Study Guide for CHEM 219/229

How to write a redox reaction using Electrochemical Cell notation:

Terms to know:

- Redox Reaction: A chemical reaction that involves the transfer of electrons between species, with one species losing electrons (being oxidized) and another species gaining electrons (being reduced).
- Electrode: For the purposes of electrochemistry, a strip of metal.
- Half- cell: An electrode submerged in a solution of ions of the same metal.
- Electrochemical Cell: Two properly connected half cells. Two kinds: Galvanic and electrolytic
    - Galvanic Cell: An electrochemical cell that uses a chemical reaction to produce electrical energy.
    - Electrolytic Cell: An electrochemical cell that uses electrical energy to drive a chemical reaction.
- Anode: The half-cell where oxidation takes place.
- Cathode: The half-cell where reduction takes place.
- Salt-bridge: A porous barrier (generally a U-tube) that allows ions to move between half-cells to complete the electrical circuit.

General Cell Diagram:

Electrode|Solution||Solution|Electrode

- The single lines represent the phase boundary between each electrode and its solution
- The double lines represent the salt bridge
- The anode is always written on the left of the diagram, the cathode always on the right.
- Example:
    - For the following reaction:

Mg (s) + FeCl2 (aq) -> Fe (s) + MgCl2 (aq)

    - We start by assigning oxidation numbers:
    - Mg (s):
        - Mg O.N = 0
    - $FeCl_{2\,(aq)}$:
        - Fe O.N = +2
        - Cl O.N = -1
    - $Fe_{(s)}$:
        - Fe O.N = 0
    - $MgCl_{2\,(s)}$
        - Mg O.N = +2
        - Cl O.N = -1

    - We can see that the Mg is being oxidized (it goes from a 0 to a +2 O.N), while the Fe is being reduced (goes from a +2 to a 0 O.N).
- We can then break the redox reaction into half-reactions. One reduction half-reaction and one oxidation half-reaction:

$$\text{Red: } Mg_{(s)} \rightarrow Mg^{2+}_{(aq)} + 2e^-$$

$$\text{Ox: } Fe^{2+}_{(aq)} + 2e^- \rightarrow Fe_{(s)}$$

- Notice that the Cl does not appear. Because it doesn't change during the reaction, it is only a spectator ion and can be ignored.
- Each of these half reactions can then be written as a half-cell, with the oxidation half-reaction being at the anode and reduction half-reaction being at the cathode:

$$\text{Anode}|\text{Solution}||\text{Solution}|\text{Cathode}$$

$$Fe_{(s)}|Fe^{2+}_{(aq)}||Mg^{2+}_{(aq)}|Mg_{(s)}$$