

AP Chemistry Summer Assignment

PHS- Ms. Riley

The AP chemistry summer assignment is designed to refresh your memory of concepts learned in honors chemistry. Since you may not have seen this material in a year or more, it is vitally important that you take this summer assignment seriously. In class we will focus more on the material that is new in order to better prepare you for success on the AP exam in May.

Due Date is the First Day of School September 13, 2010—No exceptions!! And no excuses will be accepted as to why it can't be handed in on time as you are given more than enough time to complete the assignment.

This assignment will be graded in the first few days of class and there will be a test on the material the first week of class. You need to purchase the Barron's AP Chemistry Test Preparation book. You are to go through the book highlight and take notes/outline of the following sections: (If you did not take Honors Chemistry please see me before the end of school as there are additional topics you need to cover this summer)

1. structure of atom
2. periodic table
3. ionic compounds, formulas and reactions
4. stoichiometry
5. gases
6. covalent compounds, formulas and structure

After you read and outline each section you are to do the practice tests. And it is not good enough to write down just the letter answer as that is given to you in the answer key. To gain full credit for the assignment you must give an explanation as to why the correct answer is the one you chose. Give a nice written and well thought out description.

Then you are to do the following sections based upon previously learned chemistry material. Be sure to note what sections you may need more review and study time for as these will not be the main focus in AP yet new material that is necessary to pass the AP exam will.

You will have a quiz on the first day of class on the solubility rules and polyatomic ions. You **MUST** memorize these. Get an early start!!! See the attached charts

I. Chemical Formulas: Some helpful websites:

<http://www.wise.k12.va.us/jjk/Chemistry/formula.htm>

<http://www.phs.princeton.k12.oh.us/departments/Science/ldusch/honorspdfs/namingchpt5/Flowcharts.pdf>

1. Write formulas for the following: 2. Name each of the following:

a. barium sulfate _____ a. CuSO_4 _____

b. ammonium chloride _____ b. PCl_3 _____

c. chlorine monoxide _____ c. Li_3N _____

d. silicon tetrachloride _____ d. BaSO_3 _____

e. magnesium fluoride _____ e. N_2F_4 _____

f. sodium oxide _____ f. KClO_4 _____

g. sodium peroxide _____ g. NaH _____

h. copper (I) oxide _____ h. $(\text{NH}_4)_2\text{Cr}_2\text{O}_7$ _____

i. zinc sulfide _____ i. HNO_2 _____

j. potassium carbonate _____ j. Sr_3P_2 _____

k. hydrobromic acid _____ k. $\text{Mg}(\text{OH})_2$ _____

l. perchloric acid _____ l. Al_2S_3 _____

m. lead(II) acetate _____ m. AgBr _____

n. sodium permanganate _____ n. P_4O_{10} _____

o. lithium oxalate _____ o. $\text{HC}_2\text{H}_3\text{O}_2$ _____

p. potassium cyanide _____ p. CaI_2 _____

q. iron (III) hydroxide _____ q. MnO_2 _____

r. silicon dioxide _____ r. Li_2O _____

s. nitrogen trifluoride _____ s. FeI_3 _____

t. chromium(III) oxide _____ t. Cu_3PO_4 _____

u. calcium chlorate _____ u. PCl_3 _____

v. sodium thiocyanate _____ v. NaCN _____

w. nitrous acid _____ w. HF _____

II. Stoichiometry: Show all of your work for the following problems:

You may find the following websites helpful:

<http://www.chemtutor.com/mols.htm>

<http://www.chem.tamu.edu/class/majors/tutorialnotefiles/limiting.htm>

<http://www.usetute.com.au/idealgas.html>

1. Find the mass percent of nitrogen in each of the following compounds:

- NO
- NO₂
- N₂O₄
- N₂O

2. Benzene contains only carbon and hydrogen and has a molar mass of 78.1 g/mol. Analysis shows the compound to be 7.74 % hydrogen by mass. Find the empirical and molecular formulas of benzene.

