

5.1.1 Choose cell direction and interpret electrode data

Name: _____ Class: _____ Date: _____

Total: 19 marks

KEY WORDS evidence • conditions

Objective

Choose cell direction and interpret electrode data. All questions and marking guidance are original.

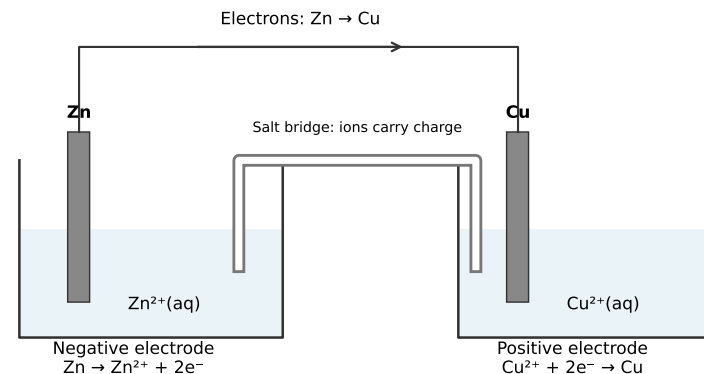
1 Key knowledge and worked examples

Reduction potentials compare half-cells with the standard hydrogen electrode: 298 K, 100 kPa gas pressure and 1.00 mol dm⁻³ solute concentrations. A metal solid can be its own electrode; an all-solution pair needs an inert conductor such as platinum. The salt bridge carries ions, while the wire carries electrons.

■ Worked method

For $\text{Zn}^{2+}/\text{Zn} = -0.76 \text{ V}$ and $\text{Cu}^{2+}/\text{Cu} = +0.34 \text{ V}$, copper(II) is reduced and zinc oxidised. $E_{\text{cell}}^{\circ} = 0.34 - (-0.76) = 1.10 \text{ V}$. Cell diagram: $\text{Zn(s)} \mid \text{Zn}^{2+}(\text{aq}) \parallel \text{Cu}^{2+}(\text{aq}) \mid \text{Cu(s)}$. Multiply half-equations to cancel electrons, but never multiply voltages. Positive E° predicts standard thermodynamic feasibility, not rate or the result under every concentration.

Spontaneous zinc-copper cell: schematic



2 Practice

2.1 State the standard hydrogen electrode materials and conditions. [4]

2.2 For $\text{Ag}^+/\text{Ag} = +0.80 \text{ V}$ and $\text{Cu}^{2+}/\text{Cu} = +0.34 \text{ V}$, identify the positive electrode and calculate E°_{cell} . [2]

2.3 Explain why an $\text{Fe}^{3+}/\text{Fe}^{2+}$ half-cell uses platinum and a salt bridge. Identify what carries charge in each part. [3]

3 Exam-style questions

3.1 Combine Ag^+/Ag and Cu^{2+}/Cu into a spontaneous equation. Explain why doubling the silver half-equation does not double its potential. [4]

3.2 A proposed reaction has positive E°_{cell} but shows no visible change. Give two distinct reasons why this need not contradict the standard prediction. [2]

3.3 Hypothetical $\text{A}^{3+}/\text{A}^{2+}$ is +0.20 V and A^{2+}/A is +0.60 V. Test disproportionation of A^{2+} . Give the balanced equation, voltage and relation to K for that reaction. [4]
