LECTURE 25

1. Determine the oxidation number of the underlined element in each of the following compounds or ions:

(a) $\underline{H}Cl$
(b) $N\underline{H}_4^+$
(c) $Na\underline{H}$
(d) $NaAl\underline{H}_4$
(e) $\underline{Fe}Cl_4^{2-}$
(f) $\underline{I}Cl_3$
(g) $\underline{S}O_4^{2-}$
(h) $\underline{Cu}(OH)_2$

2. Hydrogen peroxide (H_2O_2) is a harmful and reactive byproduct of metabolism. To prevent H_2O_2 from causing oxidative damage to cells, the enzyme catalase catalyzes the conversion of H_2O_2 to much less reactive molecules, oxygen and water.

$$2H_2O_2 \rightarrow 2H_2O + O_2$$

Using oxidation numbers, determine if H_2O_2 is reduced and/or oxidized in this reaction.

3. Using half-reactions, balance the following equations in **acidic** solution. Determine which atom or compound is the oxidizing agent and which is the reducing agent in each reaction.

(a) $Cr_2O_7^{-2}\ (aq) + C_2H_6O\ (aq) \rightarrow Cr^{+3}\ (aq) + C_2H_4O\ (aq)$

(b) $MnO_4^-\ (aq) + H_2O_2\ (aq) \rightarrow Mn^{2+}\ (aq) + O_2\ (g)$

4. Using half-reactions, balance the following equations in **basic** solution. Determine which atom or compound is the oxidizing agent and which is the reducing agent in each reaction.

(a) $CO_2\ (g) + F_2\ (g) \rightarrow FO_3^-\ (aq) + C_2O_4^{-2}\ (aq)$

(b) $Cr(OH)_3\ (aq) + Br_2\ (l) \rightarrow CrO_4^{-2}\ (aq) + Br^-\ (aq)$

5. In some alkaline batteries, a solid zinc electrode in a basic solution is oxidized to ZnO while solid manganese (IV) oxide is reduced to solid manganese (III) oxide.

(a) Write the half-reactions for both the anode and cathode of the cell, as well as the overall reaction.
(b) Calculate the mass in kg of ZnO(s) formed if 1.0×10^4 A are passed through the cell for 12 hours.

6. A jeweler is investigating a novel method for electroplating tungsten onto base metal. The jeweler passes a 30.0 A current through a solution for 1.00 hours and 100. g of tungsten is deposited on the ring. What is the oxidation number of tungsten in the solution?

5.111 Principles of Chemical Science
Fall 2014