AP Chemistry Information and Summer assignment

Overview of Course Expectations:

AP Chemistry is a college level course. Students can earn up to 8 hours college credit for successful completion of this course and a good score on the AP Exam. It is a time-consuming and challenging, yet extremely rewarding, course. This course moves at a very fast pace and classroom attendance is a MUST.

Students will be prepared to do college level work of any type upon completion of this course due to the thought processes used and the discipline/work habits required.

The course covers two semesters of college chemistry. We will complete many hours of lab work. *To have success on the AP exam, students will need to spend on* ***average*** *five to ten additional hours per week outside of class working on AP chemistry.* This time will be spent on homework assignments, pre-labs, lab reports, problem sets, etc. *There will be times that students will be able to complete things during class if they use their time efficiently.* **These statements are not meant to discourage, but to point out and state the truth to avoid any misconceptions about the high expectations for this course.** ***I will do my very best to provide a college level course/experience which not only prepares you for the AP exam, but provides a solid foundation in chemistry. I also intend for it to be fun!!***

You are fortunate to be able to take this type of college level course in the high school setting as part of a small class.

Attached to this letter, you will find a list of things that you will need to review, memorize, and/or practice prior to school starting. **The majority of the material required in this assignment is review material that students should have learned in their first year chemistry class. Some parts of the summer assignment are meant to stretch students' thinking and resourcefulness. (This means look it up if you don't know it off the top of your head as you have so many resources available to you!)** ***Students should not panic if they didn't learn it in their first year – it is easily mastered.***

Because this is a challenging problem-solving course, and for some of you, a year may have passed since you have had a chemistry course, it is imperative that you come to class the first day with some of the nomenclature, etc. second nature for you due to *the pace at which this course progresses*. Reviewing and committing to memory the topics in this ***summer assignment is not optional*** and completing the assignment in a thorough and focused manner will contribute to a student's success in this course and on the AP Chemistry exam.

I look forward to getting to know each of you! **We will have fun and we will work hard**. Students will receive a detailed course syllabus when school resumes in the fall. Please feel free to send me an e-mail over the summer if you have any questions or comments. I check e-mail frequently during the summer months. **(ylavin@rich227.org (North) (dmorrissette@rich227.org (South))**

AP Chemistry Required Materials and Summer Assignment

I. Required Materials for the AP Chemistry Course

You will be provided with these materials for the course from the book room:

Textbook and AP test study guide

Along with the internet resource for the textbook, students should also add the following sites to their internet favorites:

http://www.khanacademy.org/#Chemistry

http://www.brightstorm.com/science/chemistry

Other supplies for this course:

A sturdy three ring binder

Pencils, pens, highlighters, etc.

Scientific calculator

A stitched composition lab notebook

A great attitude and sense of humor. You will need it at times! Plan on forming study groups!

A valid **student e-mail address** that is checked frequently. As I communicate frequently with students through email, **this is NOT OPTIONAL**.

Please remember the following: To graduate from college, a student needs:

1) To understand learning is a continuous and uneven process
2) To understand that vocabulary and basic knowledge of the subject is the essential starting point.
3) To overcome the lack of immediate success (temporary failure).
4) To study and apply varying techniques:
    - comparing and contrasting
    - analysis and interpretation
    - induction and deduction
    - questioning skills
    - problem solving skills
    - rote memorization

Part II. Summer Assignment

The summer assignment consists of two parts –

Part A is the material you must have memorized by the first day of school.

Part B is practice with nomenclature, balancing equations, oxidation numbers, solubility rules, and practicing problem solving.

Summer Assignment - Part A– Material to be memorized by the 1st Day of School.
NOTE: There will be quizzes during the first two weeks of school covering the topics in this assignment!!
Memorization of material is not something that will be encouraged or emphasized in this course because this is a ***problem-solving course*** and it is impossible to memorize everything you will be asked to do. **However, memorization of some topics/rules is necessary.**

Master the memorization material listed in this assignment! **DO whatever it takes to commit this information to memory for instant recall.** Make flashcards, bingo games, etc. Have your friends and family quiz you, form study groups, etc. **Again, this information needs to be second nature to you to ensure your success in this course.**

I will be checking these assignments **the first day of class** to verify you have completed them so that you get off to a good start in this class.

