Unit 5 – Chapter 16: Electrochemistry **Name _____**

Assignment #4: Voltaic Cells & Nernst Equation **Period _____**

1) Consider a voltaic cell at 25^{0}C in which the following reaction takes place.

$$3\ H_2O_{2(aq)} + 6\ H^+_{(aq)} + 2\ Au_{(s)} \rightarrow 2\ Au^{3+}_{(aq)} + 6\ H_2O$$

a. Calculate E^0.
b. Write the Nernst equation for the cell.
c. Calculate E when $[Au^{3+}] = 0.250\ M$, $[H^+] = 1.25\ M$, $[H_2O_2] = 1.50\ M$.

2) Consider a voltaic cell at 25^{0}C in which the following reaction takes place.

$$3\ O_{2(aq)} + 4\ NO_{(g)} + 2\ H_2O \rightarrow 4\ NO_3^-{}_{(aq)} + 4\ H^+_{(aq)}$$

a. Calculate E^0.
b. Write the Nernst equation for the cell.
c. Calculate E when $[NO_3^-] = 0.750\ M$, $P_{NO} = 0.993$ atm, $P_{O2} = 0.515$ atm, pH = 2.85.

3) Consider a voltaic cell in which the following reaction takes place.

$$2\ NO_3^-{}_{(aq)} + 3\ H_{2(g)} \rightarrow 2\ NO_{(g)} + 2\ OH^-_{(aq)} + 2\ H_2O$$

a. Calculate E^0.
b. Write the Nernst equation for the cell.
c. Calculate E when $[NO_3^-] = 0.0315\ M$, $P_{NO} = 0.922$ atm, $P_{H2} = 0.437$ atm, pH = 11.50.

4) Consider the reaction

$$S_{(s)} + 2\ H^+_{(aq)} + 2\ Ag_{(s)} + 2\ Br^-_{(aq)} \rightarrow 2\ AgBr_{(s)} + H_2S_{(aq)}$$

At what pH is the *voltage* zero if all other species are at standard concentrations?

5) Consider the reaction below at 25^{0}C:

$$3\ SO_4^{2-}{}_{(aq)} + 12\ H^+_{(aq)} + 2\ Cr_{(s)} \rightarrow 3\ SO_{2(g)} + 2\ Cr^{3+}_{(aq)} + 6\ H_2O$$

Use table 18.1 to answer the following questions. Support your answers with calculations.

a. Is the reaction spontaneous at standard conditions?
b. Is the reaction spontaneous at a pH of 3.00 with all other ionic species at 0.100 *M* and gases at 1.00 atm?
c. At what pH is the reaction at equilibrium with all other ionic species at 0.100 *M* and gases at 1.00 atm?