AP Chemistry Summer Assignment

Date Due: 1st Day of Class
For Questions Contact: Laura Trout troutl@lancastercountryday.org

"Why is there a summer assignment for AP Chemistry?" The AP Chemistry course assumes that you recall the concepts you learned in Honors Chemistry and can use those concepts with confidence. The summer work serves to review topics you studied in first-year Honors chemistry. The AP Chemistry summer work will help you adjust to the course and will show you areas where you need to review. We dive right in on the first day of class, assuming you remember moles, stoichiometry, writing reactions, gas laws, solutions, etc.

"So how do I go about doing the summer assignment?"
Take a look at the problems in each section. If you remember how to do the problems without re-reading that material in the text, please do so. If not, use the resources you have to try and figure it out: e-book from Honors Chemistry, your notes from class, etc. Feel free to use other resources such as Khan Academy. Working with others in the class, or those that have completed the class, is also fair. It would be a good idea to check your answers against someone else when you are finished. Do not just copy answers! If you can't do most of these on your own, you are going to have a hard time in AP Chemistry.

I will offer Zoom help sessions over the summer. Here are the dates and times. Use this link to enter the Zoom room when it is time.

July 16	10-11 am	Aug 14	7-8 pm
July 31	4-5 pm	Aug 18	7-8 pm
Aug 11	10-11 am		

For mathematical problems ***I expect to see all work*** (with the exception of adding up molar masses and simple metric conversions, i.e. mL to L). ***Units should be included*** on all numerical values (within the problem and in the answer). This will be the rule in the class as well. Use your understanding of significant figures to round answers to an appropriate number of digits. ***I love to see the Factor Label Method used to solve problems.***

"Will there be a lot of memorization in AP Chem?"
The short answer is "no". For AP Chemistry, you will not need to memorize ion names, however it is helpful. You will always be given the chemical formula for a substance on an exam. You will not need to memorize any mathematical equations. There is an AP Chemistry equation sheet that will always be available for you during class and on exams. I also encourage you to start using the AP Chemistry periodic table, rather than the PT from Honors Chemistry. Notice there are no names on the AP Chemistry periodic table, so that will take some getting used to for some people. There are two things you must memorize, 1) the six strong acids and 2) some simple solubility rules. I suggest you start now.

Six Strong Acids	hydrochloric acid	HCl	nitric acid	HNO_3
	hydrobromic acid	HBr	sulfuric acid	H_2SO_4
	hydroiodic acid	HI	perchloric acid	$HClO_4$
Solubility Rules Think SNAAP.	Compounds containing these ions are always soluble.			
	sodium (Na^+)		ammonium (NH_4^+)	
	nitrate (NO_3^-)		acetate ($C_2H_3O_2^-$)	
			potassium (K^+)	

AP Chemistry Summer Assignment

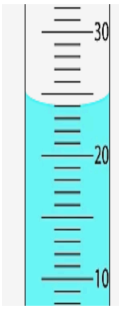
For each problem below show your work. Always use units and box your final answer.

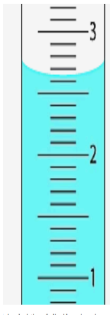
Can you work with significant figures and scientific notation?

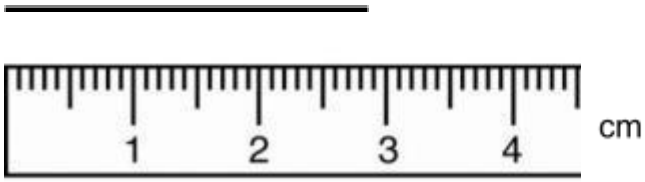
Round each of the following numbers to four significant figures, and express the result in scientific notation:

300.235800 456,500 0.006540210 – 0.000957830 – 0.035000

Record the measurement to the correct number of significant figures.







Carry out the following operations, and express the answers with the appropriate number of significant figures:

1.24056 + 75.80 _____

75 – 45.88 _____

890,000 x 112.3 _____

78,132 / 2.50 _____

Can you use dimensional analysis (FLM) to convert measurements to other units?

