AP CHEMISTRY SUMMER ASSIGNMENT
(...and First Week Test Material)

This assignment is due the first day of school. NO LATE ASSIGNMENTS WILL BE ACCEPTED!!!

1. Take the diagnostic test (NYS regents chemistry exam)
2. Read chapters 1, 2, and 3 in Chang Chemistry
3. Complete all attached worksheets.
4. Complete questions in Chang Chemistry
   a. Chapter 1: #1-52 Problems Only
   b. Chapter 2: #1-64 10-18, 33-50
   c. Chapter 3: #1-30, 35-94 Problems only (Evens)
5. Study for first week MEMORIZATION/BASIC SKILLS TEST
6. Study for the first week Chapter 1-3 TEST (see below)

AP CHEM FIRST WEEK TEST (end of first week of school)

AP Chemistry is a challenging course. While it is not all about memorization, having these items memorized is **ESSENTIAL** for success in learning the concepts covered in the course. Make flashcards, form a study group, have your friends and family quiz you, take the lists with you on vacation... do whatever it takes to get this information drilled into your head. **Do not** wait until the last minute to get this done. It is imperative that the below list comes second nature to you. In AP Chemistry, you do not have a VALENCE CHART, or ION REFERENCE SHEET!

Eight areas of memorization (test date to be posted):

1. Determining Oxidation Numbers
2. The Solubility Rules
3. ~~Variable Valences for Transition Metals~~
4. Rules for Naming Acids
5. Rules for Naming Ionic Compounds
6. Rules for Naming Binary Molecular Compounds
7. Polyatomic Ions (including name, formula and charge)
8. Significant Figures (counting them, and rounding rules in calculations)

Chapters 1-3 (test end of first week, exact date TBD):

1. Conversions (including mole conversions!)
2. Density
3. Classifying matter
4. Balancing Equations (understand state symbols)
5. Molar mass
6. Percent composition
7. Empirical and molecular formula determination
8. Stoichiometry (including limiting/excess reagent/percent yield)
   *Everything from the memorization test will also be included. You will put these skills and memorized items into action.

If this seems like too much work for the summer, this may not be the course for you. Advanced Placement Chemistry is a strenuous college level course (which could be more demanding than a typical chemistry 101 course in college). You will need to be dedicated and work very hard if you are to be successful!

Determining Oxidation States (Numbers)

Oxidation State: The oxidation number of an element indicates the number of electrons lost, gained, or unequally shared as a result of chemical bonding. Assigning numbers puts stress on elements' electronegativities, and pretends that all bonds are 100% ionic (even if they are actually covalent). The change in the oxidation state of a species lets you know if it has undergone oxidation or reduction.

Oxidation can be defined as "an increase in oxidation number". In other words, if a species starts out at one oxidation state and ends up at a higher oxidation state it has undergone oxidation.

Reduction can be defined as "a decrease in oxidation number". Any species whose oxidation number is lowered during the course of a reaction has undergone reduction.

Example:

- Na + Cl_2 -----> 2NaCl
- The Na starts out with an oxidation number of zero (0) and ends up having an oxidation number of 1+. It has been **oxidized** from a sodium atom to a positive sodium ion.
- The Cl_2 also starts out with an oxidation number of zero (0), but it ends up with an oxidation number of 1-. It, therefore, has been **reduced** from chlorine atoms to negative chloride ions.

The substance bringing about the oxidation of the sodium atoms is the chlorine, thus the chlorine is called an **oxidizing agent**. In other words, the oxidizing agent is being reduced (undergoing reduction). The substance bringing about the reduction of the chlorine is the sodium, thus the sodium is called a **reducing agent**. Or in other words, the reducing agent is being oxidized (undergoing oxidation). Oxidation is **ALWAYS** accompanied by reduction. Reactions in which oxidation and reduction are occurring are usually called **Redox reactions**.

Rules for Assigning Oxidation Numbers

There are several rules for assigning the oxidation number to an element. Learning these rules will simplify the task of determining the oxidation state of an element, and thus, whether it has undergone oxidation or reduction.

