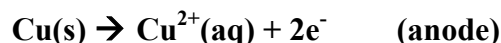


- A concentration cell containing aqueous solutions of $\text{Cu}(\text{NO}_3)_2$ and solid copper metal is constructed so that the Cu^{2+} ion concentration in the cathode half-cell is 0.66 M. Calculate the concentration of the Cu^{2+} ion in the anode half-cell if the cell potential for the concentration cell at 25 °C is 0.03 V.

Marks
2

The cathode and anode reactions are:



The standard electrode potential $E^\circ = 0$ V and the potential can be calculated using the Nernst equation for this 2 electron reaction, $n = 2$:

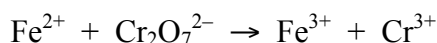
$$E = E^\circ - \frac{RT}{nF} \ln Q = - \frac{RT}{nF} \ln \left(\frac{[\text{Cu}^{2+}(\text{aq})]_{\text{anode}}}{[\text{Cu}^{2+}(\text{aq})]_{\text{cathode}}} \right)$$

$$= - \frac{(8.314 \text{ J K}^{-1} \text{ mol}^{-1})(298 \text{ K})}{(2 \times 96485 \text{ C mol}^{-1})} \ln \left(\frac{[\text{Cu}^{2+}(\text{aq})]_{\text{anode}}}{0.66} \right) = +0.03 \text{ V}$$

This gives $[\text{Cu}^{2+}(\text{aq})]_{\text{anode}} = 0.06 \text{ M}$.

Answer: **0.06 M**

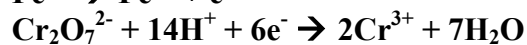
- In **acid solution**, dichromate ion oxidises iron(II) to iron(III) as illustrated in the partial equation:



Write a balanced equation for this reaction.

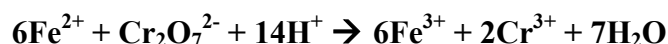
3

The half reactions are:



where H^+ has been added to the $\text{Cr}_2\text{O}_7^{2-} / \text{Cr}^{3+}$ couple to give H_2O .

To balance the electrons, the first reaction needs to be multiplied by 6. Hence:



What would happen to the cell potential if the concentration of Cr^{3+} were increased?

It would decrease. If $[\text{Cr}^{3+}]$ is increased, Le Châtelier's principle predicts that the reaction will shift towards reactants, reducing the cell potential.