Perform the following conversions. Watch your significant figures. If the answer is less than 0.001 or greater than 1000, put the answer in scientific notation:

8.60 cm to nm _____

3.00 days to s _____

75.00 km/hr to m/s _____

55.35 m^3 to cm^3 _____

1.08 atm to kPa _____

900.0 mmHg to atm _____

Can you use density as a conversion factor in a FLM problem?

a. The density of pure silver is 10.5 g/cm^3 at 20^{o}C. If 5.25 g of pure silver pellets are added to a graduated cylinder containing 11.2 mL of water, to what volume level will the water in the cylinder rise?

b. The density of air at ordinary atmospheric pressure and 25^{o}C is 1.19 g/L. What is the mass, in kilograms, of the air in a room that measures 12.5 x 15.5 x 8.0 ft? (Note: 1 foot = 0.3048 m)

Do you have a good understanding of atomic theory?

1. Let's pretend you are holding two atoms of carbon that are isotopes. Describe what the two atoms have in common and how they are different.

2. Fill in the gaps in the following table, assuming each column represents a neutral atom:

Symbol	^{39}K				
Protons		25			82
Neutrons		30	64		
Electrons			48	56	
Mass #				137	207

3. Write the correct symbol, with both superscripts and subscripts, for each of the following :

(a) the isotope of sodium with mass 23 _____

(b) the atom of vanadium that contains 28 neutrons _____

(c) the isotope of chlorine with mass 37 _____

(d) an atom of magnesium that has an equal number of protons and neutrons

_____

Do you know the order of sublevels in an electron configuration (without a cheat sheet- only the PT)?

1. Write the full electron configuration for the following atoms. Underline the valence electrons.

   Mg :

   Br :

2. Draw an orbital diagram (lines and arrows) for the following atoms.

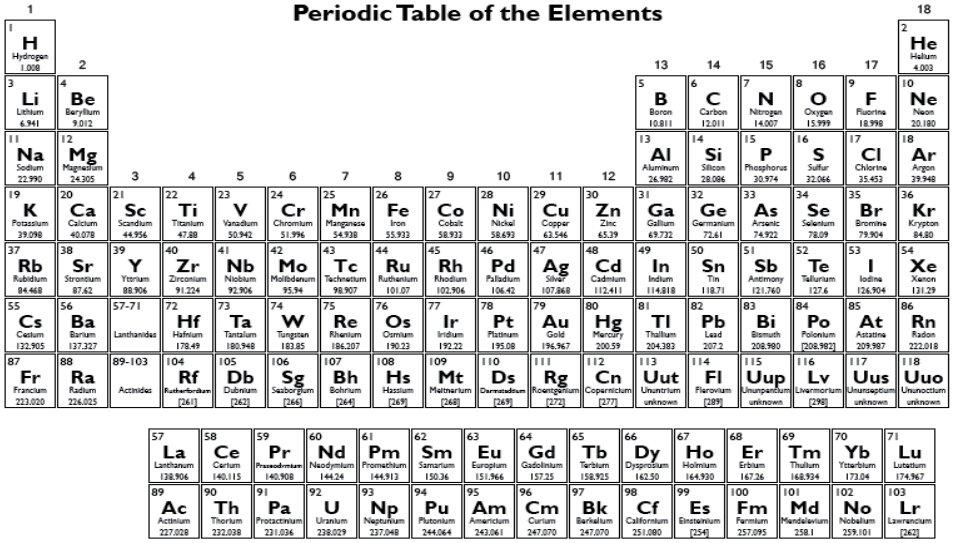
   P :

   Co:

Do you know your way around the Periodic Table?

On the diagram of the Periodic Table below, identify the location for:

metals nonmetals semimetals(metalloids) transition metals lanthanides
halogens alkali metals noble gasses alkaline earth metals



Do you understand how to calculate average atomic mass?

