Welcome to AP Chemistry!

According to the College Board, "*The AP Chemistry course is designed to be the equivalent of the general chemistry course usually taken during the first college year. The college course in general chemistry differs qualitatively from the usual first secondary school course in chemistry with respect to the kind of textbook used, the topics covered, the emphasis on chemical calculations and the mathematical formulation of principles, and the kind of laboratory work done by students. Quantitative differences appear in the number of topics treated, the time spent on the course by students, and the nature and the variety of experiments done in the laboratory. Students in an AP Chemistry course should spend at least five hours a week in individual study outside of the classroom*."

I am excited that you have accepted the challenge that an AP Chemistry course has to offer. To ensure that all students in the AP Chemistry class are ready to partake in this high-pace, rigorous journey on the first day of school, the following summer assignment must be completed. The purposes of the assignment are to revisit chemical concepts learned in your 1st year chemistry class and expose you to the level of rigor demanded by the AP curriculum. This will allow us to focus our attention on the advanced chemistry topics that will be tested on the AP exam on May 7, 2018. Your summer assignment consists of the following:

1. Read Chapters 1 – 4 of your text and complete the Practice Questions (Parts I-IV) on the following pages. These problems, worked out in their entirety, are **due the first full day of classes**.
2. Memorize the polyatomic ions and solubility rules listed.

Please take the assignment seriously and start in early August or sooner — there's a lot to do and you won't be able to complete it all on the night before!

If at any time you would like to ask me a question, please email me at jtowle@achs.net.

I look forward to a great year,

Ms. Towle

Read Chapters 1 – 4 and answer the following practice questions. These problems, worked out in their entirety, are **due the first full day of classes**. All work must be shown for calculations in order to receive credit for the problem.

I. Nomenclature

Name each of the following compounds and state whether they are ionic or covalent:

a. CuI _____

b. CuI_2 _____

c. CoI_2 _____

d. $NaHCO_3$ _____

e. S_4N_4 _____

f. SF_6 _____

g. NaOCl _____

h. $BaCrO_4$ _____

Write formulas for each of the following compounds and state whether they are ionic or covalent:

a. potassium cyanide _____

b. copper (II) nitrate _____

c. selenium tetrabromide _____

d. iodous acid _____

e. lead (IV) sulfide _____

f. copper (I) chloride _____

g. gallium arsenide _____

h. cadmium selenide _____

Each of the following compounds is incorrectly named. What is wrong with each name and what is the correct name for each compound?

a. $FeCl_3$, iron chloride _____

b. NO_2, nitrogen (IV) oxide _____

c. CaO, calcium (II) monoxide _____

d. Al_2S_3, dialuminum trisulfide _____

e. $Mg(C_2H_3O_2)_2$, manganese diacetate _____

f. $FePO_4$, iron (II) phosphide _____

g. P_2S_5, phosphorous sulfide _____

h. Na_2O_2, sodium oxide _____

i. HNO_3, nitrate acid _____

j. H_2S, sulfuric acid _____

II. Chemical Equations

For each equation below:

- identify the type (synthesis, decomposition, single replacement, metathesis/double replacement, or combustion)
- predict the products, and then
- write the balanced equation and net ionic equation.
- Remember to use the solubility rules for double replacement reactions and the activity series for single replacement reactions. Reminder: when writing these reactions, ignore all of the information about excess, or bubbling, or mixing. These are just excess words used to make complete sentences. Simply pull out the chemical formulas.
- For example:
  Solutions of silver nitrate and magnesium iodide are combined.
  This is a double replacement reaction.
  $2AgNO_3(aq) + MgI_2(aq) \rightarrow 2AgI(s) + Mg(NO_3)_2(aq)$
  $2Ag^+(aq) + 2I^-(aq) \rightarrow 2AgI(s)$

1. Ammonium sulfate reacts with barium nitrate.

2. Zinc metal is added to a solution of copper (II) chloride.

3. Propane gas (C_3H_8) is burned in excess oxygen.

4. Solid calcium chlorate is heated strongly.

5. Magnesium and nitrogen gas are heated together.

6. Chlorine gas is bubbled through a solution of sodium bromide.

7. Sodium metal is added to distilled water.

8. Sulfuric acid is combined with sodium hydroxide.

9. Solid sodium carbonate is heated in a crucible.

III. Chemical Quantities (show all calculations)

1. How many **significant figures** are in each of the following?
   a. 1.9200 mm
   b. 0.0301001 kJ
   c. 6.022 x10^{23} atoms
   d. 460.000 L
   e. 0.000036 cm^3
   f. 10000
   g. 1001
   h. 0.001345
   i. 0.0101
   j. 3.21 x 10^{-2}

2. Record the following in correct **scientific notation**:
   a. 4050,000,000 cal
   b. 0.000123 mol
   c. 0.00345 Å
   d. 700,000,000 atoms

3. Calculate the following to the **correct number** of significant figures.
   a. 1.270 g / 5.296 cm^3
   b. 12.235 g / 1.010 L
   c. 12 g + 0.38 g
   d. 170g + 2.785 g
   e. 2.1 x 3.2102
   f. 200.1 x 120
   g. 17.6 + 2.838 + 2.3 + 200

4. Assume silicon has three major isotopes in nature as shown in the table below. Calculate and fill in the missing information.