Topic/ Subject matter	Where do I find it?
Specified element names and symbols Element symbols 1 to 38 and Ag, Cd, I , Xe, Cs, Ba, W, Hg, Pb, Sn, Rn, Fr, U, Th, Pu, and Am written correctly. You should be able to locate these elements quickly because the periodic table provided on the exam does not include element names.	Periodic table
Monatomic ions (and ones with multiple oxidation states	listed in this packet
Polyatomic ions and corresponding acids (If you master a system for naming acids, you do not have to memorize them- only the ions!)	listed in this packet
6 Strong acids	**CBSPIN** hydro**C**hloric acid (HCl) hydro**B**romic acid (HBr) **S**ulfuric acid (H_2SO_4) **P**erchloric acid ($HClO_4$) hydro**I**odic acid (HI) **N**itric acid (HNO_3)
Strong bases	Group 1 metal hydroxides (NaOH, KOH etc) Group 2 metal hydroxides ($Ba(OH)_2$, $Sr(OH)_2$ $Ca(OH)_2$, these are only slightly soluble- others are insoluble
Solubility rules	listed in this packet
Colors of common ions	listed in this packet

Common Ions

Ions Usually with One Oxidation State			
Li^{+}	lithium ion	N^{3-}	nitride
Na^{+}	sodium ion	O^{2-}	oxide
K^{+}	potassium ion	S^{2-}	sulfide
Mg^{2+}	magnesium ion	F^{-}	fluoride
Ca^{2+}	calcium ion	Cl^{-}	chloride
Sr^{2+}	strontium ion	Br^{-}	bromide
Ba^{2+}	barium ion	I^{-}	iodide
Ag^{+}	silver ion		
Zn^{2+}	zinc ion		
Cd^{2+}	cadmium ion		
Al^{3+}	aluminum ion		

Cations with more than One Oxidation State			
+1		+2	
Cu^{1+}	copper (I) or cuprous ion	Cu^{2+}	copper (II) or cupric ion
Hg_2^{2+}	mercury (I) or mercurous ion	Hg^{2+}	mercury (II) or mercuric ion
+2		+3	
Fe^{2+}	iron (II) or ferrous ion	Fe^{3+}	iron (III) or ferric ion
Cr^{2+}	chromium (II) or chromous ion	Cr^{3+}	chromium (III) or chromic ion
Mn^{2+}	manganese (II) or manganous ion	Mn^{3+}	manganese (III) or manganic ion
Co^{2+}	cobalt (II) or cobaltous ion	Co^{3+}	cobalt (III) or cobaltic ion
+2		+4	
Sn^{2+}	tin (II) or stannous ion	Sn^{4+}	tin (IV) or stannic ion
Pb^{2+}	lead (II) or plumbous ion	Pb^{4+}	lead (IV) or plumbic ion

Polyatomic Ions and Acids

Formula	Name	Ion	Ion Name
H_2SO_4	sulfuric acid	SO_4^{2-}	sulfate ion
H_2SO_3	sulfurous acid	SO_3^{2-}	sulfite ion
HNO_3	nitric acid	NO_3^{1-}	nitrate ion
HNO_2	nitrous acid	NO_2^{1-}	nitrite ion
H_3PO_4	phosphoric acid	PO_4^{3-}	phosphate ion
H_2CO_3	carbonic acid	CO_3^{2-}	carbonate ion
$HMnO_4$	permanganic acid	MnO_4^{1-}	permanganate ion
HCN	hydrocyanic acid	CN^{1-}	cyanide ion
$HOCN$	cyanic acid	OCN^{1-}	cyanate ion
$HSCN$	thiocyanic acid	SCN^{1-}	thiocyanate ion
$HC_2H_3O_2$	acetic acid	$C_2H_3O_2^{1-}$	acetate ion
$H_2C_2O_4$	oxalic acid	$C_2O_4^{2-}$	oxalate ion
H_2CrO_4	chromic acid	CrO_4^{2-}	chromate ion
$H_2Cr_2O_7$	dichromic acid	$Cr_2O_7^{2-}$	dichromate ion
$H_2S_2O_3$	thiosulfuric acid	$S_2O_3^{2-}$	thiosulfate ion
H_3AsO_4	arsenic acid	AsO_4^{3-}	arsenate ion
H_3AsO_3	arsenous acid	AsO_3^{3-}	arsenite ion

