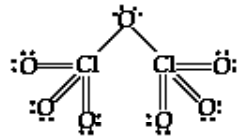
Oxidation-Reduction & Electrochemistry Problem Set

1. An oxidizing agent:

   a. receives electrons in a redox reaction.
   b. supplies electrons in a redox reaction.
   c. tend to contain atoms with low oxidation numbers.
   d. more than one of the above is correct.

2. What is the oxidation number of chlorine in dichlorine heptoxide?



   a. +4
   b. -4
   c. +7
   d. 0

3. Which of the following statements is true regarding the reaction of copper(II) sulfate with iron?

$$Fe\,(s) + CuSO_4\,(aq) \longrightarrow FeSO_4\,(aq) + Cu\,(s)$$

   I. Iron is reduced
   II. Copper is reduced
   III. Sulfate ion serves as an oxidizing agent

   a. I
   b. II
   c. I and III
   d. II and III

4. Which of the following statements is true regarding molecular oxygen and molecular hydrogen?

   a. O_2 is usually reduced in reaction (not with fluorine), while H_2 is usually oxidized (not by strong metals).
   b. The oxidation number of oxygen in O_2 is -2, while the oxidation number of hydrogen in H_2 is +1.
   c. O_2 is a strong reducing agent, while H_2 is usually an oxidizing agent.
   d. all of the above.

5. Which of the following metals will react vigorously with liquid water to give H_2?

   a. Ag
   b. Au
   c. Hg
   d. Li

6. Potassium permanganate, $KMnO^4$, is a strong oxidizing agent. Which atom in the molecule is reduced?

   a. K
   b. Mn
   c. O
   d. the substrate is reduced.

7. What is the coefficient on chlorine molecule when the following oxidation reduction reaction (in acidic solution) is balanced?

$$Cr_2O_7^{2-} + Cl^- \longrightarrow Cr^{3+} + Cl_2$$

   a. 3
   b. 1
   c. 6
   d. 7

8. In the reaction below, which species is oxidized and which is reduced?

$$NH_4NO_2 \longrightarrow N_2 + 2H_2O$$

   a. H is oxidized; N is reduced
   b. N is oxidized; O is reduced
   c. N is both oxidized and reduced
   d. N is oxidized; H is reduced

9. A large, positive standard reduction potential for a certain substance,

   a. indicates that the substance is a strong reducing agent
   b. indicates that the substance is a strong oxidizing agent
   c. indicates that the substance is easily oxidized
   d. more than one of the above is correct

10. In an electrolytic cell,

   a. oxidation occurs at the positive anode
   b. reduction occurs at the positive anode
   c. oxidation occurs at the negative anode
   d. reduction occurs at the negative anode

11. In a galvanic cell,

   a. oxidation occurs at the positive anode
   b. reduction occurs at the positive anode
   c. oxidation occurs at the negative anode
   d. reduction occurs at the negative anode

12. Which of the following results from the electrolysis of a solution of sodium chloride?

    I. production of sodium at the anode and chlorine gas at the cathode
    II. production of chlorine gas at the anode and hydrogen gas at the cathode
    III. a basic solution around the cathode

    a. I
    b. II
    c. I and III
    d. II and III

13. If 24 grams of metallic magnesium are produced in the electrolysis of molten magnesiium chloride ($MgCl_2$) , how much chlorine gas is produced (AW mg = 24 g; AW Cl = 35 g)?

    a. 35 g
    b. 70 g
    c. 17 g
    d. 24 g

14. It has been found that placing a rod of metallic zinc into a solution of copper sulfate will result in a layer of metallic copper being deposited on the zinc. However, a copper rod placed in a solution of zinc sulfate does not result in metallic zinc being deposited. Which of the following is a valid conclusion?

    I. zinc is a stronger reducing agent than copper
    II. the standard reduction potential of copper is higher than that of zinc
    III. zinc is oxidized in the solution by copper

    a. I
    b. II
    c. I and III
    d. I, II and III

15. Commercial aluminum is formed electrolytically from aluminum oxide (Al_2O_3), which is reduced at the cathode. Approximately how long must a current of 965 A be applied to form 27 g of aluminum? (Note that 96500 C = 1 mole e^-, and the AW of Al = 27 g)

    a. 5 minutes
    b. 1 1/2 minutes
    c. 300,000 seconds
    d. 1 second

16. The anode and cathode reactions for the silver oxide battery are respectively as follows:

$$Zn\ (s)\ +\ 2OH^-\ (aq) \longrightarrow Zn(OH)_2\ (s)\ +\ 2e^-$$

$$Ag_2O\ (s)\ +\ H_2O\ +\ 2e^- \longrightarrow 2Ag\ (s)\ +\ 2OH^-\ (aq)$$

    The standard reduction potential of Zn^{2+} is -0.762, and the standard reduction potential of Ag^+ is 0.800 V. What is the approximate emf of the silver oxide battery?

    a. 1.6 V
    b. 0.04 V
    c. 2.4 V