Electro Practice Problems

1. MnO_4^- (aq) + Br^- (aq) + H^+ (aq) → Mn^{+2} (aq) + Br_2 (l) + H_2O (l)
   a. After balancing the above reaction with the ½ box method how many electrons are transferred in the reaction represented by the balanced eq'n above?
      A) 2 B) 4 C) 5 D) 8 E) 10
   b. Write the 2 half reaction equations.
   c. If **E^ored + E^oox = E^ocell** then find the **E^ocell** for the redox reaction above.
   d. If **ΔG^o_{rxn} = -nF E^ocell** then what is the ΔG^o_{rxn} for the above reaction. Compare and Contrast the signs of the ΔG^o_{rxn} and E^ocell and come up with a plan for spontaneity and signs.
      (F= 96500 J/mol*V and n=moles of electrons transferred)
   e. Now find the Keq and again compare and contrast signs of $\Delta G^o_{rxn,}$ E^ocell and Keq and then comment on product/reactant favored!!

2. $Cr_2O_7^{-2}$ (aq) + Zn (s) + H^+ (aq) → Zn^{+2} (aq) + Cr^{+3} (aq) + H_2O (l)
   a. After balancing the above rxn with the ½ box method, how many electrons are transferred?
   b. Write the 2 half reaction equations.
   c. Find the **E^ocell** for the redox reaction above.
   d. Find ΔG^o_{rxn} for the above reaction. Compare and Contrast the signs of the ΔG^o_{rxn} and E^ocell.
      (F= 96500 J/mol*V and n=moles of electrons transferred)
   e. Now find the Keq and again compare and contrast signs of ΔG^o_{rxn} & E^ocell with the size of Keq.
   f. E^ocell is the potential of the reaction as long as **all solutions** are 1.0 Molar and **all gases** (if the reaction has gases) are at 1.0 atm. If even one of these values changes then the E^ocell changes to Ecell. What is the difference in those two symbols (compare and contrast the symbols)?
      The equation for finding Ecell is **Ecell = E^ocell – (RT/nF)(ln (Q))** where R = 8.31 J/mol*K
      T= 298K n = moles of electrons transferred F= 96500 J/V*mol; Q = (P/R) where (aq) = [ ] and (g) = atm for example: Ni (s) + $2H^+$ (aq) → Ni^{+2} (aq) + H_2 (g) $Q = \frac{[Ni^{+2}]\,(P_{H2})}{[H^{+1}]^2}$
      Find Ecell for the reaction in part A if $[Zn^{+2}]$ = 0.100M when everything else is standard.

$Zn(s)|Zn^{+2}(aq)\ ||\ Cu^{+2}(aq)|Cu^{+1}(aq)$

3. Write the balanced redox reaction, find the E^ocell, draw a picture of this cell with a salt bridge of KNO_3 and then predict how the voltage would change with each of the following:

   a. the products are less than standard molarity? More than standard molarity?

   b. the reactants are less than standard molarity? More than standard molarity?

Electro #2

I. Balance the following redox reactions and then use your standard reduction potentials in aqueous solution sheet to find the $E°_{cell}$.

$E°_{cell} = E°_{ox} + E°_{red}$: Remember $E°_{0x}$ values are the negative of the $E°_{red}$ values found on the sheet. Read the ½ reactions backwards to make them be $E°_{ox}$ ½ reactions.

1. Co^{+2} (aq) + Fe (s) ⟶ Co (s) + Fe^{2+} (aq)
2. Ni (s) + Ag^{+} (aq) ⟶ Ni^{2+} (aq) + Ag (cr)
3. Co^{+3} (aq) + Ag (s) ⟶ Ag^{+1} (aq) + Co^{+2} (aq)
4. Sn^{+4} (aq) + Cu (s) ⟶ Sn^{+2} (aq)+ Cu^{+2} (aq)

II. For each of the reactions in Part I, find the $\Delta G°$ and the Keq. Relate the signs of the $\Delta G°$ and $E°_{cell}$ to the magnitude of the Keq.

III. For each of the reactions in Part I, find the E_{cell} at nonstandard conditions if the following conditions are changed:

For 1 the $[Co^{+2}]$ = .10M while all other solutions are standard.

For 2 the $[Ni^{+2}]$ = .20M while all other solutions are standard.

For 3 the $[Co^{+2}]$ = 1.10M while all other solutions are standard.

For 4 the $[Sn^{+2}]$ = 0.10M, $[Sn^{+4}]$ = 0.40M, & $[Cu^{+2}]$ = 0.30M.

IV. Of the reactions in Part I which one could you look at the states and say for sure that the $\Delta S°$ is a positive number? Explain your answer.

V. If 3.67 g of sodium chloride is dissolved in100.0 mL of water in a coffee cup calorimeter causing the temperature of the water to decrease from 25.00°C to 24.43 °C,

a. What is the molar heat of dissolving for sodium chloride?

b. Write a thermochemical equation for the dissolving of sodium chloride. If 40.0 g of sodium chloride dissolves how many kJ of heat are absorbed?

c. Using your charts find the $\Delta S°rxn$. Then using the Gibbs Free energy equation find the $\Delta G°rxn$. From the $\Delta G°rxn$ find Keq for the reaction.