Year 13 Science: Oxidation-reduction: electrode potentials and cells

Name: _____ Date: _____

Try these without your notes first, then check the answer key.

Practice

1. Find the oxidation number of S in $S_2O_3^{2-}$.

2. Calculate E°cell for Mg(s) | Mg^{2+}(aq) || Cu^{2+}(aq) | Cu(s).

3. Will Fe^{3+} oxidise I^-? Give E°cell.

4. In the zinc–copper cell, which electrode is the anode, and which way do electrons flow in the wire?

5. $CuSO_4$(aq) is electrolysed with graphite electrodes. What forms at each electrode?

Fix the mistake

6. Correct this statement: "For Mg + $2Ag^+$, E°cell = 2(+0.80) − (−2.37) = +3.97 V."

7. Correct this statement: "The anode is always the positive electrode."

8. Correct this statement: "Electrons flow through the salt bridge."

9. Correct this statement: "E°cell is positive, so the reaction will happen quickly."

Answer key (for parents and tutors)

1. Find the oxidation number of S in $S_2O_3^{2-}$.
   $2x + 3(-2) = -2$, so S = +2.
2. Calculate E°cell for Mg(s) | Mg^{2+}(aq) || Cu^{2+}(aq) | Cu(s).
   E°cell = +0.34 − (−2.37) = +2.71 V.
3. Will Fe^{3+} oxidise I^-? Give E°cell.
   Yes: E°cell = +0.77 − (+0.54) = +0.23 V, positive, so $2Fe^{3+} + 2I^- \rightarrow 2Fe^{2+} + I_2$ is spontaneous.
4. In the zinc-copper cell, which electrode is the anode, and which way do electrons flow in the wire?
   Zinc is the anode (oxidised, negative); electrons flow from the zinc to the copper.
5. $CuSO_4$(aq) is electrolysed with graphite electrodes. What forms at each electrode?
   Copper at the cathode (Cu^{2+} is reduced before water) and oxygen gas at the anode (water is oxidised).
6. Correct this statement: "For Mg + $2Ag^+$, E°cell = 2(+0.80) − (−2.37) = +3.97 V."
   E° values are never multiplied by the coefficients: E°cell = +0.80 − (−2.37) = +3.17 V.
7. Correct this statement: "The anode is always the positive electrode."
   The anode is where oxidation happens: negative in a galvanic cell, positive in an electrolytic cell.
8. Correct this statement: "Electrons flow through the salt bridge."
   Electrons flow only in the wire; ions move through the salt bridge to keep each half-cell neutral.
9. Correct this statement: "E°cell is positive, so the reaction will happen quickly."
   A positive E°cell shows the reaction is spontaneous, not that it is fast.