Isotope	Mass (amu)	Abundance
Si-28	27.98	
Si-29		4.70%
Si-32	29.97	3.09%

5. Calcium carbonate decomposes upon heating. How many grams of calcium oxide will be produced after 12.25 g of calcium carbonate is completely decomposed?

6. When ammonia gas, oxygen gas and methane gas (CH_4) are combined, the products are hydrogen cyanide gas and water. Calculate the mass of each product produced when 2.25×10^2 g of oxygen gas is reacted with an excess of the other two reactants. If the actual yield of the experiment is 105 g of HCN, calculate the percent yield.

7. One type of electromagnetic radiation has a frequency of 107.1 MHz, another type has a wavelength of 2.12×10^{-10} m, and another type has photons with energy equal to 3.97×10^{-19} J/photon. Identify each type of electromagnetic radiation and place them in order of increasing photon energy and increasing frequency.

8. Determine the empirical formula of the compounds with the following compositions by mass:
   a. 10. 4 % C, 27. 8% S , 61. 7 % Cl

   b.21.7 % C, 9.6 % O, and 68.7 % F

9. Calculate the percentage by mass of the following compounds:

   a. SO_3

   b. CH_3COOCH_3

   c. Ammonium Nitrate.

IV. Atomic Structure, Periodicity, and Bonding Review

1. Answer the following questions based on the given electron configuration and identify the elements.

a. Arrange these atoms in order of increasing size: $[Kr]5s^2 4d^{10} 5p^5$; $[Kr]5s^2 4d^{10} 5p^1$; $[Kr]5s^2 4d^{10} 5p^3$.

b. Arrange these atoms in order of decreasing first ionization energy: $[Ne]3s^2 3p^5$; $[Ar]4s^2 3d^{10} 4p^3$; $[Ar]4s^2 3d^{10} 4p^5$.

2. Write the expected ground-state electron configuration for the following:

a. the element with one unpaired 5p electron that forms a covalent with compound fluorine

b. the first-row transition metal with the most unpaired electrons

b. the metalloid in period 3

c. the halogen in period 5

d. the element with atomic number 47

e. the sodium ion

Polyatomic Ion Names

1+
ammonium, NH_4^+
hydronium, H_3O^+

2+
mercury (I), Hg_2^{2+}

1-
acetate, $C_2H_3O_2^-$, or CH_3COO^-
bromate, BrO_3^-
perchlorate, ClO_4^-
chlorate, ClO_3^-
chlorite, ClO_2^-
hypochlorite, ClO^-
cyanide, CN^-
hydrogen carbonate, HCO_3^- (also called bicarbonate)
hydrogen sulfate, HSO_4^-
hydroxide, OH^-
iodate, IO_3^-
nitrate, NO_3^-
nitrite, NO_2^-
permanganate, MnO_4^-
thiocyanate, SCN^-

2-
carbonate, CO_3^{2-}
chromate, CrO_4^{2-}
dichromate, $Cr_2O_7^{2-}$
oxalate, $C_2O_4^{2-}$
peroxide, O_2^{2-}
sulfate, SO_4^{2-}
sulfite, SO_3^{2-}
thiosulfate, $S_2O_3^{2-}$

3-
phosphate, PO_4^{3-}
phosphite, PO_3^{3-}
arsenate, AsO_4^{3-}

SOLUBILITY RULES

1. Salts of ammonium (NH_4^+) and Group IA are always soluble.

2. a. All chlorides (Cl^-) are soluble except AgCl, Hg_2Cl_2, and $PbCl_2$ which are insoluble.

   b. All bromides (Br^-) are soluble except AgBr, Hg_2Br_2, $HgBr_2$, and $PbBr_2$ which are insoluble.

   c. All iodides (I^-) are soluble except AgI, Hg_2I_2, HgI_2, and PbI_2 which are insoluble.

3. Chlorates (ClO_3^-), nitrates (NO_3^-), and acetates (CH_3COO^-) are soluble.

4. Sulfates (SO_4^{-2}) are soluble except $CaSO_4$, $SrSO_4$, $BaSO_4$, Hg_2SO_4, $HgSO_4$, $PbSO_4$, and Ag_2SO_4 which are insoluble.

5. Phosphates (PO_4^{-3}), and carbonates (CO_3^{-2}) are insoluble except NH_4^+ and Group IA compounds.

6. All metallic oxides (O^{-2}) are insoluble except NH_4^+ and Group IA compounds.

7. All metallic hydroxides (OH^-) are insoluble except NH_4^+ and Group IA and Group IIA from calcium down.

8. All sulfides (S^{-2}) are insoluble except NH_4^+ and Groups IA and IIA.