ANSWER KEY.

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Redox Application

Chemistry | ANSWER KEY

Use oxidation numbers, the activity series below, and AN OX, RED CAT to answer each question. Explain your reasoning.

Activity series (most active first)	Mg	Al	Zn	Fe	Cu	Ag

1. Carbon monoxide burns in air: $2CO + O_2 \rightarrow 2CO_2$. Which element is oxidized, and which is reduced?

C is oxidized (+2 in CO to +4 in CO_2). O from O_2 is reduced (0 to −2).

2. Aluminum reacts with oxygen: $4Al + 3O_2 \rightarrow 2Al_2O_3$. Which element is oxidized? How many electrons does each Al atom lose?

In Al_2O_3, $2x + 3(-2) = 0$, so Al = +3. Al goes 0 to +3, so Al is oxidized and each Al atom loses 3 electrons.

3. Galvanized nails are iron coated with zinc. Explain why the coating keeps the iron from rusting.

Zinc is higher than iron on the activity series, so zinc is oxidized instead of iron. The zinc also covers the iron and blocks oxygen and water.

4. Iron rusts: $4Fe + 3O_2 \rightarrow 2Fe_2O_3$. A student says rusting is not redox because no electricity is involved. Explain why the student is wrong.

Rusting is redox because oxidation numbers change. In Fe_2O_3, $2x + 3(-2) = 0$, so Fe goes from 0 to +3 (oxidized) and O goes from 0 to −2 (reduced). Electrons move from iron to oxygen even without a wire.

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5. A galvanic cell has an iron strip in Fe^{2+} solution and a copper strip in Cu^{2+} solution. (a) Which metal is the anode? (b) Which way do electrons flow? (c) Which electrode gains mass?

(a) Fe, because it is more active than Cu, so it is oxidized, and oxidation happens at the anode. (b) From Fe to Cu through the wire. (c) The copper cathode gains mass as Cu builds up (the iron anode loses mass).

6. A galvanic cell has an aluminum strip in Al^{3+} solution and a silver strip in Ag^{+} solution. Which metal is the anode? Write the half-reaction at the anode and at the cathode.

Al is the anode because it is more active than Ag.
Anode (oxidation): $Al \rightarrow Al^{3+} + 3e^{-}$
Cathode (reduction): $Ag^{+} + e^{-} \rightarrow Ag$

7. What does the salt bridge do in a galvanic cell? What would happen without it?

It lets ions move between the beakers so the charges stay balanced. Without it, charge would build up and the reaction would stop, so no electricity would flow.

8. Purple MnO_4^{-} is added to a flask of Fe^{2+} in acid. The purple disappears until 18.4 mL is added. After that, the purple color stays. What has happened, and why is no extra indicator needed?

At 18.4 mL all the Fe^{2+} has reacted (been oxidized), so there is nothing left for MnO_4^{-} to react with. That is the endpoint. Permanganate is its own indicator because its purple color stays once the reaction is over.

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