Solutions

Each answer shows the steps, then the **result**.

2.1

- hydrogen gas at 1 atm bubbled over a platinum electrode in 1 mol dm^{-3} H^+, defined as 0.00 V

2.2

- it must be positive

2.3

- 298 K; a pressure of 1 bar for any gas; all solutions at a concentration of 1 mol dm^{-3}

2.4

- $E^\ominus_{cell}$ describes only the thermodynamic feasibility, not the rate; a large activation energy can make the reaction immeasurably slow, so nothing is seen

2.5

- It becomes more positive; Fe^{3+} is on the left of the half-equation, so raising its concentration shifts the equilibrium to the right by Le Chatelier's principle

3.1 B

- A more positive $E^\ominus$ is a stronger oxidising agent

3.2 A

- More oxidised species makes the potential more positive

3.3

(a)

- $E^\ominus_{cell} = (+0.80) - (-0.44) = +1.24$ V

(b)

- the Fe^{2+}/Fe electrode (more negative) is the negative terminal; electrons flow from the iron to the silver electrode in the external circuit

3.4

- yes; $E^\ominus_{cell}$ for Ag^+ oxidising Fe is positive (+1.24 V), so the reaction is feasible

3.5

(a)

- The strongest oxidising agent is MnO_4^-, because it has the most positive $E^\ominus$ and is most readily reduced; the strongest reducing agent is V^{2+}, because its half-cell has the most negative $E^\ominus$

(b)

- $E^{\ominus}_{\text{cell}} = +0.77 - 0.15 = +0.62$ V, which is positive, so the reaction is feasible; $2Fe^{3+} + Sn^{2+} \rightarrow 2Fe^{2+} + Sn^{4+}$

(c)

- $MnO_4^- + 8H^+ + 5Fe^{2+} \rightarrow Mn^{2+} + 4H_2O + 5Fe^{3+}$; $E^{\ominus}_{\text{cell}} = +1.52 - 0.77 = +0.75$ V

(d)

- For Sn^{2+} to reduce V^{3+}: $E^{\ominus}_{\text{cell}} = -0.26 - 0.15 = -0.41$ V, which is negative, so that reaction is not feasible. Even where a value is positive, a high activation energy can make the reaction too slow to observe

(e)

- It becomes more positive; the oxidised species is in excess, so by Le Chatelier's principle the equilibrium shifts to the right, favouring reduction