Oxyhalogen Acids

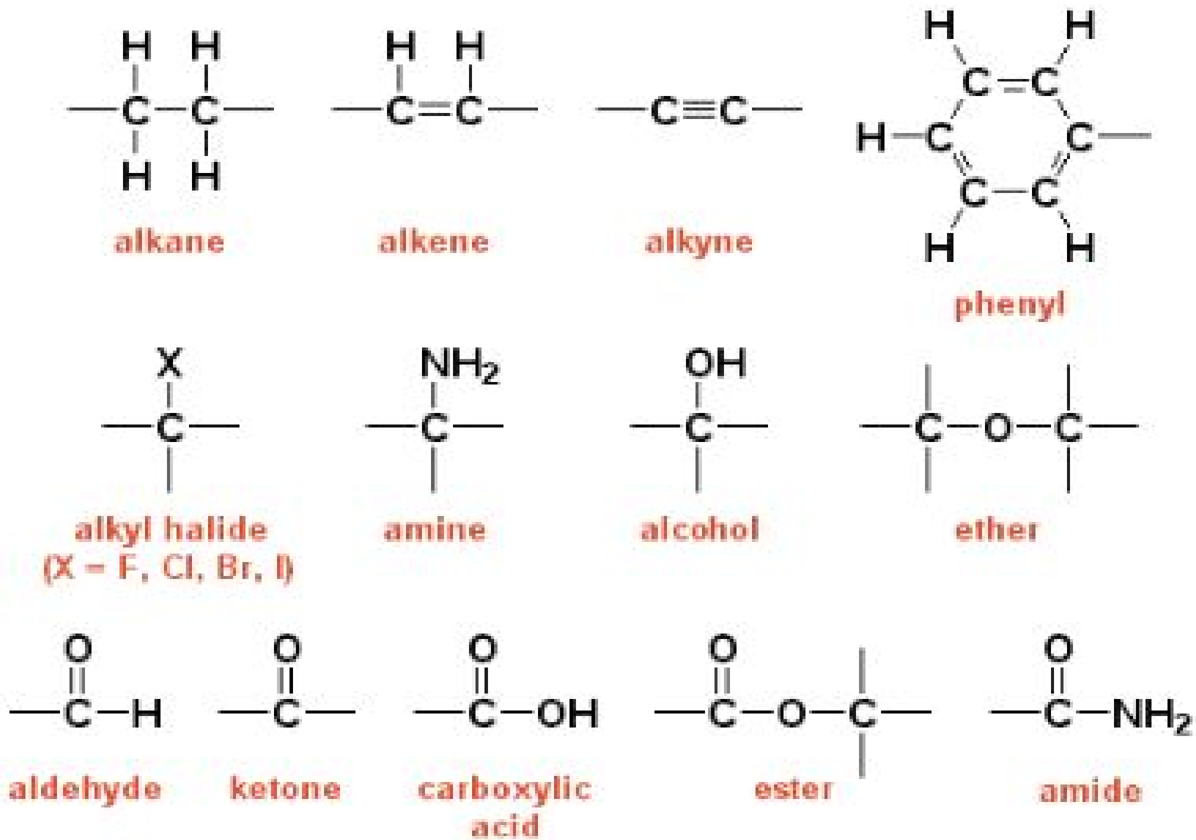
Formula	Oxy name	Ion	Ion name
$HClO$	hypochlorous acid	ClO^{1-}	hypochlorite ion
$HClO_2$	chlorous acid	ClO_2^{1-}	chlorite ion
$HClO_3$	chloric acid	ClO_3^{1-}	chlorate ion
$HClO_4$	perchloric acid	ClO_4^{1-}	perchlorate ion

Br, I, can be substituted for Cl. F may form hypofluorous acid and the hypofluorite ion.

Other Ions	
Ion	**Ion Name**
O_2^{2-}	peroxide ion
OH^{1-}	hydroxide ion
HSO_4^{1-}	bisulfate ion; hydrogen sulfate ion
NH_4^{+}	ammonium ion
O_2^{1-}	superoxide ion
HCO_3^{1-}	bicarbonate ion; hydrogen carbonate ion
HPO_4^{2-}	hydrogen phosphate ion
$H_2PO_4^{1-}$	dihydrogen phosphate ion

Colors of Common Ions in Aqueous Solution	
Most common ions are colorless in solution, however, some have distinctive colors. These colors have appeared in questions on the AP exam.	
Fe^{2+} and Fe^{3+}	various colors
Cu^{2+}	blue to green
Cr^{2+}	blue
Cr^{3+}	green or violet
Mn^{2+}	faint pink
Ni^{2+}	green
Co^{2+}	pink
MnO_4^{1-}	dark purple
CrO_4^{2-}	yellow
$Cr_2O_7^{2-}$	orange

Organic Functional Groups



Be able to recognize, draw, and name these!

