CHM 1046 Professor Fowler
Chapter 19 Homework

A voltaic cell contains a Cu anode in a 1.0 M $CuSO_4$ solution connected to a Pt cathode in a solution containing 1.0 M $Fe(NO_3)_3$ as well as 1.0 M $Fe(NO_3)_2$. The reduction of Fe^{+3} to Fe^{+2}, together with the oxidation of Cu to Cu^{+2}, form a spontaneous cell reaction.

1. Review Figures 17.3 and 17.4, Example 17.3, and Example 19.04. Sketch the cell with labels for the anode, cathode, salt bridge, and correct e^{-1} flow direction. Also, show the correct direction for the ions in the salt bridge. Write the shorthand cell notation. (2 pts)

2. Review Examples 19.01 and 19.02. Write the balanced half-cells reactions and the balanced complete redox reaction.   Include phase subscripts on all reactions. Label the oxidation and reduction half-cells. Also, label the substances or ions that are the reducing and oxidizing agents. (2 pts)

3. a. Review Example 19.07 and 19.08. Determine the standard cell potential (E^o). (1 pt)
   b. Review Example 19.09. Find the standard change in Gibb's free energy (ΔG^o).
      Use significant figures. Show all signs, units, and conversion factors. (1 pt)
   c. Review Example 19.11. Use E^o to find the equilibrium constant (K).
      Use significant figures. Show all signs, units, and conversion factors. (1 pt)

4. Review Example 19.12. Write the expression for Q and determine
   its value if $[Cu^{+2}]_i = 0.200$ M and $[Fe^{+3}]_i = [Fe^{+2}]_i = 2.00$ M.
   Then, use Q and E^o to determine E using the Nernst equation at 25 ^{o}C.
   Use significant figures and show all units. (1.5 pts)

5. Review Examples 19.14 and 19.15. If the cell's current for $Cu^{+2}_{(aq)} + 2e^{-1} \rightarrow Cu_{(s)}$ is
   2.895 A (1 A = 1 C/s), use Faraday's constant to determine how many moles of e^{-1} are
   reacting per second (mol e⁻/s). Then, find the mol/s and g/s of Cu^{2+} as well.
   Finally, determine the mass of copper (g and mg) that is plated after one hour.
   Show all units and conversion factors. (1.5 pts)