CHEM 116 Notes for 11/25/08
Lecture 21
JR

Electrochemistry Overview
- Know how to recognize a redox (electron transfer) reaction
- Oxidation vs. Reduction
    - There are two ways to know whether oxidation or reduction is occurring:
        1. Loss of electrons is oxidation. Gain of electrons is reduction (LEO the lion says GER).
            - LEO: Lose Electrons = Oxidation
            - GER: Gain Electrons = Reduction

        2. If reduction is occurring, the oxidation number is moving **down** the number line. If oxidation is occurring, the oxidation number is moving **up** the number line.

    - **Agent:** that which "causes"
        - **Example:** the *oxidizing agent* causes oxidation. (Usually the oxidizing agent is the species that is getting reduced)

For the **Final Exam** you need to:
- Assign oxidation numbers to elements to figure out which species contain elements that are changing.
- Balance redox reactions in neutral, acid, and base solutions.
- Diagram an electrochemical cell and indicate direction of flow of negative charge through the system.
- Read and write electrochemical cell notation.
- Use reduction potentials to predict cell voltage under standard conditions.
- Use the Nernst equation to predict cell voltage at non-standard conditions.

Redox reactions at a macroscopic level:
- Signals that a redox reaction is *definitely* occurring:
    - Rusting of a metal reactant, production of a new metal.
    - Combustion
    - Hydrogen ions (H+) or water is consumed and hydrogen gas is produced (vice-versa)
    - Hydroxide ions (OH-) are consumed and oxygen gas is produced
- Signals that a redox reaction *could* be occurring:
    - Color change
    - Production of a gas
    - Hydrogen ions (H+) or hydroxide ions (OH-) catalyze the reaction

Redox reactions at a particle level:
- Electrons are exchanged from one species to another
- One species is an electron acceptor, and the other is an electron donor (one muse lose electrons and the other must gain electrons)

- A redox reaction can be broken into two halves:
  - The electron donation (oxidation)
  - The electron acceptance (reduction)
- If Q < K for the starting concentrations, then the reaction is product-favored and the reaction progresses toward products, generating electricity.

Oxidation numbers:

- Oxidation numbers are a charge (real or fake) that can be assigned to each atom in a compound.
  - Charged particles, the charge is real
  - In molecules, the charge is not real

How to Assign Oxidation Numbers:

- Oxidation numbers sum to zero if compound is neutral. If compound is not neutral, then the sum is equal to the total overall charge.
- Atoms in free, neutral elements have oxidation number zero.
  - Zn, Ar, O, S, Ag, N
- Charged ions have oxidation numbers equal to their charges.
- Oxygen, when in a compound or ion, nearly always has an oxidation number of -2 (**exception: peroxides**).
- Hydrogen, when in a compound or ion, nearly always has an oxidation number of +1 (**exception: hydrides**).