KTT 111 : Model Answers
Sem1 2004/2005 : Q1 : STOICHIOMETRY

Sem 1 (2004/2005) : Stoichiometry

Q1 (a) oxalate salt : $H_2C_2O_4 \cdot KHC_2O_4 \cdot xH_2O$

$H_2C_2O_4$ → $2H^+$; KHC_2O_4 → H^+ ← This salt behave as triprotic acid

$H_2C_2O_4 \longrightarrow 2H^+ + C_2O_4^{2-}$

$HC_2O_4^- \longrightarrow H^+ + C_2O_4^{2-}$

oxalate salt behave as triprotic acid

$H_3A + 3OH^- \longrightarrow H_2O + A^-$

(H_3A (acid)) 29.07 mL, 0.9528 M

$$n_{H_3A} = \frac{1}{3} \times n_{OH^-} = \left(\frac{1}{3} \times \frac{29.07 \times 0.9528}{1000}\right) mol$$

atau $$\frac{2.3463}{M_r} = \frac{29.07 \times 0.9528}{3 \times 1000}$$

$$\therefore M_r \text{ (oxalate salt)} = 254.13$$

$M_r (H_2C_2O_4 \cdot KHC_2O_4) = 218.16$

$$218.16 + 18.0152x = 254.13$$

$$x = 2 \text{ (Ans)}$$

oxalate salt formula : $H_2C_2O_4 \cdot KHC_2O_4 \cdot 2H_2O$

Q1 (b) Balanced equations

$SO_2 + H_2O \longrightarrow H_2SO_3$ ..... (i)

$H_2SO_3 + I_2 + H_2O \longrightarrow H_2SO_4 + 2HI$ ..... (ii)

$2Na_2S_2O_3 + I_2 \longrightarrow 2NaI + Na_2S_4O_6$ ..... (iii)

$$n_{I_2} \text{ (added)} = \left(\frac{25.0 \times 0.0500}{1000}\right) mol = 1.25 \times 10^{-3} mol$$

$$n_{S_2O_3^{2-}} \text{ (react with excess } I_2) = \left(\frac{17.25 \times 0.09855}{1000}\right) mol$$

$$= 1.70 \times 10^{-3} mol$$

$$n_{I_2} \text{ (excess)} = \frac{1}{2} \times n_{S_2O_3^{2-}}$$

$$= \left(\frac{1}{2} \times 1.70 \times 10^{-3}\right) mol$$

$$= 8.5 \times 10^{-4} mol$$

1/2

Sem I (2004/2005) : Stoichiometry

Q1 (6) cont.

n_{I_2} (reacted with SO_2) $= (1.25\times10^{-3}) - (8.5\times10^{-4})$ mol

$= 4.0\times10^{-4}$ mol

From equation (i) and (ii)

$$n_{I_2} \equiv n_{SO_3^{2-}} \equiv n_{SO_2}$$

n_{SO_2} (in 25 mL diluted solution) $= 4.0\times10^{-4}$ mol

n_{SO_2} (in 1 L) $= (4.0\times10^{-4}) \times \frac{1000}{25}$ mol

$= 0.016$ mol

∴ 25.0 mL saturated solution contains 0.016 mol SO_2

Concentration of SO_2, $[SO_2] = \left(\frac{1000}{25.0} \times 0.016\right)$ mol dm^{-3}

$= 0.64$ mol dm^{-3}

$= (0.64 \times 64.0638)$ g dm^{-3}

$= 41.0$ g dm^{-3} (Ans)

Oxidation number of sulfur in H_2SO_3, H_2SO_4, $Na_2S_2O_3$, $Na_2S_4O_6$

$H_2\underline{S}O_3$: $+2 + x + 3(-2) = 0$ $\quad x = 6 - 2 = +4$ (Ans)

$H_2\underline{S}O_4$: $+2 + x + 4(-2) = 0$ $\quad x = 8 - 2 = +6$ (Ans)

$Na_2\underline{S}_2O_3$: $2(+1) + 2x + 3(-2) = 0$ $\quad x = +2$ (Ans)

$Na_2\underline{S}_4O_6$: $2(+1) + 4x + 6(-2) = 0$ $\quad x = +2.5$ (Ans)

2/2

Prepared by
V. Manoharan
vmano@usm.my
manovv1955@yahoo.com
04-6533888 ext 3566