

AP Chemistry Summer Assignment

Mrs. Cook

June 2009

Welcome to AP Chemistry!! You already have a background in chemistry from your General Chemistry class, but AP Chem is very different. Rather than memorizing how to do particular types of problems, you must really understand the chemistry and be apply it to all sorts of different situations. AP Chemistry is a difficult course and the AP Exam is very challenging. To succeed, you must keep up with the assignments and be willing to spend time working through the material. Like all AP classes, AP Chem comes with a summer assignment. It is due the first day of class and we will have a quiz on the material that is to be memorized. The assignment will count as one test grade. I encourage you to form a study group and begin by working on the summer assignment together. The course is much easier if you have a support system. I check my e-mail frequently, so feel free to contact me if you are having problems doing the summer assignment. My e-mail address is: patricia.cook@vbschools.com Please take the summer assignment seriously. Each section is referenced with web tutorials to help you if you have forgotten some of your General Chemistry, but feel free to use any good website.

If you feel the summer assignment is too much to do, then you probably do not belong in AP Chemistry!

I look forward to see you in the fall.

Have a great summer,

Mrs. Cook

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!!!

Solubility Rules:

1. All compounds containing the alkali metal cations and the ammonium ion are **soluble**.
2. All compounds containing NO_3^- , ClO_4^- , ClO_3^- , and $\text{C}_2\text{H}_3\text{O}_2^-$ anions are **soluble**.
3. All chlorides, bromides and iodides are **soluble except** those containing Ag^+ , Pb^{2+} or Hg_2^{2+} .
4. All sulfates are **soluble except** those containing Hg_2^{2+} , Pb^{2+} , Sr^{2+} , Ca^{2+} , or Ba^{2+} .
5. All hydroxides are **insoluble except** compounds of the alkali metals, Ca^{2+} , Sr^{2+} , and Ba^{2+} .
6. All compounds containing PO_4^{3-} , S^{2-} , CO_3^{2-} , and SO_3^{2-} are **insoluble except** those that also contain alkali metals or NH_4^+ .

Polyatomic Ions

Name	Symbol
ammonium	NH_4^+
acetate	$\text{C}_2\text{H}_3\text{O}_2^-$
bromate	BrO_3^-
perchlorate	ClO_4^-
chlorate	ClO_3^-
chlorite	ClO_2^-
hypochlorite	ClO^-
cyanide	CN^-
dihydrogen phosphate	H_2PO_4^-
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^-
permanganate	MnO_4^-
thiocyanate	SCN^-
carbonate	CO_3^{2-}
dichromate	$\text{Cr}_2\text{O}_7^{2-}$
chromate	CrO_4^{2-}
oxalate	$\text{C}_2\text{O}_4^{2-}$
selenate	SeO_4^{2-}
silicate	SiO_3^{2-}
sulfate	SO_4^{2-}
sulfite	SO_3^{2-}
phosphate	PO_4^{3-}
phosphite	PO_3^{3-}

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:

a. barium sulfate _____

b. ammonium chloride _____

c. chlorine monoxide _____

d. silicon tetrachloride _____

e. magnesium fluoride _____

f. sodium oxide _____

g. sodium peroxide _____

h. copper(I) oxide _____

i. zinc sulfide _____

j. potassium carbonate _____

k. hydrobromic acid _____

l. perchloric acid _____

m. lead(II) acetate _____

n. sodium permanganate _____

o. lithium oxalate _____

p. potassium cyanide _____

q. iron (III) hydroxide _____

r. silicon dioxide _____

s. nitrogen trifluoride _____

t. chromium(III) oxide _____

u. calcium chlorate _____

v. sodium thiocyanate _____

w. nitrous acid _____

2. Name each of the following:

a. CuSO_4 _____

b. PCl_3 _____

c. Li_3N _____

d. BaSO_3 _____

e. N_2F_4 _____

f. KClO_4 _____

g. NaH _____

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

i. HNO_2 _____

j. Sr_3P_2 _____

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

l. Al_2S_3 _____

m. AgBr _____

n. P_4O_{10} _____

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

p. CaI_2 _____

q. MnO_2 _____

r. Li_2O _____

s. FeI_3 _____

t. Cu_3PO_4 _____

u. PCl_3 _____

v. NaCN _____

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:
 - a. NO
 - b. NO₂
 - c. N₂O₄
 - d. 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.
 - a. Write a balanced chemical equation for this reaction.

 - b. How many grams of calcium oxide will be produced after 12.25 grams of calcium carbonate are completely decomposed?

 - c. What is the volume of carbon dioxide gas produced 12.25 grams of calcium carbonate at STP?

- d. 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 (CH_4) 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.

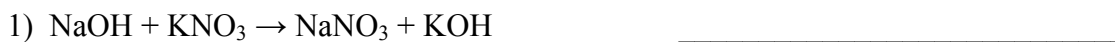
III. Chemical Reactions

In AP Chemistry, most of the reaction 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:

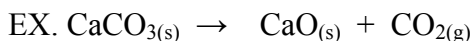
http://spiapho.sbc.edu/worksheets/Gen_Chem_2/Chp15,Acids_and_Bases.doc

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:

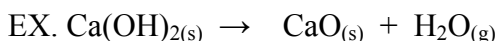
H_2SO_4 = strong H_2SO_3 = weak

Learn these types of decomposition reactions:

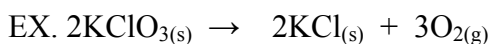
1. Metallic carbonates, when heated, form metallic oxides and $\text{CO}_2(\text{g})$.



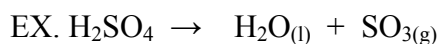
2. Most metallic hydroxides, when heated, decompose into metallic oxides and water.



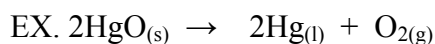
3. Metallic chlorates, when heated, decompose into metallic chlorides and oxygen.



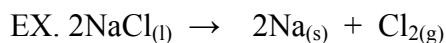
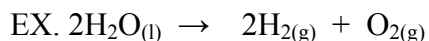
4. Some acids, when heated, decompose into nonmetallic oxides and water.



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)

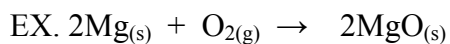
3. lithium chlorate (heated)

4. electrolysis of aluminum oxide

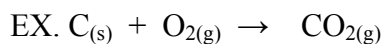
5. sulfuric acid heated gently

Learn these types of synthesis reactions:

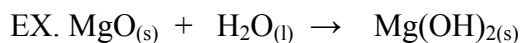
1. Metal + oxygen \rightarrow metal oxide



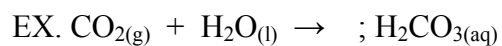
2. Nonmetal + oxygen \rightarrow nonmetallic oxide



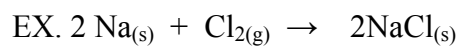
3. Metal oxide + water \rightarrow metallic hydroxide



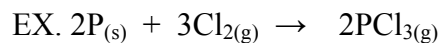
4. Nonmetallic oxide + water \rightarrow acid



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
