Chapter 20 Electrochemistry

Answer Key Below

Oxidation

1. Identify the oxidation number of the underlined element in each compound:
   a. $K_2\underline{C}O_3$
   b. $(NH_4)_2\underline{Cr}_2O_7$
   c. $\underline{H}_2SO_4$

2. Find the oxidation numbers for nickel, sulfur, and oxygen in $Ni_2(SO_4)_3$?

3. Identify the initial and final oxidation number for iron in the reaction below:

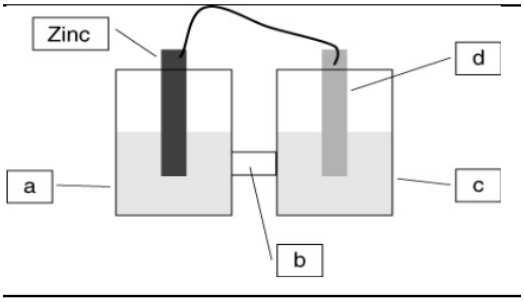
$$Fe_2O_3(s) + 3CO(g) \rightleftharpoons 2Fe(s) + 3CO_2(g)$$

4. Identify the oxidizing and reducing agents in the reaction below:

$$2Hg^{2+} + N_2H_4 \rightarrow 2Hg + N_2 + 4H^+$$

5. Which is false about voltaic cells?
    a. Electrons flow from the cathode to the anode
    b. Reduction occurs at the cathode
    c. The electrode where oxidation is occurring is denoted with a negative sign
    d. The purpose of a salt bridge is to neutralize charge buildup in the solution

6. A voltaic cell shows the oxidation of zinc metal and the reduction of silver cations with solutions of silver nitrate and zinc nitrate. Which letter represents the silver and the silver nitrate on the diagram?



7. Determine the E° for the following reaction:

$$Zn(s) + Pb^{2+}(aq) \rightarrow Zn^{2+}(aq) + Pb(s)$$

Half-reaction	Standard Reduction Potential
$Zn^{2+}(aq) + 2e^- \rightarrow Zn(s)$	–0.763
$Pb^{2+}(aq) + 2e^- \rightarrow Pb(s)$	–0.126

8. If the standard reduction potential of $Zn^{2+} \rightarrow Zn$ is –0.76 V, what is the standard reduction potential of $Mg^{2+} \rightarrow Mg$?

$$Mg / Mg^{2+}(aq) // Zn^{2+}(aq) / Zn \qquad E^\circ = +1.61 \text{ V}$$

9. Rank the halogens from weakest to strongest oxidizing agent based on periodic trends:

Br_2 F_2 I_2 Cl_2

10. For a given cell:

$$Zn(s)|Zn^{2+}(aq)||Cu^{2+}(aq)|Cu(s)$$

Calculate Ecell at 25°C if: $[Zn^{2+}] = 0.250\ M$ $[Cu^{2+}] = 1.50\ M$ E°Cell = 1.10 V

11. What is ΔG° for the following balanced reaction, if E˚cell = +2.431 V

$$Al(s) + Fe^{3+}(aq) \rightarrow Al^{3+}(aq) + Fe(s)$$

12. How many grams of elemental aluminum can be produced by electrolysis of Al_2O_3 using a current of 100 amperes for 24 hours?

Answer Key:

1. +4, +6, +1
2. Ni +3, S +6, O -2
3. +3, 0
4. Oxidizing agent: Hg^{2+}, Reducing agent: N_2H_4
5. A
6. silver = d silver nitrate = c
7. + 0.637 V
8. –2.37 V
9. $I_2 < Br_2 < Cl_2 < F_2$
10. 1.12 V
11. -704 kJ/mol
12. 805 g