z respectively.

$\therefore$ x + y + z = 1.249

$BaCO_3 \longrightarrow BaCrO_4$

Redox change

$Cr^{6+} + 3e^- \longrightarrow Cr^{3+}$

$2I^- \longrightarrow I_2 + 2e^-$

Meq. of $BaCO_3$ = Meq. of $BaCrO_4$ = Meq. of I_2

$$\therefore \quad \frac{x}{197/3} \times 1000 = 20 \times 0.05 \times \frac{100}{10}$$

$\therefore$ x = 0.657 gm ... (1)

The equivalent weight of $BaCrO_4$ is M/3, therefore for $BaCO_3$, it should be M/3 also because mole ratio of $BaCO_3$ and $BaCrO_4$ is 1 : 1.

Applying POAC for C atom,

Moles of C in $BaCO_3$ + Moles of C in $CaCO_3$ = Moles of C in CO_2

$\therefore \quad \frac{x}{197}+\frac{y}{100}=\frac{168}{22400}$

$\Rightarrow \quad 200x + 294y = 295.5$ ... (2)

From equation (1) and (2)

$y = 0.416$ gm

$\therefore \quad 0.0657 + 0.416 + z = 1.249$

$z = 0.176$

% of CaO = $\frac{0.176}{1.249}$ = 14.09%

156. The chemical reaction is, $H_2O + KI + O_3 \longrightarrow I_2 + O_2 + KOH$

Milliequivalents of iodine = Milliequivalents of KI = Milli equivalents of O_3 reacted

Milliequivalents of $Na_2S_2O_3 = 1.5 \times 0.01 = 1.5 \times 10^{-2}$

Millimoles of iodine = $\frac{1.5\times10^{-2}}{2} = 7.5 \times 10^{-3}$ [$\because$ n-factor for iodine = 2]

Millimoles of ozone = 7.5×10^{-3}

Volume of ozone = $\frac{nRT}{P}=\frac{7.5\times10^{-6}\times0.0821\times300}{1} = 184.725 \times 10^{-6}$ litre

Volume per cent of ozone = $\frac{184.725\times10^{-6}}{10} \times 100 = 1.847 \times 10^{-3}$

157. $XO + K_2Cr_2O_7 \longrightarrow Cr^{3+} + XO_4^-$

$X_2O_3 + K_2Cr_2O_7 \longrightarrow Cr^{3+} + XO_4^-$

Let, wt. of XO in the mixture be x g

Equivalent of $K_2Cr_2O_7$ consumed by the mixture = 0.015×6

Equivalents of XO = $\frac{x}{x+16}\times5$

Equivalents of X_2O_3 = $\frac{2.18-x}{2x+48}\times8$

$\therefore \quad \frac{x}{x+16}\times5+\frac{2.18-x}{2x+48}\times8 = 0.015 \times 6$

Since 1 mole of XO gives 1 mole XO_4^- and 1 mole of X_2O_3 gives 2 moles of XO_4^-,

$\therefore \quad \frac{x}{x+16}+\frac{2x(2.18-x)}{2x+48} = 0.0187$

On solving, x = 99

158. Moles of $KIO_3 = \frac{0.1}{214} = 0.00047$

$\therefore$ Moles of I_2 liberated from $KIO_3 = \frac{0.00047}{2} = 0.000235$

Moles of KI reacting = $0.00047 \times 5 = 0.00235$ ($\because$ n-factor for KIO_3 and KI are 5 ad 1 respectively)

Moles of I_2 produced from KI = $\frac{0.00235}{2} = 0.001175$

Total moles of I_2 produced and reacted = 0.000235 + 0.001175 = 0.00141 equivalents of I_2 reacted

$= 0.00141 \times 2 = 0.00282$ = equivalents of thiosulphate Solution:

Molarity = $\frac{0.00282\times1000}{V} = 0.063$ M (For thiosulphate n-factor = 1)

(V = 45 mL)