Solubility Rules:
Learn the following solubility rules:
Salts containing the following ions are normally ***soluble:***
• All salts of Group IA (Li^+, Na^+, etc.) and the ammonium ion (NH_4^+) are *soluble*.
• All salts containing nitrate (NO_3^{1-}), acetate (CH_3COO^{1-}) and perchlorates (ClO_4^{1-}) are *soluble*.
• All chlorides (Cl^{1-}), bromides (Br^{1-}), and iodides (I^{1-}) are *soluble* except those of Cu^+, Ag^+, Pb^{2+}, and Hg_2^{2+}.
• All salts containing sulfate (SO_4^{2-}) are *soluble* except those of Pb^{2+}, Ca^{2+}, Sr^{2+}, and Ba^{2+}.
Salts containing the following ions are normally insoluble:
• Most carbonates (CO_3^{2-}) and phosphates (PO_4^{3-}) are *insoluble* except those of Group IA and the ammonium ion.
• Most sulfides (S^{2-}) are *insoluble* except those of Group IA and IIA and the ammonium ion.
• Most hydroxides (OH^{1-}) are *insoluble* except those of Group IA, calcium, and barium.
• Most oxides (O^{2-}) are insoluble except for those of Group IA, and Group IIA which react with water to form the corresponding hydroxides.
SI Base Units & Prefixes
Be sure to refamiliarize yourself with the SI prefixes for measurement pico (10^{-12}) through Tera (10^{12}).
SI Unit for Length = meter; for Mass = kg; for volume = m^3 (1 liter)

<u>Summer Assignment Part B</u>:   Practice with Nomenclature, Balancing Equations, Oxidation Numbers, Solubility Rules and Problem Solving

<u>Nomenclature:</u> Simple Inorganic Formulas and Nomenclature – Complete Exercise 1 in the Appendix of this packet. **Review the naming rules and commit the naming prefixes to memory!**

<u>Oxidation Numbers</u>: Oxidation Numbers: Anions and Cations – Complete Exercise 2 in the Appendix of this packet. **Review/Memorize the Rules for Oxidation Numbers**

<u>More Nomenclature</u>: Ternary Nomenclature: Acids and Salts - Complete Exercise 3 in the Appendix of this packet.

<u>Balancing Equations</u> – Balancing Molecular Equations - Complete Exercise 4 in the Appendix of this packet.

<u>Reaction Types and Reaction Prediction</u> - Predict the products, write the equation and then balance, etc. – Complete Exercise 5 in the Appendix of this packet.

<u>Solubility Rules</u> – Using Solubility Rules Table – you must memorize these! –Complete Exercise 6 in the Appendix of this packet using the solubility rules listed in Part A of the summer assignment. **Compare these rules to the ones in the reference packet for Honors Chemistry!!**

<u>Review Problem Set</u> – Complete the problems on attached Review Problem Set – show your work and clearly mark your final answers!! Use correct significant figures for math answers and units where needed!

Polyatomic Ions Ending in "ate"

BO_3^{-3}	CO_3^{-2}	NO_3^{-1}	O	F
	SiO_4^{-4}	PO_4^{-3}	SO_4^{-2}	ClO_3^{-1}
		AsO_4^{-3}	SeO_4^{-2}	BrO_3^{-1}
			TeO_4^{-2}	IO_3^{-1}

Notes and Observations

- The individual locations of the elements in the table correspond to their relative locations on the periodic table.
- The "legs" – green shaded areas all end in "O_3".
- The "interior" – blue shaded areas all end in "O_4".
- The charges of the ions become more positive as you go across a "period".
- For ions with the same root containing oxygen, the suffixes and prefixes are : *(Using chlorate as an example)*
  - Ions starting with *"per"* will have one more oxygen. **Ex.** ClO_4^{-1} = *per*chlorate
  - Ions ending in *"ite"* will have one less oxygen. Ex. ClO_2^{-1} = chlor*ite*
  - Ions starting with *"hypo"* and ending in *"ite"* will have two less oxygens. Ex. ClO^{-1} = *hypochlorite*

Naming binary molecular compounds

A. With molecules, the prefix system is used.

Number	**Prefix**	**Number**	**Prefix**
1	mono-	7	hepta-
2	di-	8	octa-
3	tri-	9	nona-
4	tetra-	10	deca-
5	penta-	11	undeca-
6	hexa-	12	dodeca-

A. The less-electronegative element is always written first. It only gets a prefix if it has more than one atom in the molecule.
B. The second element gets the prefix and the ending *–ide.*
C. The *o or a* at the end of the prefix is dropped when the word following the prefix begins with another vowel, for example monoxide or pentoxide.

