



HOLMDEL TOWNSHIP SCHOOL DISTRICT

"A COMMITMENT TO EXCELLENCE"

Office of Science and Mathematics

36 Crawfords Corner Road
(732) 946-1873
Holmdel, NJ 07733
Fax: (732) 817-1969

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To My Future AP Chemists:

Welcome to AP Chemistry!

I hope you are all ready for a fun, yet challenging year. Students who finish AP Chemistry come out with a much better understanding of the world around them. They also come out with a sense of great accomplishment. AP Chemistry is a difficult class, but with determination and perseverance, you will surely succeed! Like almost all AP classes, AP Chem comes with a summer assignment. Previous AP students have designed this assignment-it is what they think is important to review and know before starting class in the fall. This assignment will be graded in the first few days of class. There will be a test on the material the first week of class. Don't procrastinate!

Enjoy your summer; take July off, but realize that come August, you must put in the time for get these set in your minds. Why the rush? The AP Chemistry test is on Thursday, May 9th, 2019. We have to finish everything by the end of March so that we can review for the month of April. HHS students have ALWAYS performed incredibly well in the past years, with a great majority (> 80%) getting 5's. Magic? Nope, but plain and unadulterated hard work. You are all capable of earning 5's, but you must work for it!

Please check your email frequently towards the end of August for emails from me. You may always email me at: jblaha@holmdelschools.org.

AP CHEMISTRY FIRST WEEK TEST

AP Chemistry is a difficult course. It is not about memorization; however, having these items memorized is essential for success in learning the concepts covered in the course. Make flashcards, have your friends and family quiz you, take the lists with you on vacation, or do whatever it takes to get this information firmly planted in your head. Do not wait until the night before school begins. The first day test will cover six areas of memorization:

1. Polyatomic Ions (including name, symbol and charge)
2. Variable Valences for Transition Metals
3. Rules for Naming Acids
4. Rules for Naming Ionic Compounds
5. The Solubility Rules
6. Determining Oxidation Numbers

See you soon!

Dr. Blaha

AP Chemistry Summer Assignment

1. Go to the following website:
<http://www.sciencegeek.net/APchemistry/APtaters/directory.shtml>

This site has interactive questions and answers based on your Zumdahl textbook. Please work through Units 1-3.

2. Know how to write formulas and names of ionic compounds, molecular compounds, and acids.
 - Know formulas of polyatomics!
3. Memorize the solubility rules.
4. Do the problem sets for Zumdahl chapters 1-5. Understand each concept, do not just do the problems as if they are mere 'plug and chug' problems. **Take special care with the 'For Review' problems- they check your understanding! The AP Chemistry test has been changed for next year and it is stressing more understanding and less 'plug and chug!'**
5. Do the following (these will be collected during the first week of school; the answers to the problems are found at the end of the book).
 - a. Chapter 1:
 - Do the 'For Review' end of chapter questions.
 - b. Chapter 2:
 - Do the 'For Review' end of chapter questions.
 - c. Chapter 3:
 - Do the 'For Review' end of chapter questions.
 - d. Chapter 4:
 - Do the 'For Review' end of chapter questions.
 - e. Chapter 5:
 - Do the 'For Review' end of chapter questions.
 - f. The worksheet packet attached to this.
6. This summer assignment will be collected Tuesday, September 11th, 2018.

TBA, to be done during the first week of school: some kind of assessment on the summer assignment.

**May 9th 2019: The 2019 AP Chemistry Test
Perfect Practice Makes Perfect!!!!!!**

Rules for Determining Oxidation Number

Oxidation Number: A number assigned to an atom in a molecular compound or molecular ion that indicates the general distribution of electrons among the bonded atoms.

