ELECTROCHEMISTRY PRACTICE

This worksheet should help you identify how we use electrochemistry to understand chemical reactions. It is intended for you to work through it in order. *(Don't skip ahead.)*

Suppose you want to make a galvanic cell that you can use as a battery. In this battery, the two half reactions are:

$Ni^{2+}_{(aq)} \rightarrow Ni_{(s)}$ $E° = -0.23$ V

$Fe_2O_{3\,(s).} \rightarrow Fe^{2+}_{(s)}$ $E° = 0.77$ V

In order for the reaction to be spontaneous, what is the cathode? What is the anode? Show the $E°_{cell}$ calculation for how you determined this.

What compound is being oxidized? What is being reduced?

What is the balanced redox reaction for the battery? (in basic conditions)

Draw a diagram of the cell and write the shorthand cell notation.

What is the value of ΔG° for the reaction?

What is the value of K for the reaction?

Considering Le Chatelier's principle, when you make the battery should you have high or low Fe^{2+} and Ni^{2+} concentrations? Why?

Now check your hypothesis. Solve for Q, E_{cell}, and ΔG for the following two scenarios:

Scenario A: $[Ni^{2+}] = 0.250$ M $[Fe^{2+}] = 0.250$ M
Scenario B: $[Ni^{2+}] = 1.3$ M $[Fe^{2+}] = 1.3$ M

Which scenario will yield a better, longer lasting battery?

As the reaction proceeds, what will happen to the mass of the Ni electrode? What will happen to the mass of the Fe_2O_3 electrode?