Appendix

Exercises for Part B of the Summer Assignment

Nomenclature Review

Forming binary ionic compounds

A. In a binary ionic compound the total positive charges must equal the total negative charges. The best way to write correct formula units for ionic compounds is to use the "Criss Cross Method".

B. Sample problem: What ionic compound would form when calcium ions combine with bromide ions?

Steps to the Criss Cross Method:

1. Write the ions with their charges, cations are always first. Ca^{2+} Br^{1-}
2. Cross over the charges by using the absolute value of each ion's charge as the subscript for the other ion. Ca1 Br2
3. Check to make sure the subscripts are in the lowest whole number ratio possible. Then write the formula. $CaBr_2$

Naming binary ionic compounds

A. Combine the names of the cation and the anion.

B. Example: $BaBr_2$ is named barium bromide.

C. First write the ions formed for the following elements. Then use the Criss Cross method to determine the formula. Then name the compounds.

Naming binary ionic compounds that contain polyatomic ions

A. The polyatomic ions on your common ions list should be memorized.

B. The most common oxyanions – polyatomic anions that contain oxygen, end in *–ate.*
Oxyanions with one less oxygen end in *–ite*. For example:

NO_3^{-1} is nitrate SO_4^{2-} is sulfate
NO_2^{-1} is nitrite SO_3^{2-} is sulfite

C. Anions with one less oxygen than the *–ite* ion are given the prefix *hypo-*.

D. Anions with one more oxygen than the *–ate* ion are given the prefix *per-*.

ClO^{-1} is hypochlorite ClO_3^{-1} is chlorate
ClO_2^{-1} is chlorite ClO_4^{-1} is perchlorate

E. Naming compounds with polyatomics is the same as naming other compounds, just name the cation and then the anion. If there is a transition metal involved, be sure to check the charges to identify which ion (+1, +2, +3, +4….) it may be so that you can put the correct Roman numeral in the name. Name the following.

Exercise 1 - Nomenclature: Simple Inorganic Formulas and Nomenclature

I. In the first column, classify each of the following as molecular (M) or ionic (I). In the second column, name each compound:

	M or I	Name		M or I	Name
1) CaF_2			10) SrI_2		
2) P_4O_{10}			11) CO		
3) K_2S			12) Cs_2Po		
4) NaH			13) $ZnAt_2$		
5) Al_2Se_3			14) P_2S_3		
6) N_2O			15) AgCl		
7) O_2F			16) Na_3N		
8) SBr_6			17) Mg_3P_2		
9) Li_2Te			18) XeF_6		

II. In the first column, write the chemical formula (formula unit) for the compound formed between the two given elements. In the second column, write the name for the compound:

	Elements	Formula Unit	Name
1	magnesium and iodine		
2	potassium and sulfur		
3	chlorine and aluminum		
4	zinc and bromine		
5	strontium and oxygen		
6	calcium and nitrogen		
7	calcium and oxygen		
8	copper(I) and oxygen		
9	copper(II) and chlorine		
10	mercury(II) and oxygen		
11	nitrogen and aluminum		
12	sulfur and cesium		

Exercise 2 - Nomenclature: Oxidation Numbers: Anions and Cations

Summary of Rules for Oxidation Numbers:

- Rule 1: Atoms in a pure element have an oxidation number of zero.
- Rule 2: The more electronegative element in a binary compound is assigned the number equal to the negative charge it would have as an anion. The less-electronegative atom is assigned the number equal to the positive charge it would have as a cation.
- Rule 3: Fluorine has an oxidation number of -1 in all of its compounds because it is the most electronegative element.
- Rule 4: Oxygen has an oxidation number of -2 in almost all compounds.

  Exceptions:

  Peroxides, such as H_2O_2, in which its oxidation # is -1

  When oxygen is in compounds with halogens, such as OF_2, its oxidation # is +2.
- Rule 5: Hydrogen has an oxidation # of +1 in all compounds that are more electronegative than it; it has an oxidation # of -1 in compounds with metals.
- Rule 6: The algebraic sum of the oxidation numbers of all atoms in a neutral compound is zero.
- Rule 7: The algebraic sum of the oxidation numbers of all atoms in a polyatomic ion is equal to the charge of the ion.
- Rule 8: Rules 1-7 apply to covalently bonded atoms; however, oxidation numbers can also be assigned to atoms in ionic compounds.

