Redox Reactions & Galvanic Cells

INSTRUCTOR / SELF-STUDY ANSWER KEY

Answers and reasoning appear in red. Use these to discuss why incorrect choices are incorrect.

Part A — Concept checks

1. **Oxidation means…**

   Answer: B. lose electrons — OIL: oxidation is loss of electrons.

2. **In a galvanic cell, oxidation occurs at the…**

   Answer: C. anode — Anode = oxidation for all electrochemical cells.

3. **Electrons travel through the external wire from…**

   Answer: B. anode to cathode — The anode supplies electrons for cathode reduction.

4. **In the Zn/Cu galvanic cell, which species is oxidized?**

   Answer: C. Zn(s) — $Zn(s) \rightarrow Zn^{2+} + 2e^{-}$.

5. **$E°_{cathode} = 0.80$ V and $E°_{anode(reduction)} = 0.20$ V. $E°_{cell}$ = …**

   Answer: B. 0.60 V — Subtract: $0.80 - 0.20 = 0.60$ V.

6. **The salt bridge primarily allows…**

   Answer: B. ion movement to maintain charge balance — Ions migrate to maintain electrical neutrality.

Part B — Application and explanation

7. For $Zn(s) \mid Zn^{2+}(aq) \parallel Cu^{2+}(aq) \mid Cu(s)$, calculate $E°_{cell}$.

   Model solution: $E°_{cathode} = +0.34$ V (Cu^{2+}/Cu); $E°_{anode(reduction)} = -0.76$ V (Zn^{2+}/Zn). $E°_{cell} = +0.34 - (-0.76) = +1.10$ V. Final answer: +1.10 V

8. Explain why this guideline matters, with an example of what could go wrong if you ignore it: Electrons flow in the external wire from anode to cathode. In a galvanic cell, the anode is negative; sign conventions differ for electrolytic cells.

   Model explanation: Electrons flow in the external wire from anode to cathode. In a galvanic cell, the anode is negative; sign conventions differ for electrolytic cells. Example/check: Oxidation is loss of electrons and reduction is gain. In a galvanic cell, oxidation occurs at the anode, reduction at the cathode.

REFERENCE RELATIONSHIP

$E°_{cell} = E°_{cathode(reduction)} - E°_{anode(reduction)}$