3. Calcium carbonate decomposes upon heating, producing calcium oxide and carbon dioxide.

- Write a balanced chemical equation for this reaction.
- How many grams of calcium oxide will be produced after 12.25 grams of calcium carbonate are completely decomposed?
- What is the volume of carbon dioxide gas produced 12.25 grams of calcium carbonate at STP?
- What is the volume of carbon dioxide in L if the pressure is pressure is 785mm Hg and the temperature is 30°C? ($R = 62.4 \text{ mm} \times \text{L/mol} \times \text{K}$)

4. Hydrogen gas and bromine gas react to form hydrogen bromide gas.

- Write a balanced equation for this reaction.
- 3.2 grams of hydrogen react with 9.5 grams of bromine. Which is the limiting reagent?
- How many grams of hydrogen bromide gas can be produced using the amounts in (b)?
- How many grams of excess reactant are left unreacted?
- What volume of HBr, measured at STP is produced in (b)?

5. When ammonia gas, oxygen gas and methane gas (CH₄) are combined, the products are hydrogen cyanide gas and water.
- Write a balanced chemical equation for this reaction.
 - Calculate the mass of each product produced when 225 grams of oxygen gas is reacted with an excess of the other two reactants.
 - If the actual yield of the experiment in (b) is 105 grams of HCN, calculate the percent yield.

III. Chemical Reactions & Equations

In AP Chemistry, most of the reactions we write are called "net ionic." But before we can do that, you need to review and memorize some basic reaction types. For some basic review, go to the following website:

<http://misterguch.brinkster.net/6typesofchemicalrxn.html>

Now try these sample problems from the website:

Give the type for each of the following reactions:



You will also need to learn which acids and bases are strong and which are weak. See this document online:

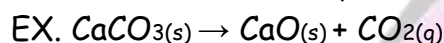
http://spiepho.sbc.edu/worksheets/Gen_Chem_2/Chp15,Acids_and_Bases.doc

It takes awhile to read, but it is very complete! A simple way to remember acids: all binary acids, except HF are strong. Oxyacids (contain polyatomic ions) are strong if there are two or more oxygen atoms than hydrogen atoms:

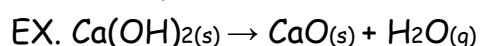
H_2SO_4 = strong H_2SO_3 = weak

Learn these types of decomposition reactions:

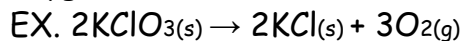
1. Metallic carbonates, when heated, form metallic oxides and $\text{CO}_2(\text{g})$.



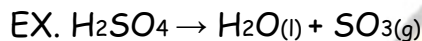
2. Most metallic hydroxides, when heated, decompose into metallic oxides and water.



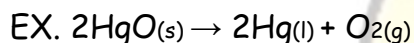
3. Metallic chlorates, when heated, decompose into metallic chlorides and oxygen.



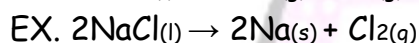
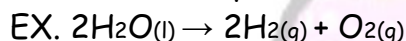
4. Some acids, when heated, decompose into nonmetallic oxides and water.



5. Some oxides, when heated, decompose.



6. Some decomposition reactions are produced by electricity.



Now try these: (Rewrite as a balanced equation with the products predicted):

1. barium hydroxide (heated)

2. sodium carbonate (heated)

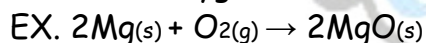
3. lithium chlorate (heated)

4. electrolysis of aluminum oxide

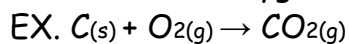
5. sulfuric acid heated gently

Learn these types of synthesis reactions:

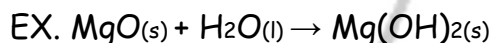
1. Metal + oxygen \rightarrow metal oxide



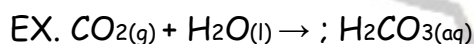
2. Nonmetal + oxygen \rightarrow nonmetallic oxide



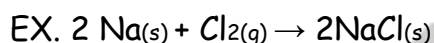
3. Metal oxide + water \rightarrow metallic hydroxide



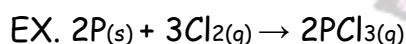
4. Nonmetallic oxide + water \rightarrow acid



5. Metal + nonmetal \rightarrow salt



6. A few nonmetals combine with each other.



Now try these: (Rewrite as a balanced equation with the products predicted):