1. The oxidation number of an atom in the elemental state is zero.
   <u>Example</u>: Cl_2 and Al both are 0
2. The oxidation number of a monatomic ion is equal to its charge.
   <u>Example</u>: In the compound NaCl, the sodium has an oxidation number of 1+ and the chlorine is 1-.
3. The algebraic sum of the oxidation numbers in the formula of a compound is zero.
   <u>Example</u>: the oxidation numbers in the NaCl above add up to 0
4. The oxidation number of hydrogen in a compound is 1+, except when hydrogen forms compounds called hydrides with active metals, and then it is 1-.
   <u>Examples</u>: H is 1+ in H_2O, but 1- in NaH (sodium hydride).
5. The oxidation number of oxygen in a compound is 2-, except in peroxides when it is 1-, and when combined with fluorine. Then it is 2+.
   <u>Example</u>: In H_2O the oxygen is 2-, in H_2O_2 it is 1-.
6. The algebraic sum of the oxidation numbers in the formula for a polyatomic ion is equal to the charge on that ion (or neutral compound).
   <u>Example</u>: in the sulfate ion, SO_4^{2-}, the oxidation numbers of the sulfur and the oxygens add up to 2-. The oxygens are 2- each, and the sulfur is 6+.
   <u>Example</u>: in the sodium nitrate, $NaNO_3$, the oxidation numbers of the oxygens add up to 6-. The sodium is 1+. The nitrogen must be in a 5+ state.

It's important to understand that oxidation numbers treat each atom *as if* it were an ion. We pretend electronegative atoms gain as many electrons as they need, and atoms with low electronegativity (electropositive) *lose* as many electrons as they need. This is an assumption that we make for convenience. For example, in CO_2, the atoms *share* electrons, albeit unequally. For convenience, we assign oxygen a number of 2-, while carbon gets a 4+. In REALITY, the oxygen atoms did not necessary GAIN 2 electrons, and the carbon atoms did *not necessarily* LOSE 4. This is *one way* to evaluate the state of individual atoms.

Rules for Naming Acids

You must recognize acids! Anything written HX, or RCOOH for organic acids is written that way to TELL YOU that it is an acid.

1. When the name of the anion ends in –ide, the acid name begins with the prefix hydro-, the stem of the anion has the suffix –ic and it is followed by the word acid.
   -ide becomes hydro _____ic Acid

   <u>Example</u>: Cl^- is the Chlor<u>ide</u> ion so HCl = <u>hydro</u>chlor<u>ic</u> acid

2. When the anion name ends in -ite, the acid name is the stem of the anion with the suffix –ous, followed by the word acid.
   -ite becomes ______ous Acid

   <u>Example</u>: ClO_2^- is the Chlorite ion so $HClO_2$ = Chlor<u>ous</u> acid.

3. When the anion name ends in –ate, the acid name is the stem of the anion with the suffix –ic, followed by the word acid.
   -ate becomes ______ic Acid

   <u>Example</u>: ClO_3^- is the Chlorate ion so $HClO_3$ = Chloric acid.

4. Organic acids (RCOOH): Use prefix for the number of carbons in the molecule followed by "-anoic acid".

   <u>Example</u>: CH_3COOH = ethanoic acid (aka acetic acid, aka vinegar)

Rules for Naming Ionic Compounds

1. Balance Charges (charges should net zero; cross charges to positive subscripts, and reduce to lowest ratio)
2. Cation is always written first (in name and in formula)
3. Change the ending of the anion to –ide (unless polyatomic ion, then named as given above).

Rules for Naming Binary Molecular Compounds

1. Use prefixes for the number of atoms of each element: from 1-10 = mono, di, tri, tetra, penta, hexa, hepta, octa, nona, deca
2. The most electronegative atom is in general written second, and ends in "-ide". (P_2O_5 = diphosphorus pentoxide)
3. If there is only *one* of the first element, you can omit "mono".
   (NO_2 is nitrogen dioxide, **not** mononitrogen dioxide)

Polyatomic Ions

Name	Symbol (& Charge)
ammonium	NH_4^+
acetate	$C_2H_3O_2^-$
bromate	BrO_3^-
carbonate	CO_3^{2-}
chlorate	ClO_3^-
chlorite	ClO_2^-
chromate	CrO_4^{2-}
cyanide	CN^-
dichromate	$Cr_2O_7^{2-}$
dihydrogen phosphate	$H_2PO_4^-$
hypochlorite	ClO^-
hydrogen carbonate (bicarbonate)	HCO_3^-
hydrogen sulfate (bisulfate)	HSO_4^-
hydrogen sulfite (bisulfite)	HSO_3^-
hydroxide	OH^-
iodate	IO_3^-
nitrate	NO_3^-
nitrite	NO_2^-
oxalate	$C_2O_4^{2-}$
perchlorate	ClO_4^-
permanganate	MnO_4^-
phosphate	PO_4^{3-}
phosphite	PO_3^{3-}
thiocyanate	SCN^-
selenate	SeO_4^{2-}
silicate	SiO_3^{2-}
sulfate	SO_4^{2-}
sulfite	SO_3^{2-}