1. What isotope is used as the standard in establishing the atomic mass scale?

2. The atomic mass of magnesium is reported as 24.3, yet no atom of magnesium has the mass of 24.3 amu. Explain.

3. Only two isotopes of copper occur naturally, Cu-63 (abundance 69.09 percent) and Cu-65 (abundance 30.91 percent). Calculate the average atomic mass of copper.

Do you know your nomenclature rules?

(Note: You do not need to memorize the ions or prefixes for naming. You may use the reference sheet from H. Chem.)

Give the name for each of the following ionic compounds: For transition metals that have more than one charge, use Roman numerals.

AlF_3	Hg_2S
$Fe(OH)_2$	$Ca(C_2H_3O_2)_2$
$Cu(NO_3)_2$	$Cr_2(CO_3)_3$
$Ba(ClO_4)_2$	K_2CrO_4
Li_3PO_4	$(NH_4)_2SO_4$

Write the chemical formula for each of the following ionic compounds:

copper (I) oxide	mercury (I) bromide
aluminum hydroxide	iron (III) carbonate
zinc nitrate	sodium hypobromite

Give the name or chemical formula, as appropriate, for each of the following acids:

$HBrO_3$	hypochlorous acid
HBr	iodic acid
H_3PO_4	sulfurous acid

Give the name or chemical formula, as appropriate, for each of the following molecular substances:

SF_6	dinitrogen tetroxide
IF_5	hydrogen cyanide
XeO_3	tetraphosphorous hexasulfide

Can you calculate percent mass? (show your work!)

Calculate the percentage by mass of oxygen in the following compounds:

NO_2 $Cr(NO_3)_3$

Can you balance a chemical equation and identify the type of reaction it illustrates?

Balance the following equations, and indicate what type of reaction each one is:

a. $Al\ (s) + Cl_2\ (g) \rightarrow AlCl_3\ (s)$ _____

b. $PbCO_3\ (s) \rightarrow PbO\ (s) + CO_2\ (g)$ _____

c. $C_7H_8O_2\ (l) + O_2\ (g) \rightarrow CO_2\ (g) + H_2O\ (l)$ _____

d. $Al(NO_3)_3\ (aq) + Na_3PO_4\ (aq) \rightarrow AlPO_4\ (s) + NaNO_3\ (aq)$ _____

e. $AlCl_3\ (aq) + Zn\ (s) \rightarrow ZnCl_2\ (aq) + Al\ (s)$ _____

Can you imagine a chemical reaction?

Write balanced chemical equations, including phase notations, to correspond to each of the following descriptions. Then draw a picture of what you would see if you were watching the reaction occur in the lab. Label all of the substances in the drawing.

Solid calcium carbide, CaC_2, reacts with water to form an aqueous solution of calcium hydroxide and acetylene gas, C_2H_2.

When solid potassium chlorate is heated, it decomposes to form solid potassium chloride and oxygen gas.

Solid zinc metal reacts with sulfuric acid to form hydrogen gas and an aqueous solution of zinc sulfate.

When liquid phosphorus trichloride is added to water, it reacts to form a solution of phosphorous acid and hydrochloric acid.

A solution of acetic acid (CH_3COOH) is titrated with a solution of sodium hydroxide.

Can you work with mass, moles and particle number in conversions?

1. The molecular formula of aspartame, the artificial sweetener marketed as NutraSweet, is $C_{14}H_{18}N_2O_5$.
    a. What is the molar mass of aspartame?

    b. How many moles of aspartame are present in 1.00 mg of aspartame?

    c. How many molecules of aspartame are present in 1.00 mg of aspartame?

    d. How many hydrogen atoms are present in 1.00 mg of aspartame?

Can you determine the empirical and molecular formulas of a compound from mass or %mass data?