1. magnesium burned in oxygen

2. hydrogen gas + nitrogen gas

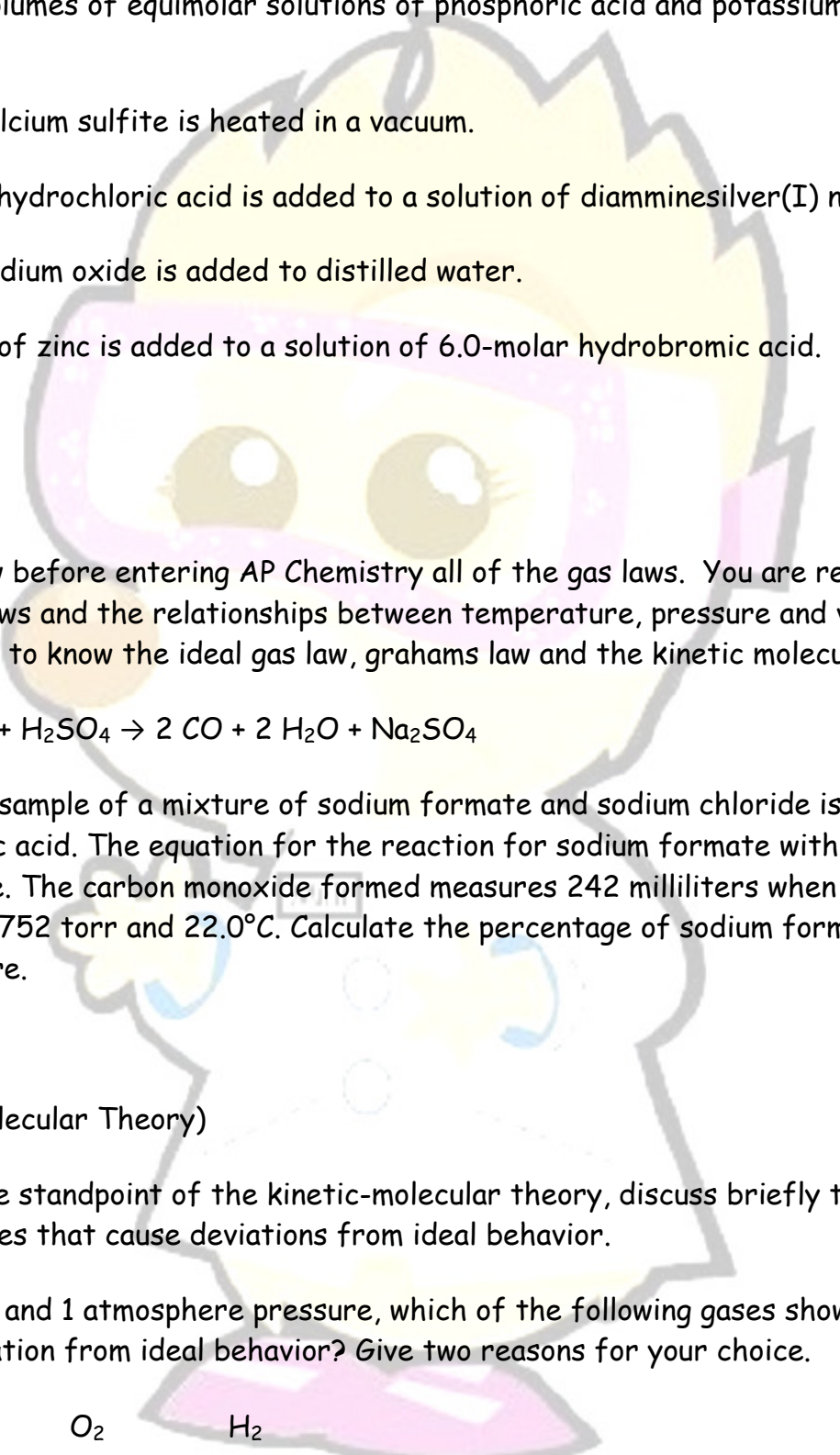
3. sulfur burned (complete combustion)

4. calcium oxide added to water

AP Chemical Equations Practice:

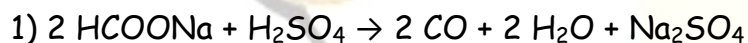
Directions: Use appropriate ionic and molecular formulas to show the reactants and the products for the following chemical reactions. Each occurs in aqueous solution unless otherwise indicated. Represent substances in solution as ions if the substance is extensively ionized. Omit formulas for any ions or molecules that are unchanged by the reaction. In all cases a reaction occurs. You need not balance."