1. The oxidation number of any uncombined element is 0.
2. The oxidation number of a monatomic ion equals the charge on the ion.
3. The more electronegative element in a binary compound is assigned the number equal to the charge it would have if it were an ion.
4. The oxidation number of fluorine in a compound is always -1 .
5. Oxygen has an oxidation number of -2 unless it is combined with F, when it is $+2$, or it is in a peroxide, when it is -1 .
6. The oxidation state of hydrogen in most of its compounds is $+1$ unless it is combined with a metal, in which case it is -1 .
7. In compounds, the elements of groups 1 and 2 as well as aluminum have oxidation numbers of $+1$, $+2$, and $+3$, respectively.
8. The sum of the oxidation numbers of all atoms in a neutral compound is 0.
9. The sum of the oxidation numbers of all atoms in a polyatomic ion equals the charge of the ion.

Solubility Rules

1. All compounds containing 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-} ions are insoluble except those that also contain alkali metals or NH_4^+ .

Variable Valences for Transition Metals: Pay attention to mercury(I)!

Zinc (I)	Zn^{1+}
Zinc (II)	Zn^{2+}
Antimony (III)	Sb^{3+}
Antimony (V)	Sb^{5+}
Bismuth (III)	Bi^{3+}
Bismuth (V)	Bi^{5+}
Silver(I)	Ag^{1+}
Gold (I)	Au^{1+}
Gold (III)	Au^{3+}
Tin (II)	Sn^{2+}
Tin (IV)	Sn^{4+}
Mercury(I)	Hg_2^{1+}
Mercury(II)	Hg^{2+}
Nickel (II)	Ni^{2+}
Nickel(III)	Ni^{3+}
Lead(II)	Pb^{2+}
Lead (VI)	Pb^{4+}
Copper(I)	Cu^{1+}
Copper(II)	Cu^{2+}
Cobalt(II)	Co^{2+}
Cobalt(III)	Co^{3+}
Iron (II)	Fe^{2+}
Iron (III)	Fe^{3+}
Manganese (II)	Mn^{2+}
Manganese (III)	Mn^{3+}
Chromium (II)	Cr^{2+}
Chromium (III)	Cr^{3+}

Common polyatomic cations, arranged by charge.

Alternate names are given in italics. Select the name of the ion for information about its occurrence, uses, properties, and structure.

+1

NH_4^+	ammonium
H_3O^+	hydronium

-1

$\text{C}_2\text{H}_3\text{O}_2^-$	acetate				
CN^-	cyanide				
H_2PO_4^-	dihydrogen phosphate				
HCO_3^-	hydrogen carbonate or bicarbonate				
HSO_4^-	hydrogen sulfate or bisulfate				
OH^-	hydroxide				
ClO^-	hypochlorite	BrO^-	hypobromite	IO^-	hypoiodite
ClO_2^-	chlorite	BrO_2^-	bromite	IO_2^-	iodite
ClO_3^-	chlorate	BrO_3^-	bromate	IO_3^-	iodate
ClO_4^-	perchlorate	BrO_4^-	perbromate	IO_4^-	periodate
NO_3^-	nitrate				
NO_2^-	nitrite				
MnO_4^-	permanganate				
SCN^-	thiocyanate				

-2

CO_3^{2-}	carbonate
CrO_4^{2-}	chromate
$\text{Cr}_2\text{O}_7^{2-}$	dichromate
HPO_4^{2-}	hydrogen phosphate
O_2^{2-}	peroxide
SO_4^{2-}	sulfate
SO_3^{2-}	sulfite
$\text{S}_2\text{O}_3^{2-}$	thiosulfate

-3

PO_4^{3-}	phosphate
AsO_4^{3-}	arsenate

Naming and writing chemical formulas is an essential skill to know before starting AP Chemistry.

Rules for Naming an Acid

1. When the name of the anion ends in -ide, the acid name is 'hydro _____ ic acid'
Example: Cl^- is the Chloride ion so $\text{HCl} = \underline{\text{hydrochloric}}$ acid
2. When the anion name ends in -ite, the acid name is the stem of the anion with the suffix -ous, followed by the word acid. -ite becomes _____ous Acid
Example: ClO_2^- is the Chlorite ion so $\text{HClO}_2 = \text{Chlorous acid}$.
3. When the anion name ends in -ate, the acid name is the stem of the anion with the suffix -ic, followed by the word acid. -ate becomes _____ic Acid
Example: ClO_3^- is the Chlorate ion so $\text{HClO}_3 = \text{Chloric acid}$.

