Dougherty Valley HS AP Chemistry
Electrochemistry – Study Questions

WORKSHEET #4

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

Show all work

[1] Write 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. ($E° = +1.24V$)

[2] Balance the following reactions in acidic solutions:

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

b. $Fe^{2+}(aq) + Cr_2O_7^{2-}(aq) \rightarrow Cr^{3+}(aq) + Fe^{3+}(aq)$

c. $MnO_4^-(aq) + H_2SO_3(aq) \rightarrow Mn^{2+}(aq) + SO_4^{2-}(aq)$

[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

Calculate the standard cell potential to show that this is so.

From the cell potential calculate the value of the equilibrium constant for the reaction at 25°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°rxn = -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.

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. (10.5 kJ)