Dougherty Valley HS Chemistry - AP
Electrochemistry – Study Questions

Worksheet #4

Name: **Period:** **Seat#:**

Directions: Use half-reactions and/or reduction tables to answer the following questions. Remember to use binder paper for more space if needed – there is so much to keep track of when doing redox problems, don't get questions wrong because you weren't using enough binder paper! ☺

1) Write the equations for the reaction between iron and a solution of silver nitrate to produce Fe(II) ions and silver metal.

a. Write the balanced half-cell reactions

b. Write the overall balanced equation for the reaction

c. Draw a diagram of the cell and calculate the standard cell potential. *$E^\circ = +1.24V$*

2) Balance the following reactions in acidic solutions:

a. $Al(s) + Ag^+(aq) \rightarrow Al^{3+}(aq) + Ag(s)$ *1, 3, 1, 3*

b. $Fe^{2+}(aq) + Cr_2O_7^{2-}(aq) \rightarrow Cr^{3+}(aq) + Fe^{3+}(aq)$ *$6, 1, 14H^+, 2, 6, 7H_2O$*

c. $MnO_4^-(aq) + H_2SO_3(aq) \rightarrow Mn^{2+}(aq) + SO_4^{2-}(aq)$ *$2, 5, 6H^+, 2, 5, 3H_2O$*

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3) Consider the following pairs of half-reactions, decided which of the two half-reactions will occur at the anode and which will occur at the cathode, draw diagrams for the cells, and calculate the standard cell potentials:

a.	Co^{2+} (aq) + $2e^- \rightarrow$ Co(s) Ag^+ (aq) + $e^- \rightarrow$ Ag(s) *E°cell = +1.08V*	
b.	Ni^{2+} (aq) + $2e^- \rightarrow$ Ni(s) Cu^{2+} (aq) + $2e^- \rightarrow$ Cu(s) *E°cell = +0.59V*	
c.	Sn^{2+} (aq) + $2e^- \rightarrow$ Sn(s) Mg^{2+} (aq) + $2e^- \rightarrow$ Mg(s) *E°cell = +2.23V*	

4) The reaction of copper metal with silver ions in a solution of silver nitrate is spontaneous *(*Hint - makes Cu^{2+})*

a. Calculate the standard cell potential to show that this is so.
b. From the cell potential calculate the value of the equilibrium constant for the reaction at 25°C.
c. From the equilibrium constant, or from the cell constant, calculate the standard free energy change for the reaction. Indicate clearly how these three quantities are related *ΔG°xn = -88.8 kJ*

5) A copper-zinc voltaic cell is constructed using 100 mL solutions of 1M solutions of copper sulfate and zinc sulfate with a sodium sulfate salt bridge. After some time, t, has passed at 25°C, the concentration of the Zn^{2+} ions in the anode half cell had increased to 1.50M and the concentration of the Cu ions in the cathode half-cell had decreased to 0.50M. *(*Hint - makes Cu^{2+})*

a. Calculate the initial cell potential. *$E°cell = +1.100V$*

b. Calculate the cell potential at time t. *$E°cell = +1.086V$*

c. Calculate the total charge provided by the cell. *9648.5 C*

d. Calculate (approximately) the energy provided by the cell. *105 kJ*