- 1) excess potassium hydroxide solution is added to a solution of aluminum nitrate.
- 2) a solution of sodium bromide is added to an acidified solution of potassium bromate.
- 3) sulfur dioxide gas is bubbled into distilled water.
- 4) phosphine (phosphorus trihydride) gas is bubbled into liquid boron trichloride.
- 5) hydrogen gas is passed over hot iron(II) oxide powder.
- 6) solid potassium amide is added to distilled water.
- 7) a strip of magnesium metal is heated strongly in pure nitrogen gas.
- 8) a solution of nickel chloride is added to a solution of sodium sulfide.
- 9) Solutions of tin(II) chloride and iron(III) chloride are mixed.
- 10) Solutions of cobalt(II) nitrate and sodium hydroxide are mixed.
- 11) Ethene gas is burned in air.

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- 12) Equal volumes of equimolar solutions of phosphoric acid and potassium hydroxide are mixed.
- 13) Solid calcium sulfite is heated in a vacuum.
- 14) Excess hydrochloric acid is added to a solution of diamminesilver(I) nitrate.
- 15) Solid sodium oxide is added to distilled water.
- 16) A strip of zinc is added to a solution of 6.0-molar hydrobromic acid.

IV. Gases

You must know before entering AP Chemistry all of the gas laws. You are responsible for knowing the laws and the relationships between temperature, pressure and volume. It is also important to know the ideal gas law, graham's law and the kinetic molecular theory.



A 0.964 gram sample of a mixture of sodium formate and sodium chloride is analyzed by adding sulfuric acid. The equation for the reaction for sodium formate with sulfuric acid is shown above. The carbon monoxide formed measures 242 milliliters when collected over water at 752 torr and 22.0°C. Calculate the percentage of sodium formate in the original mixture.

2) (Kinetic Molecular Theory)

(a) From the standpoint of the kinetic-molecular theory, discuss briefly the properties of gas molecules that cause deviations from ideal behavior.

(b) At 25°C and 1 atmosphere pressure, which of the following gases shows the greatest deviation from ideal behavior? Give two reasons for your choice.

CH_4 SO_2 O_2 H_2

(c) Real gases approach ideality at low pressure, high temperature, or both. Explain these observations.

3) (Kinetic Molecular Theory - deviation from ideality)

The van der Waals equation of state for one mole of a real gas is as follows:

$$(P + \frac{a}{V^2})(V - b) = RT$$

For any given gas, the values of the constants a and b can be determined experimentally. Indicate which physical properties of a molecule determine the magnitudes of the constants a and b . Which of the two molecules, H_2 or H_2S , has the higher value for a and which has the higher value for b ? Explain.

One of the van der Waals constants can be correlated with the boiling point of a substance. Specify which constant and how it is related to the boiling point.

4) (Molar mass determination)

Three volatile compounds X, Y, and Z each contain element Q. The percent by weight of element Q in each compound was determined. Some of the data obtained are given below.

Compound	Percent by Weight of Element Q	Molecular Weight
X	64.8%	?
Y	73.0%	104.
Z	59.3%	64.0

(a) The vapor density of compound X at 27 degrees Celsius and 750. mm Hg was determined to be 3.53 grams per liter. Calculate the molecular weight of compound X.

(b) Determine the mass of element Q contained in 1.00 mole of each of the three compounds.

(c) Calculate the most probable value of the atomic weight of element Q.

(d) Compound Z contains carbon, hydrogen, and element Q. When 1.00 gram of compound Z is oxidized and all of the carbon and hydrogen are converted to oxides, 1.37 grams of CO_2 and 0.281 gram of water are produced. Determine the most probable molecular formula.