Common Acid Names

$\text{HC}_2\text{H}_3\text{O}_2$ acetic acid

HNO_3 nitric acid

CH_3COOH acetic acid

H_3PO_4 phosphoric acid

H_2CO_3 carbonic acid

H_2SO_4 sulfuric acid

HCl hydrochloric acid

Rules for Naming Binary Ionic Compounds

1. Balance Charges (charges should equal zero)
2. Cation is always written first (in name and in formula)
3. Change the ending of the anion to -ide

Rules for Naming Tertiary Compounds

1. Balance Charges (charges should equal zero)
2. Cation is always written first (in name and in formula)
 - Remember transition metal ions need to have their charge specified, except for Zn (always +2), Ag (always +1) and Cd (always +2).
3. Name of the polyatomic ion.

Examples: Na_2SO_4 sodium sulfate

CuSO_3 copper (II) sulfite

Rules for naming molecular compounds (nonmetal-nonmetal)

1. Use prefixes: mono, di, tri, tetra, penta, hexa, hepta, octa, nona, and deca.
2. Drop the prefix 'mono' if it is at the beginning of the name.
3. There are some exceptions in which the 'mono' prefix is dropped: HCl – hydrogen chloride; HBr – hydrogen bromide
4. If there are two vowels in a row and the first vowel is an 'a' or an 'o' (do NOT drop any 'i's, drop the first vowel. P_2O_5 - diphosphorus pentoxide; but PI_3 is phosphorus triiodide.

TO BE TURNED IN September 11, 2018.

Name _____

I. Chemical Formula

1. Write formulas for the following substances:

- a. Barium sulfate _____
- b. Ammonium chloride _____
- c. Chlorine monoxide _____
- d. Silicon tetrachloride _____
- e. Magnesium fluoride _____
- f. Sodium oxide _____
- g. Sodium peroxide _____
- h. Copper (I) iodide _____
- 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. Cobalt (III) nitrate _____
- x. Nitrous acid _____
- y. Ammonium phosphate _____
- z. Potassium chromate _____

2. Name each of the following compounds (Give acid names where appropriate)

- 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. Cs_3N _____
- x. $\text{Zn}(\text{NO}_3)_2$ _____
- y. N_2O _____
- z. HF _____

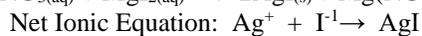
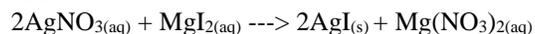
II. Chemical Equations

For each equation below, identify the type (synthesis, decomposition, single replacement, double replacement, or combustion), predict the products, and then write the balanced reaction and the net ionic equation. Remember to use the solubility rules for double replacement reactions and the activity series for single replacement reactions. Hint: when writing these reactions, ignore all of the information about heat, 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.



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. Magnesium and nitrogen gas are heated together.
5. Sodium bicarbonate solution is reacted with acetic acid solution.
6. Solutions of lead nitrate and calcium iodide are combined.
7. Sulfuric acid is combined with sodium hydroxide.
8. Isopropyl alcohol ($\text{C}_3\text{H}_7\text{OH}$) is burned in oxygen.
9. Iron metal shavings are added to hydrochloric acid.
10. Solid sodium carbonate is heated in a crucible.
11. Sodium metal is added to distilled water.

III. Stoichiometry

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

a. NO

b. NO₂

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% H by mass. Find the empirical and molecular formulas of benzene.

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

a. Write a balanced chemical equation for this reaction.

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

c. What volume of carbon dioxide gas is produced from this amount of calcium carbonate, at STP?