Determine the Oxidation Number of each underlined element in the table below:

1) $K_2\underline{S}$	6) $\underline{S}_8$	11) $\underline{C}_{60}$
2) $Na\underline{Cl}O_4$	7) $\underline{Mg}$	12) $\underline{Zr}O_2$
3) $\underline{Br}Cl$	8) $K_2\underline{W}_4O_{13}$	13) $K_2\underline{Cr}_2O_7$
4) $Li_2\underline{C}O_3$	9) $Mg(\underline{B}F_4)_2$	14) $Al_2(\underline{Cr}O_4)_3$
5) $\underline{O}F_2$	10) $\underline{Au}_2O_3$	15) $Cs_2\underline{Te}F_8$

Exercise 3 – **More Nomenclature** – Including Some Ternary Nomenclature: Acids and Salts

(See pages 6 & 7 above for guidance on acid naming and some polyatomic ions we didn't use in Honors Chemistry.)

I. Name the following substances:

Formula	Name	Formula	Name
1) $FeSO_3$		16) Fe_2O_3	
2) $Cu(NO_3)_2$		17) $(NH_4)_2SO_3$	
3) Hg_2Cl_2		18) $Ca(MnO_4)_2$	
4) AgBr		19) PF_5	
5) $KClO_3$		20) LiH	
6) $MgCO_3$		21) HIO_3	
7) BaO_2		22) $NaBrO_3$	
8) KO_2		23) $Ca_3(PO_4)_2$	
9) SnO_2		24) HIO_4	
10) $Ni_3(PO_4)_2$		25) $Fe(IO_3)_3$	
11) $Pb(OH)_2$		26) HAt*(aq)*	
12) $CuCH_3COO$		27) C_6H_5COOH	
13) N_2O_4		28) $Hg_2(IO)_2$	
14) Rb_3P		29) H_3PO_3	
15) S_8		30) NH_4BrO_3	

II. Write formulas for the following substances:

Name	Formula	Name	Formula
1) vanadium (V) oxide		16) francium dichromate	
2) dihydrogen monoxide		17) calcium carbide	
3) ammonium oxalate		18) mercury (I) nitrate	
4) polonium (VI) thiocyanate		19) cerium (IV) benzoate	
5) tetraphosphorus decoxide		20) potassium hydrogen phthlate	
6) zinc hydroxide		21) carbonic acid	
7) potassium cyanide		22) calcium hypochlorite	
8) cesium thiosulfate		23) hydrotelluric acid	
9) oxygen molecule		24) copper (II) nitrite	
10) mercury (II) acetate		25) nitrous acid	
11) silver chromate		26) hypoiodous acid	
12) tin (II) carbonate		27) cyanic acid	
13) sodium hydrogen carbonate		28) phthalic acid	
14) manganese (VII) oxide		29) tin(IV) chromate	
15) copper(II) dihydrogen phosphate		30) hydrocyanic acid	

III. Practice with acids! Remember:

-IC from –ATE	*-OUS from –ITE*	*HYDRO-, -IC from -IDE*

Complete the Following Table:

Name of Acid	Formula of Acid	Name of Anion
*hydro*chlor*ic*	HCl	chlor*ide*
sulfur*ic* acid	H_2SO_4	sulf*ate*
	HI	
		sulf*ite*
chlor*ous* acid		
		nitr*ate*
	$HC_2H_3O_2$ or CH_3COOH	
*hydro*brom*ic* acid		
		sulf*ide*
	HNO_2	
chrom*ic* acid		
		phosph*ate*

Exercise 4 – <u>Balancing Equations</u>

I. Balance the following equations by adding coefficients as needed. Some equations may already be balanced.

1) __ C_6H_6 + __ O_2 → __ H_2O + __ CO_2

2) __ NaI + __ $Pb(SO_4)_2$ → __ PbI_4 + __ Na_2SO_4

3) __ NH_3 + __ O_2 → __ NO + __ H_2O

4) __ HNO_3 + __ $Mg(OH)_2$ → __ H_2O + __ $Mg(NO_3)_2$

5) __ H_3PO_4 + __ $NaBr$ → __ HBr + __ Na_3PO_4

6) __ CaO + __ MnI_4 → __ MnO_2 + __ CaI_2

7) __ C_2H_2 + __ H_2 → __ C_2H_6

8) __ VF_5 + __ HI → __ V_2I_{10} + __ HF

9) __ OsO_4 + __ $PtCl_4$ → __ PtO_2 + __ $OsCl_3$

10) __ Hg_2I_2 + __ O_2 → __ Hg_2O + __ I_2

Exercise 5 – <u>Reaction Prediction Practice – Honors Chemistry Review</u>

I. Predict the products, write the equation <u>and</u> then balance.

<u>COMBUSTION</u>

1. C_4H_9OH + oxygen →

2. C_7H_{14} + oxygen →

<u>SYNTHESIS</u>

1. sodium + oxygen →

2. calcium + nitrogen →

3. potassium + bromine →

DECOMPOSITION

1. Strontium carbonate →

2. Mercury (II) oxide →

3. aluminum chlorate →

DOUBLE REPLACEMENT

1. Iron (III) sulfate + calcium hydroxide →

2. Sodium hydroxide + sulfuric acid →

3. sodium sulfide + manganese (VI) acetate →

4. chromium(III) bromide + sodium sulfite →

5. barium hydroxide + chlorous acid →

SINGLE REPLACEMENT

Use the activity series in your book (or online) to complete and balance these equations. If no reaction occurs, write NR.

