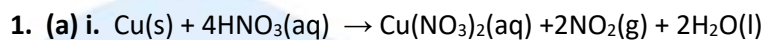


SL & HL Answers to Oxidation & reduction (3) questions



ii. The oxidation state of copper increases from 0 to +2 so copper has been oxidised and the oxidation state of nitrogen decreases from +5 to +4 so nitrogen has been reduced.

(b) i. In Step 2 iodide ions have been oxidised from -1 to 0 so iodide ions are acting as the reducing agent.

ii. The oxidation state of copper has changed from +2 to +1.

(c) Thiosulfate ions are acting as the reducing agent as they reduce elemental iodine (oxidation state zero) to iodide ions (oxidation state -1).

(d) Amount of $\text{S}_2\text{O}_3^{2-}(\text{aq})$ in $21.4 \text{ cm}^3 = (21.4 \div 1000) \times 0.200 = 4.28 \times 10^{-3} \text{ mol}$

Amount of I_2 in $10.0 \text{ cm}^3 = 2.14 \times 10^{-3} \text{ mol}$

Amount of I_2 in $100 \text{ cm}^3 = 2.14 \times 10^{-2} \text{ mol}$

Amount of copper reacted = $2 \times 2.14 \times 10^{-2} = 4.28 \times 10^{-2} \text{ mol}$

Mass of copper reacted = $63.55 \times 4.28 \times 10^{-2} = 2.72 \text{ g}$

(e) The percentage of copper in the coin = $(2.72 \div 3.03) \times 100 = 89.8\%$

2. i. When the addition of one drop of the potassium manganate(VII) solution causes a faint pink colour to remain.

ii. *Half-equations:* $\text{MnO}_4^-(\text{aq}) + 8\text{H}^+(\text{aq}) + 5\text{e}^- \rightarrow \text{Mn}^{2+}(\text{aq}) + 4\text{H}_2\text{O(l)}$

$\text{SO}_2(\text{aq}) + 2\text{H}_2\text{O(l)} \rightarrow \text{SO}_4^{2-}(\text{aq}) + 4\text{H}^+(\text{aq}) + 2\text{e}^-$

Overall equation: $2\text{MnO}_4^-(\text{aq}) + 5\text{SO}_2(\text{aq}) + 2\text{H}_2\text{O(l)} \rightarrow 2\text{Mn}^{2+}(\text{aq}) + 5\text{SO}_4^{2-}(\text{aq}) + 4\text{H}^+(\text{aq})$

iii. Amount of $\text{MnO}_4^-(\text{aq}) = (12.0 \div 1000) \times 2.50 \times 10^{-2} = 3.00 \times 10^{-4} \text{ mol}$

Since 2MnO_4^- reacts with 5SO_2

Amount of $\text{SO}_2 = 5/2 \times 3.00 \times 10^{-4} = 7.50 \times 10^{-4} \text{ mol}$

Mass of sulfur = $32.07 \times 7.50 \times 10^{-4} = 2.41 \times 10^{-2} \text{ g}$

Percentage by mass of S in fuel = $(2.41 \times 10^{-2} \div 10.0) \times 100 = 0.24\%$