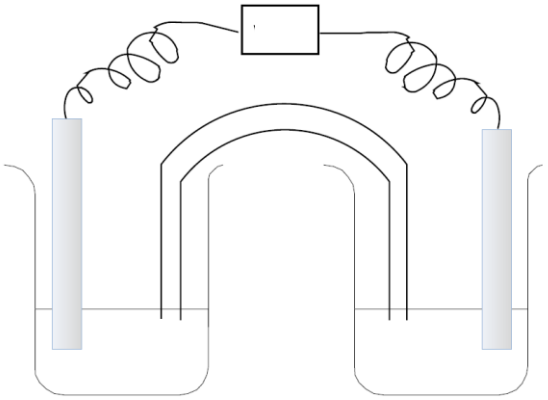
Galvanic Cells

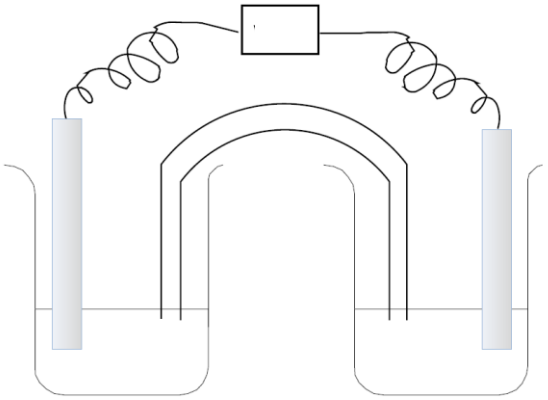
For each redox reaction below:

a) Write the reduction and oxidation half-reactions.
b) Determine $E°_{red}$ and $E°_{ox}$.
c) Write the complete balanced redox equation.
d) Determine $E°_{cell}$.
e) Draw the galvanic cell.
f) Write the standard line notation for the cell.

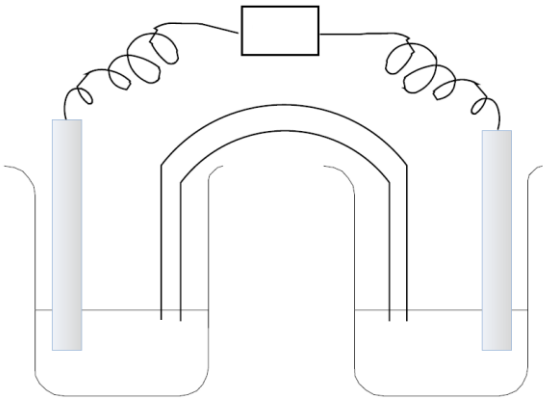
1) $Al^{3+}(aq) + Mg(s) \rightarrow Al(s) + Mg^{2+}(aq)$



2) $Zn(s) + Fe^{+3}(aq) \rightarrow Zn^{+2}(aq) + Fe^{+2}(aq)$



3) $MnO_4^-(aq) + H^+(aq) + ClO_3^-(aq) \rightarrow ClO_4^-(aq) + Mn^{2+}(aq) + H_2O(l)$



Electro Homework

Part A. For each reaction, write the reduction equation and the oxidation equation. Then balance the overall redox equation and calculate $E°_{cell}$.

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

1) $Co^{2+}(aq) + Fe\ (s) \longrightarrow Co\ (s) + Fe^{2+}\ (aq)$

2) $Ni\ (s) + Ag^{+}\ (aq) \longrightarrow Ni^{2+}(aq) + Ag\ (cr)$

3) $Co^{3+}\ (aq) + Ag\ (s) \longrightarrow Ag^{+}\ (aq) + Co^{+2}\ (aq)$

4) $Sn^{4+}\ (aq) + Cu\ (s) \longrightarrow Sn^{2+}(aq) + Cu^{2+}(aq)$

Part B. For each reaction in Part A, without doing any calculations, determine the following:

a. Is the reaction thermodynamically favorable (spontaneous) or not thermodynamically favorable (nonspontaneous)?
b. Is $\Delta G°$ negative or positive?
c. Is Keq greater than or less than one?
d. Is the reaction product or reactant favored?

Part C. Draw the voltaic cell (assume all electrodes are in an aqueous nitrate solution) and write the line notation for Reaction #1.

Part D. For each reaction in Part A, calculate $\Delta G°$ and Keq.

Part E. For each reaction in Part A, determine the value of 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 $[Sn^{+2}] = 0.10M$, $[Sn^{+4}] = 0.40M$, & $[Cu^{+2}] = 0.30M$.