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

a. Write a balanced chemical equation for this reaction.

b. 3.2 g of hydrogen gas and 9.5 g of bromine gas react. Which is the limiting reagent?

c. How many grams of hydrogen bromide gas can be produced using the amounts in (b)?

d. How many grams of the excess reactant is left unreacted?

e. 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.

a. Write a balanced chemical equation for this reaction.

b. Calculate the mass of each product produced when 225 g of oxygen gas is reacted with an excess of the other two reactants.

c. If the actual yield of the experiment in (b) is 105 g of HCN, calculate the percent yield.

6) **When solutions of potassium iodide and lead (II) nitrate are combined, the products are potassium nitrate and lead (II) iodide.**

a. Write a balanced equation for this reaction, including (aq) and (s);

b. Write a net ionic equation for this.

c. Calculate the mass of precipitate produced when 50.0 mL of 0.45M potassium iodide solution and 75mL of 0.55M lead (II) nitrate solution are mixed. (Note that this is a limiting reagent problem).

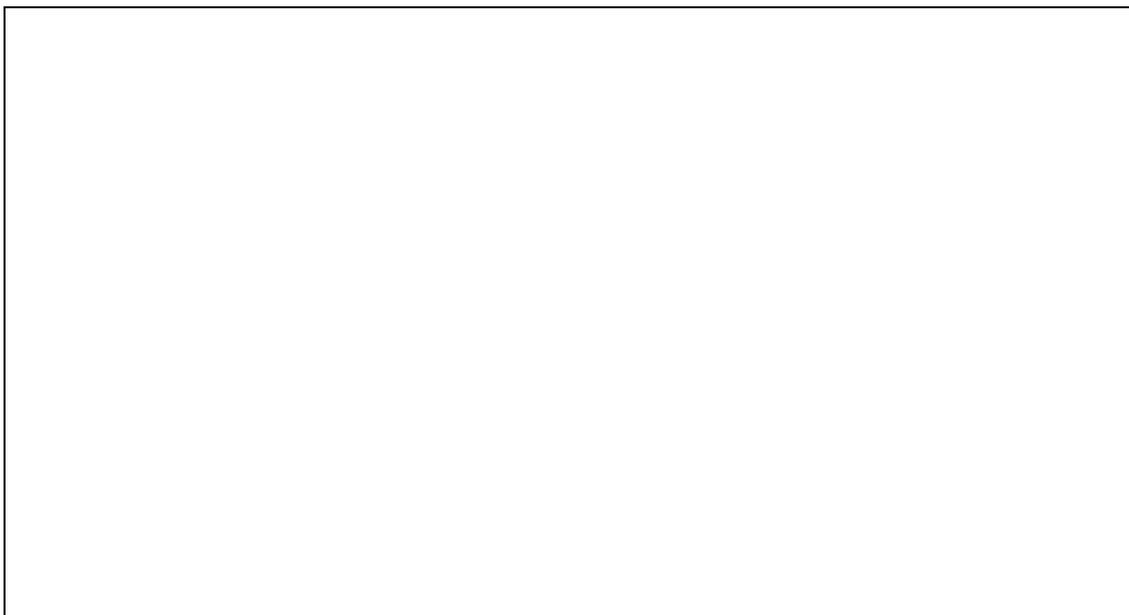
d. Calculate the volume of 0.50M potassium iodide required to react completely with 50.0 mL of 0.50M lead (II)nitrate.

7. When oxygen gas reacts with nitrogen monoxide, nitrogen dioxide is formed.

a. Write a balanced equation for this reaction.

b. Sketch a drawing showing the reaction between 8 molecules each of nitrogen monoxide and oxygen gas. Please be specific by drawing circles for each atom, and labeling each N or O. For example:

For nitrogen monoxide:



Make sure you follow the Law of Conservation of Matter, that is, same number of atoms on both sides of the equation.

c. Do you have a limiting reagent? What is your limiting reagent? Your excess reagent?

d. If 30.0 L each of nitrogen monoxide and oxygen gas at 0°C and 1.0 atm are reacted, how many grams of nitrogen dioxide are obtained?