

Question	Marking Guidance	Mark	Comments
7(a)	<p>Diagram of an $\text{Fe}^{3+}/\text{Fe}^{2+}$ electrode that includes the following parts labelled:</p> <p>Solution containing Fe^{2+} and Fe^{3+} ions</p> <p>Platinum electrode connected to one terminal of a voltmeter</p> <p>Salt bridge</p> <p>298 K and 100 kPa / 1 bar</p> <p><u>all solutions</u> unit / 1 mol dm⁻³ concentration</p>	<p>1</p> <p>1</p> <p>1</p> <p>1</p> <p>1</p>	<p>Must be in the solution of iron ions (one type will suffice)</p> <p>Do not allow incorrect material for salt bridge and salt bridge must be in the solution (ie it must be shown crossing a meniscus)</p> <p>Allow zero current / high resistance voltmeter as alternative to M4 or M5</p> <p>Ignore hydrogen electrode even if incorrect</p>
7(b)	<p>$\text{Cu}^{2+} + \text{Fe} \rightarrow \text{Cu} + \text{Fe}^{2+}$</p> <p>$\text{Fe} \text{Fe}^{2+} \text{Cu}^{2+} \text{Cu}$ correct order</p> <p>Phase boundaries and salt bridge correct, no Pt</p> <p>Copper electrode</p>	<p>1</p> <p>1</p> <p>1</p> <p>1</p>	<p>Ignore state symbols</p> <p>Allow $\text{Cu} \text{Cu}^{2+} \text{Fe}^{2+} \text{Fe}$</p> <p>Allow single/double dashed line for salt bridge</p> <p>Penalise phase boundary at either electrode end</p> <p>Can only score M3 if M2 correct</p> <p>Allow any reference to copper</p>

7(c)	$E^\ominus \text{Au}^+/\text{Au} > E^\ominus \text{O}_2/\text{H}_2\text{O}$ So Au^+ ions will oxidise water / water reduces Au^+ $2\text{Au}^+ + \text{H}_2\text{O} \rightarrow 2\text{Au} + 1/2\text{O}_2 + 2\text{H}^+$	1 1 1	Allow $E_{\text{cell/e.m.f.}} = 0.45 \text{ V}$ Allow $1.68 > 1.23$ QoL Allow multiples
7(d)	$E^\ominus \text{Ag}^+/\text{Ag} > E^\ominus \text{Fe}^{2+}/\text{Fe}$ And $E^\ominus \text{Ag}^+/\text{Ag} > E^\ominus \text{Fe}^{3+}/\text{Fe}^{2+}$ So silver ions will oxidise iron (to iron(II) ions) and then oxidise Fe(II) ions (further to Fe(III) ions producing silver metal)	1 1 1	Allow $E_{\text{cell/e.m.f.}} = 1.24$ Allow $0.80 > -0.44$ Allow $E_{\text{cell/e.m.f.}} = 0.03$ Allow $0.80 > 0.77$ Allow Ag^+ ions will oxidise iron to iron(III)