Unit 14: Redox Reactions and Electrochemistry

adapted from http://www.phschool.com/advanced/lesson_plans/chem_brown_2003/index.html

Objectives:

- Identify redox reactions, the species oxidized, reduced, the oxidizing agent, and the reducing agent.
- Balance redox reactions by using oxidation number method and half-reactions method.
- Diagram and label electrochemical cells, both voltaic and electrolytic.
- Calculate emf of voltaic cell given electrode potentials.
- Given electrode potentials predict if a reaction is spontaneous.
- Interconvert E°, $\Delta G°$, and K for a redox reaction.
- Be able to calculate any variable in the Nernst equation given the others.
- Calculate time, current, or amount of a substance produced by electrolysis given the other two.
- Calculate the maximum electrical work performed by a voltaic cell.

Lab Objectives:

- Use electrolysis to determine the value of the faraday and Avogadro's number.
- Learn to construct electrolytic and voltaic cells.
- Measure the potential of a voltaic cell at various temperatures.
- Calculate ΔG, ΔH, and ΔS.

Suggested Labs:

- Electrolysis, the Faraday, and Avogadro's Number
- Electrochemical Cells and Thermodynamics

Key Words:

redox reactions
electrochemistry
oxidizing agent (oxidant)
reducing agent (reductant)
half-reaction
voltaic (galvanic) cell
anode
cathode
emf
cell potential
standard emf
standard reduction potential
standard hydrogen electrode
faraday
Nernst equation
electrolytic cell

Tips:

- In **all** electrochemical cells (voltaic and electrolytic), oxidation takes place at the anode and reduction at the cathode. In determining E° for a cell, or a reaction, do not multiply the $E°_{sp}$ of either reactant by the stoichiometric coefficient.