1. Nickel + steam →

2. Chlorine + aluminum iodide →

3. Potassium + water →

4. lead + copper (II) chloride →

5. Zinc + hydrochloric acid →

Reaction Prediction Practice – Net Ionic Equations

For each of the following reactions, use your solubility rules and the examples in this booklet and your notes to write the:

- ***Molecular equation***
- ***Complete ionic equation***
- ***Net ionic equation***

DOUBLE REPLACEMENT (all are aqueous solutions)

1. Iron (III) sulfate + calcium hydroxide →

2. Sodium hydroxide + sulfuric acid →

3. Calcium nitrate + lithium phosphate →

SINGLE REPLACEMENT

1. Chlorine gas + aluminum iodide (aqueous) →

2. Potassium metal + water →

3. Zinc metal + hydrochloric acid (aqueous) →

Exercise 6 – <u>Solubility Rules: Using Solubility Rules Table on page 8 of this handout – you must Memorize these!</u>

For the compounds in the table, write the formula for each compound in the first column and then use the solubility rules to determine if each compound is soluble or insoluble in water. In the second column write an *(S)* for those that are soluble and an *(I)* for those that are insoluble in water.

Name	Formula	*(S) or (I)*
silver nitrate		
cobalt (II) sulfate		
zinc hydroxide		
iron (III) iodide		
nickel (II) chloride		
lead (II) iodide		
sodium carbonate		
barium sulfate		
lead (II) sulfide		
silver phosphate		
lithium phosphate		
nickel (II) carbonate		
copper (II) hydroxide		
tin (IV) sulfate		
lead (II) nitrate		

Review Problem Set: Complete the problems below – show your work and clearly mark your final answers!! Report your answers with correct significant figures and don't forget units!!

Calculations, Sig Figs, and Conversions

1. Perform the following calculations with correct significant figures:

   A. $\dfrac{4.6584 \times 48.34}{4.18}$

   B. (5.02 – 4.68 + 38.760 + 14.0) / 3.1416

Density:

2. Calculate the mass of a sample of copper that occupies 5.3×10^{-2} cm^3 if the density of copper is 8.94 g/cm^3.
3. An 9.46 g sample of a solid is placed in a 25.00 ml flask. The remaining volume in the flask is filled with benzene in which the solid is insoluble. The solid and the benzene together weigh 26.83 g. The density of the benzene is 0.879 g/ml. What is the density of the solid?

Electromagnetic Spectrum

4. What is the wavelength of light with a frequency of 3.2×10^{14} Hz.
5. How much energy (in KJ) is associated with a radio wave of wavelength 1.2×10^{2} m?

Atomic Theory, Electron Configuration & Periodicity

6. Copy and fill in the following table:

Element/ion	# of protons	# of neutrons	# of electrons
Fe			
Na^+			
	27		25
S^{2-}			
Cr^{3+}			

7. Write the electron configurations for Ca^{2+} and Br^{-1}
8. For Se write:
   A. the complete electron configuration
   B. the noble gas electron configuration
   C. the orbital diagram from the noble gas electron configuration
   D. the dot diagram
9. For the following elements, draw the Lewis dot structures.
   A. Pb B. N C. F D. Ca E. He
10. **Given these elements:** S, Se, I, Ca and Be
    Place these elements in order of:
    A. increasing atomic radius
    B. decreasing ionization energy

Average Atomic Mass

11. Find the mass of an element, if, out of a sample of 100:
    5 % have a mass of 176,
    19 % have a mass of 177,
    27 % have a mass of 178,
    14 % have a mass of 179 and
    35 % have a mass of 180?
    Identify this element by symbol and name?