1. Determine the empirical formula of each of the following compounds if a sample contains
    a. 10.4 percent C 27.8 percent S 61.7 percent Cl

    b. 6.51 g C 2.88 g O 20.61 g F

2. Determine the empirical and molecular formulas of each of the following substances:
    a. Ibuprofen, a headache remedy contains 75.69 percent C, 8.80 percent H, and 15.51 percent O by mass; molar mass about 206 g

    b. Benzene contains only carbon and hydrogen and is 7.74% hydrogen by mass. The molar mass of benzene is 78.1 g/mol.

Can you perform stoichiometry calculations to predict quantities involved in reactions?

1. Automotive air bags inflate when sodium azide, NaN_3, rapidly decomposes to its component elements:

$$2\ NaN_3\ (s) \rightarrow Na(s) + 3\ N_2\ (g)$$

    a. How many moles of N_2 are produced by the decomposition of 1.50 moles of NaN_3?

    b. How many grams of NaN_3 are required to form 5.00 g of nitrogen gas?

    c. How many grams of NaN_3 are required to produce 10.0 L of nitrogen gas if the gas has a density of 1.25 g/L?

2. A piece of aluminum foil 0.550 mm thick and 1.00 cm square is allowed to react with bromine to form aluminum bromide.
    a. How many moles of aluminum were used? (The density of aluminum is 2.699 g/cm^3.)

    b. How many grams of aluminum bromide form, assuming that the aluminum reacts completely?

<u>Can you find the limiting reactant and theoretical yield for a reaction?</u>

1. The fizz produced when an Alka-Seltzer tablet is dissolved in water is due to the reaction between sodium bicarbonate, $NaHCO_3$, and citric acid, $H_3C_6H_5O_7$:

    $$3\ NaHCO_3\ (aq) + H_3C_6H_5O_7\ (aq) \rightarrow 3\ CO_2\ (g) + 3\ H_2O(l) + Na_3C_6H_5O_7\ (aq)$$

    In a certain experiment 1.00 g of sodium bicarbonate and 1.00 g of citric acid are allowed to react.

    a. Which reactant is the limiting reactant? You must show work to support your answer.

    b. What is the theoretical yield of carbon dioxide (in grams)?

    c. How much of the limiting reactant is left when the reaction is complete?

    d. How many grams of the excess reactant remain after the reaction is complete?

2. When hydrogen sulfide gas is bubbled into a solution of sodium hydroxide, the reaction forms sodium sulfide and water. What is the theoretical yield of sodium sulfide if 2.50 g of hydrogen sulfide is bubbled into 150.0 mL of a 0.300 M solution of sodium hydroxide? Assume that the limiting reagent is completely consumed.

3. Hydrogen peroxide is oxidized with permanganate solution to produce oxygen gas by the following reaction.
$10\ H^+(aq) + 3\ H_2O_2(aq) + 4\ MnO_4^{1-}(aq) \rightarrow 4\ MnO_2(aq) + 8\ H_2O + 3\ O_2(g)$

   In the lab a student mixed 30.0 mL of 0.30 M hydrogen peroxide solution with 30.0 mL of 0.30 M potassium permanganate solution. The oxygen that was produced was collected by water displacement at 298 K and 1.00 atm of pressure. The volume of oxygen collected was 178 mL. (Ignore the effect of water vapor in the collection tube here.)

   a. What is the limiting reactant?

   b. What is the theoretical yield of oxygen gas, in milliliters?

   c. What is the percent yield of oxygen gas?

Can you work with concentrations?

1. a) What is the molarity of a copper (II) chloride solution where 5.00 g of copper(II) chloride solid is placed in a volumetric flask and dissolved in deionized water up to the 250 mL mark?

   b) What is the molarity of copper(II) ions in the solution above?

   c) What is the concentration of chloride ions in the solution above?

2. A student is given a stock solution of sodium acetate that is 8.000 M.

   a) If 25.00 mL of the stock solution was placed in a 100 mL volumetric flask and filled to the line with distilled water, what would be the concentration of the new solution?

   b) How many milliliters of the stock solution would be needed if the student wanted to make 1.00 L of 0.250 M sodium acetate?

   c) Describe the procedure, including the specific glassware or tools that would be needed for the student to make the solution described in part b).