Welcome to AP Chemistry!

I am looking forward to next year and hope that you feel the same. AP Chemistry is a very fast paced course as we cover 2 college semesters of material and need to be prepared for the test in early May. The first 3 chapters of the text are a review of concepts you have learned in your previous chemistry course. This summer assignment will help you review these chemistry basics and increase your chances of a successful year.

I encourage you to pace yourself so that you do not end up trying to cram all the material in right before school starts. Start by reading through each chapter being careful to look for new terms and ideas. You might find taking notes helpful.

Required assignments:

1. Create an account on Mastering Chemistry before school. www.PearsonMyLabandMastering.com.
2. rutschilling82086
    - SSSRCC-WHIRR-ALARY-CADET-GNASH-VIRES
    - Brown/Lemay, Chemistry: The Central Science 14e MasteringChemistry
    - Math XL is a Pearson Education account, you may use the same account logon.

3. Mastering Chemistry assignments are due on Aug 27th for Chapter 1 & 2 and Chapter 3.

4. Knowing element and ion information will be essential. Key elements are atomic numbers 1-54 and Au, Hg, Pt, U and Pb. See the attached for a listing of ions and tips on memorization.

We will have quizzes on the elements and ions starting the 2nd day of school. The first test will be on Chapters 1-3 and will be given the within the first week of school.

There is a list of objectives after this letter to help guide your review. Optional review resources include:

- list of Bozeman AP chemistry videos that correspond to each chapter (following pages)
- online animations posted on http://padlet.com/grutschilling/APchemSummer may prove to be useful.
- tutorials available in Mastering Chemistry.

If you have any questions this summer, please email me at grutschilling@mndhs.org. I will periodically check this account and look forward to hearing from you.

Have a restful and fun-filled summer. See you in August!

Mrs. Rutschilling

Learning objectives:

1. Identify the representative particles: atom (element) formula unit (ionic compound), molecule (molecular covalent compound)
2. Draw particle diagrams showing the progression of a chemical reaction that proceeds 100 % to completion, with a particular focus on precipitation reactions.
3. Explain why early models of atomic structure were modified or rejected, with a particular focus on the transition from Bohr's model to the quantum mechanical model.
4. Convert mass to/from moles using molar mass
5. Convert moles to/from molecules, formula units, and atoms using Avogadro's number. A particular focus is placed on converting a unit in the denominator.
6. Calculate the number of atoms or ions within a formula using subscripts.
7. Draw particle diagrams indicating relative numbers of ions and atoms in a formula
8. Determine the empirical and molecular formulas of a substance from % or mass data (percent to mass, mass to moles, divide by the smallest, multiply 'til whole)
9. Perform stoichiometry calculations for reactions that proceed 100% to completion (i.e. are not reversible). You should be able to convert to and from moles using molar mass, molarity, molar volume, or the ideal gas law.
10. Explain why only values for pure substances can be used when performing stoichiometric calculations.
11. Differentiate between experimental yields and the maximum/theoretical yield of a chemical reaction.
12. Perform stoichiometry calculations using the % yield (% efficiency) for reactions that proceed 100% to completion (that are not reversible). You should be able to calculate the % yield using data from stoichiometry AND use data from % yield to perform a stoichiometry calculation. MEMORIZE:

$$\%\ \boldsymbol{yield}\ (\boldsymbol{AKA\ efficiency}) = \frac{\boldsymbol{experimental\ yield}}{\boldsymbol{theoretical\ yield}} \times \mathbf{100}$$

13. Perform limiting reactant/reagent calculations to determine the maximum/theoretical yield.
14. Determine and justify which reactant is the limiting reactant and which is in excess.
15. Calculate the amount of limiting and excess reactant remaining at the end of the reaction.

Optional Bozeman AP Chemistry videos

http://www.bozemanscience.com/matter (9:16)

http://www.bozemanscience.com/scientific-method watch ONLY from 4:49 until end (approx. 6:00)

http://www.bozemanscience.com/significant-digits (11:18)

http://www.bozemanscience.com/factor-label-method (9:50)

http://www.bozemanscience.com/history-of-the-atom (9:09)

http://www.bozemanscience.com/a-tour-of-the-periodic-table (9:28)

http://www.bozemanscience.com/atoms-the-periodic-table (9:14)

http://www.bozemanscience.com/naming-compounds-part-1 (5:39)

http://www.bozemanscience.com/naming-compounds-part-2 (5:38)

http://www.bozemanscience.com/ap-chem-001-molecules-elements 6:08

http://www.bozemanscience.com/ap-chem-003-the-mole 7:01

http://www.bozemanscience.com/beginners-guide-balancing-equations ***Only watch the LAST two minutes unless this is a difficult topic for you 2:00***

http://www.bozemanscience.com/ap-chem-028-stoichiometry ***Only watch FIRST 6:30

Common Ions and Their Charges

A mastery of the common ions, their formulas and their charges, is essential to success in AP Chemistry.. You will always be allowed a periodic table, which makes identifying the monoatomic ions automatic." For tips on learning the ions, see the next page.