Mole Calculations

12. Convert 3.48 x 10^{20} molecules of SO_2 to moles. What is the mass of this quantity?
13. Calculate the following for quantities for 4.68g of $Ca_3(PO_4)_2$:
    a. formula units
    b. Ca^{2+} ions
    c. PO_4^{3-} ions
    d. O atoms

Empirical & Molecular Formula

14. The koala bear dines exclusively on eucalyptus leaves. The chief constituent in eucalyptus oil is a substance called eucalyptol, which contains 77.87 % C, 11.76 % H and the remainder O. If the molecular weight of eucalyptol is 154 amu, what is the empirical and molecular formula of this compound?

Molarity, Molality & Colligative Properties (Freezing Point Depression & Boiling Point Elevation)

15. How many grams of solute are present in 100. ml of 1.50 M $MgSO_4$?
16. What is the molarity of 35 g of iron(II) acetate dissolved in enough water to make 250 ml of solution?

Bonding & Lewis Dot Structures

17. Draw the Lewis structures for the following and identify its VSEPR Shape (molecular geometry) and polarity (polar or nonpolar):
    A. CH_4, methane B. H_2O C. SO_2 D. Ozone, O_3 B. phosphate ion

Stoichiometry (mass, solution, and gas)

18. Suppose a solution containing 4.50g of sodium phosphate is mixed with a solution containing 3.75g of barium nitrate. How many grams of barium phosphate can be produced?
19. Over the years, the thermite reaction (mixing of solid iron (III) oxide with aluminum metal) has been used for welding railroad rails, in incendiary bombs, and to ignite solid-fuel rocket motors.
    A. Write a balanced equation representing the reaction.
    B. What masses of iron (III) oxide and aluminum must be used to produce 15.0 g of iron?
    C. What is the maximum mass of aluminum oxide that could be produced?
20. Given: 50 ml of 2.0 M nitric acid reacts with 15 g of aluminum hydroxide
    A. Write a balanced equation for the reaction.
    B. Write the net ionic equation.
    C. Which of the reactants would be the limiting reagent?
    D. How many grams of water would be produced?

KMT, States of Matter, & Gas Laws

21. A sample of diborane gas (B_2H_6), a substance that bursts into flame when exposed to air, has a pressure of 345 torr at a temperature of –15°C and a volume of 3.48 L. If conditions are changed so that the temperature is 36°C and the pressure is 268 torr, what will be the volume of the sample?
22. The density of a gas was measured at 1.30 atm and 47°C and found to be 1.95 g/L. Calculate the molar mass of the gas.

Acids, Bases, pH, and Titrations

23. What is the $[H^+]$, $[OH^{1-}]$, pH, and pOH of a 0.005 M solution of calcium hydroxide?
24. What is the concentration (in M) of 50.0 ml of hydrochloric acid, if 75.0 ml of 0.52 M sodium hydroxide is required to titrate to equivalence point?

Thermochemistry

25. The specific heat capacity of graphite is 0.71 J/°C-g. Calculate the energy (in calories) required to raise the temperature of 1.8 kg of graphite by 100.0 °C.
26. Calculate the amount of energy released by the freezing of 13.3 g of water.
27. Calculate the amount of energy absorbed when 27.0 g of water is boiled.

Equilibrium & LeChatelier's Principle:

28. When Phosphorus pentachloride gas decomposes to form phosphorus trichloride gas and chlorine gas, 120 J of heat are released.
    A. Write a balanced equation for this reaction.

    Explain any shift that would occur for the following and **explain why:**
    B. more phosphorus pentachloride is added.
    C. The temperature is decreased
    D. The pressure is increased
    E. Chlorine gas is removed

Steps for BALANCING REDOX REACTIONS

Remember redox reactions ***always*** involve a transfer of electrons (e- lost must = e- gained).

STEPS:

1. Write the unbalanced equation. (Be sure all charges & subscripts are copied correctly.)
2. Divide into half reactions.
3. Balance all atoms in each half reaction, **EXCEPT** H and O.
4. Balance O by adding H_2O.
5. Balance H by adding H^+ - Check to see if the equation is now balanced.
6. Balance the charges of the half reactions by adding e- to the side with the greater positive charge.
7. Multiply the half reactions by coefficients so that the overall ***e- lost = e- gained***
8. Add the half reactions; cancel out (or reduce down) anything that appears on both sides.
9. Check to see if the equation is balanced.

*10. (***optional – only done if solution is basic***) If basic, add OH^- to both sides to cancel out the H^+ and make water.

Use the Steps above to Balance the following redox reactions:

29. $Cr_2O_7^{2-} + SO_3^{2-} \rightarrow Cr^{3+} + SO_4^{2-}$ (acidic)

30. $Cr(OH)_3 + ClO^{-1} \rightarrow CrO_4^{2-} + Cl_2$ (basic)