1. Raw and scaled hour exam III grades are posted on-line.
2. If you took the conflict exam please pick up your exam at the front of the class.
3. Class Wednesday is optional, no new material covered.
4. The final for this class is Thursday May 14th 8-11am, please see the website for your location. Please arrive 10-15 minutes early. Bring calculator, pencil, eraser and ID. You WILL NOT be taking the exam with you. The grades will be posted by the end of next week.
5. The final is the same format as the hour exams but will consist of 65 multiple choice questions.
6. Detailed solutions of all three hour exams are posted on-line under the powerpoint slides tab.
**REDOX Reactions**

**REDOX** - oxidation-reduction reactions, reactions involving the transfer of electrons from one species to another.

**Oxidation** - atom loses electrons. Oxidation number increases.

**Reduction** - atom gains electrons. Oxidation number decreases.

**Oxidizing agent** - species that causes oxidation to occur; always compound/ion that contains the atom that is reduced.

**Reducing agent** - species that causes reduction to occur; always compound/ion that contains the atom that is oxidized.
REDOX Reactions

Oxidation Involves Loss of electrons

Reduction Involves Gain of electrons
REDOX Reactions
Assigning Oxidation Numbers

Oxidation numbers are a way of keeping track of the number of electrons in redox reactions.

For covalent compounds, the oxidation number does not represent the actual charge on the elements in the compound.

Oxidation numbers are IMAGINARY numbers and are used to recognize redox reactions.
1. The sum of the oxidation numbers for all atoms in a compound/ion must equal the charge on that compound/ion.

2. Any element by itself has an oxidation number equal to 0.

3. For ionic compounds, the oxidation number for the monoatomic ion equals the charge on the ion.

4. For covalent compounds:
   a) Assign hydrogen a +1 value.
   b) Assign oxygen a -2 value.
   c) Assign halogens a -1 value.
   D) Use these rules and rule 1 to assign all others.
Assigning Oxidation Numbers

Assign oxidation numbers to all of the elements in the following compounds:

a) KMnO₄

b) (NH₄)₂HPO₄

c) Fe₃O₄
Recognizing Redox Reactions

If a reaction is a redox reaction then the oxidation numbers will change for some elements in the reaction.

If there is no change in oxidation numbers it is not a redox reaction.

Are the following reactions redox reactions:

\[ \text{Cu (s)} + 2 \text{Ag}^+ (\text{aq}) \rightarrow 2 \text{Ag (s)} + \text{Cu}^{2+} (\text{aq}) \]

\[ \text{SiCl}_4 (\text{l}) + 2 \text{H}_2\text{O (l)} \rightarrow 4 \text{HCl (aq)} + \text{SiO}_2 (\text{s}) \]
Balancing Redox Reactions

1. Write the equations for the oxidation and reduction half reactions.
2. For each half reaction:
   a) Balance all elements except hydrogen and oxygen.
   b) Balance oxygen using $\text{H}_2\text{O}$.
   c) Balance hydrogen using $\text{H}^+$.
   d) Balance charge using electrons.
   Each half reaction should now be mass and charge balanced.
3. If necessary, multiply one or both balanced half-reactions by an integer to equalize the number of electrons transferred in two half-reactions (electrons must cancel).
4. Add the half-reactions together, and cancel identical species.
5. Check that the reaction is charge and mass balanced.
Balancing Redox Reactions

General rules for balancing redox reactions in basic solution:

Basic solutions are treated the same way as acidic solutions with the following changes:

After step 4:

5. To both sides of the equation, add a number of OH⁻ ions equal to the number of H⁺ ions. H⁺ will react with OH⁻ to form H₂O.
6. Form H₂O on the side containing both H⁺ and OH⁻ ions, then cancel H₂O molecules appearing on both sides of equation.
7. Check mass and charge balance.
Balance the following redox reactions that occur in acidic solution:

\[ \text{Cu (s) + NO}_3^- (aq) \rightarrow \text{Cu}^{2+} (aq) + \text{NO} (g) \]

\[ \text{Mn}^{2+} (aq) + \text{NaBiO}_3 (s) \rightarrow \text{Bi}^{3+} (aq) + \text{MnO}_4^- (aq) \]
Balancing Redox Reactions
Balance the following redox reactions that occur in basic solution:

\[ \text{Cl}_2 (g) \rightarrow \text{Cl}^- (aq) + \text{OCl}^- (aq) \]

\[ \text{NO}_2^- (aq) + \text{Al} (s) \rightarrow \text{NH}_3 (g) + \text{AlO}_2^- (aq) \]
Balancing Redox Reactions