KSCP (2001/02): Stoichiometry

Q1 (a)(i) $n_{Zr} : n_{Cl} = \frac{39.0}{91.224} : \frac{60.6}{35.4527}$ $(Zr = 91.224)$ $(Cl = 35.4527)$

$= 0.4275 : 1.7093$

$= 1 : 4$

Empirical formula = $ZrCl_4$ (Ans)

$ZrCl_4$ (12.5g) + Zr (0.37g) $\longrightarrow$ 45.9% Zr & 53.7% Cl

$n_{Zr} : n_{Cl} = \frac{45.9}{91.224} : \frac{53.7}{35.4527}$

$= 0.5032 : 1.5147$

$= 1 : \frac{1.5147}{0.5032}$

$= 1 : 3$

Empirical formula : $ZrCl_3$ (Ans)

(ii) $(ZrCl_4)n = 233.02$

$[91.224 + 4(35.4527)]n = 233.02$

$(233.03)n = 233.02$

$n = 1$

Molecular formula : $ZrCl_4$ (Ans)

(iii) $(ZrCl_3)n = 197.57$

$[91.224 + 3(35.4527)]n = 197.57$

$197.58\, n = 197.57$

$n = 1$

Molecular formula = $ZrCl_3$ (Ans)

(iv) $Zr + 2Cl_2 \longrightarrow ZrCl_4$

$3ZrCl_4 + Zr \longrightarrow 4ZrCl_3$

(v) $ZrCl_4$: $+x - 4 = 0$, $x = +4$ } oxidation no for Zr = (+4)

$ZrCl_3$: $+x - 3$, $x = +3$ } oxidation no. for Zr = (+3)

Q1 (b) Balancing redox equation.

$$Br^- + BrO_3^- \longrightarrow Br_2$$

$$5(2Br^- \longrightarrow Br_2 + 2e^-) \text{ (oxidation)}$$

$$10e^- + 12H^+ + 2BrO_3^- \longrightarrow Br_2 + 6H_2O \text{ (reduction)}$$

(−10 +12 −2)

$$10Br^- + 12H^+ + 2BrO_3^- \longrightarrow 6Br_2 + 6H_2O$$

Q1 (c)

$$0.335\ \% = (4 \times 55.847)\ g$$

$$\therefore\ 100\ \% = \left(\frac{100 \times 4 \times 55.847}{0.335}\right) g$$

$$= 66682.98$$

$$= 66683.0\ g$$

Relative molecular mass of hemoglobine = 66683.0

@ 6.7×10^4 (Ans)

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