From the table:	
Cations	**Name**
H^+	Hydrogen
Li^+	Lithium
Na^+	Sodium
K^+	Potassium
Rb^+	Rubidium
Cs^+	Cesium
Be^{2+}	Beryllium
Mg^{2+}	Magnesium
Ca^{2+}	Calcium
Ba^{2+}	Barium
Sr^{2+}	Strontium
Al^{3+}	Aluminum
Anions	**Name**
H^-	Hydride
F^-	Fluoride
Cl^-	Chloride
Br^-	Bromide
I^-	Iodide
O^{2-}	Oxide
S^{2-}	Sulfide
Se^{2-}	Selenide
N^{3-}	Nitride
P^{3-}	Phosphide
As^{3-}	Arsenide
Type II Cations	**Name**
Fe^{3+}	Iron(III)
Fe^{2+}	Iron(II)
Cu^{2+}	Copper(II)
Cu^+	Copper(I)
Co^{3+}	Cobalt(III)
Co^{2+}	Cobalt(II)
Sn^{4+}	Tin(IV)
Sn^{2+}	Tin(II)
Pb^{4+}	Lead(IV)
Pb^{2+}	Lead(II)
Hg^{2+}	Mercury(II)

Ions to memorize:	
Cations	**Name**
Ag^+	Silver
Zn^{2+}	Zinc
Hg_2^{2+}	Mercury(I)
NH_4^+	Ammonium
Anions	**Name**
NO_2^-	Nitrite
NO_3^-	Nitrate
$SO3^{2-}$	Sulfite
$SO4^{2-}$	Sulfate
HSO_4^-	Hydrogen sulfate (bisulfate)
OH^-	Hydroxide
CN^-	Cyanide
PO_4^{3-}	Phosphate
HPO_4^{2-}	Hydrogen phosphate
$H_2PO_4^-$	Dihydrogen phosphate
NCS^-	Thiocyanate
CO_3^{2-}	Carbonate
HCO_3^-	Hydrogen carbonate (bicarbonate)
ClO^-	Hypochlorite
ClO_2^-	Chlorite
ClO_3^-	Chlorate
ClO_4^-	Perchlorate
BrO^-	Hypobromite
BrO_2^-	Bromite
BrO_3^-	Bromate
BrO_4^-	Perbromate
IO^-	Hypoiodite
IO_2^-	iodite
IO_3^-	iodate
IO_4^-	Periodate
$C_2H_3O_2^-$	Acetate
MnO_4^-	Permanganate
$Cr_2O_7^{2-}$	Dichromate
CrO_4^{2-}	Chromate
O_2^{2-}	Peroxide
$C_2O_4^{2-}$	Oxalate
NH_2^-	Amide
BO_3^{3-}	Borate
$S_2O_3^{2-}$	Thiosulfate

Tips for Learning the Ions

"From the Table"

These are ions can be organized into two groups.

1. Their place on the table suggests the charge on the ion, since the neutral atom gains or loses a predictable number of electrons in order to obtain a noble gas configuration.
    a. All Grp 1 Elements lose one electron to form an ion with a 1^+ charge
    b. All Grp 2 Elements lose two electrons to form an ion with a 2^+ charge
    c. Grp 13 metals like aluminum lose three electrons to form an ion with a 3^+ charge
    d. All Grp 17 Elements gain one electron to form an ion with a 1^- charge
    e. All Grp 16 nonmetals gain two electrons to form an ion with a 2^- charge
    f. All Grp 15 nonmetals gain three electrons to form an ion with a 3^- charge

    Notice that cations keep their name (sodium ion, calcium ion) while anions get an "-ide" ending (chloride ion, oxide ion).

2. Metals that can form more than one ion will have their positive charge denoted by a roman numeral in parenthesis immediately next to the name of the cation.

Polyatomic Anions

There are a number of patterns that can greatly reduce the amount of memorizing required.

1. "ate" anions have one more oxygen then the "ite" ion, but the same charge. If you memorize the "ate" ions, then you should be able to derive the formula for the "ite" ion and vice-versa.
    a. sulfate is SO_4^{2-}, so sulfite has the same charge but one less oxygen (SO_3^{2-})
    b. nitrate is NO_3^-, so nitrite has the same charge but one less oxygen (NO_2^-)

2. If you know that a sufate ion is SO_4^{2-}, then to get the formula for hydrogen sulfate ion, you add a hydrogen ion to the front of the formula. Since a hydrogen ion has a 1^+ charge, the net charge on the new ion is less negative by one.
    a. Example:

PO_4^{3-},	➔	HPO_4^{2-}	➔	$H_2PO_4^-$
phosphate		hydrogen phosphate		dihydrogen phosphate

3. Learn the hypochlorite ➔ chlorite ➔ chlorate ➔ perchlorate series, and you also know the series containing iodite/iodate as well as bromite/bromate.
    a. The relationship between the "ite" and "ate" ion is predictable. Learn one and you know the other.
    b. The prefix "hypo" means "under" or "too little" (think "hypodermic", "hypothermic" or "hypoglycemia")
        i. Hypochlorite is "under" chlorite, meaning it has one less oxygen
    c. The prefix "hyper" means "above" or "too much" (think "hyperkinetic")
        i. the prefix "per" is derived from "hyper" so perchlorate (hyperchlorate) has one more oxygen than chlorate.
    d. Notice how this sequence increases in oxygen while retaining the same charge:

ClO^-	➔	ClO_2^-	➔	ClO_3^-	➔	ClO_4^-
hypochlorite		chlorite		chlorate		perchlorate