

AP Chemistry Summer Assignment Instructions

AP Chemistry AP Chemistry AP Chemistry AP Chemistry AP Chemistry AP Chemistry

Silently challenge everything. This does not mean in a contemptuous manner. Challenge your own understanding in your mind. Take on a healthy dose of skepticism without being a cynic. Find insight about your own thinking and improve upon it.

Complete Part I, Part II, and Part III. It will be due the first day of class.

Part I

1. Purchase the required text. (**Chemistry 10th Ed**, Zumdahl, Zumdahl, and DeCoste)
2. Complete the following:
 - A. Read and outline Ch 1
 - B. Ch 1 Problems (19, 25, 29, 32, 35, 37, 38, 41, 43, 59, 69, 83, 89, 127; describe the separation techniques of distillation, filtration, chromatography)
 - C. Read and outline Ch 2
 - D. Ch 2 Problems (1, 10, 11, 23, 25, 30, 33, 38, 39, 41, 61, 63, 71, 83, 89, 99)
 - E. Read and outline Ch 3.1-3.2
 - F. Ch 3a Problems (6, 39, 53, 55, 63)

Part II

Included in the packet are the following handouts: common ions, naming compounds flow chart, solubility rules, and naming and solubility worksheet

1. Memorize the names, formulas, and charges of common ions.
2. Memorize the naming compounds flow chart.
3. Memorize the solubility rules.
4. Complete the solubility and naming compounds worksheet.

Note: Take time to memorize this information. Do NOT procrastinate. (Procrastination is a five-syllable word for sloth.) Flashcards are useful. Knowing this information will make the rest of the year easier. The AP Test is written with the expectation that this information has been memorized. **You will be quizzed on the ions, naming compounds, and solubility rules the second day of class.**

Part III

Read 3.10 and 3.11. Complete the Limiting Reactants Worksheet.

Solubility and Naming Compounds Worksheet

AP Chemistry AP Chemistry AP Chemistry AP Chemistry AP Chemistry AP Chemistry

Name the following compounds from their formula:

Formula	Name	Formula	Name
1. NH_4I		9. MnO_2	
2. $\text{Fe}_2(\text{SO}_3)_3$		10. H_2O_2	
3. H_3PO_4 (aq)		11. KCl	
4. AgClO_3		12. $\text{Co}(\text{C}_2\text{H}_3\text{O}_2)_2$	
5. SnC_2O_4		13. $\text{Co}_2(\text{Cr}_2\text{O}_7)_3$	
6. NaCN		14. Li_3P	
7. $\text{Zn}(\text{OH})_2$		15. Li_3PO_3	
8. Rb_2SiO_3		16. Li_3PO_4	

Write the chemical formula from the compounds name:

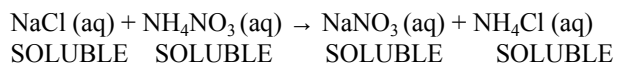
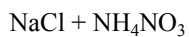
Name	Formula	Name	Formula
1. Lead (IV) Carbonate		9. Barium Phosphate	
2. Magnesium Fluoride		10. Bismuth (III) Hydride	
3. Cesium Arsenate		11. Aluminum Borate	
4. Boron (III) Silicate		12. Copper (I) Hypochlorite	
5. Francium Nitrite		13. Hypochlorous Acid	
6. Cobalt (II) Chloride		14. Chlorous Acid	
7. Mercury (I) Permanganate		15. Chloric Acid	
8. Mercury (II) Fluoride		16. Perchloric Acid	

Solubility

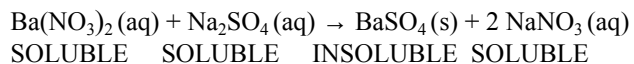
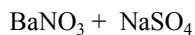
Determine if a precipitate will form through double displacement if both beakers are mixed. Write the proper balanced molecular equation with the states of matter.

(aq) = aqueous → soluble

(s) = solid → insoluble



no reaction



precipitate

Solutions	Balanced Molecular Equation	Precipitate / No reaction
1. NaCl + Ba(NO ₃) ₂		
2. (NH ₄) ₂ SO ₄ + Sr(ClO ₄) ₂		
3. NaCl + AgNO ₃		
4. K ₂ CO ₃ + CaSO ₄		
5. Rb ₂ S + Na ₂ O		
6. KNO ₃ + SrCl ₂		
7. Fe(NO ₃) ₂ + NH ₄ OH		
8. CaF ₂ + MgBr ₂		
9. (NH ₄) ₂ CO ₃ + NaOH		
10. Na ₂ SO ₄ + Pb(NO ₃) ₂		

Names, Formulas, and Charges of Common Ions

Positive Ions (Cations)

1+	2+	3+	4+
Silver Ag^+ Ammonium NH_4^+	Zinc Zn^{2+} Nickel(II) Ni^{2+}	Aluminum Al^{3+} Antimony(III) Sb^{3+} Arsenic(III) As^{3+} Bismuth(III) Bi^{3+} Boron(III) B^{3+}	
Copper (I) Cu^+	Copper(II) Cu^{2+} Cobalt(II) Co^{2+} Chromium(II) Cr^{2+} Iron(II) Fe^{2+}	Cobalt(III) Co^{3+} Chromium(III) Cr^{3+} Iron(III) Fe^{3+}	
Mercury(I) Hg_2^{2+}	Mercury(II) Hg^{2+} Lead(II) Pb^{2+} Manganese(II) Mn^{2+} Tin(II) Sn^{2+}		Lead(IV) Pb^{4+} Manganese(IV) Mn^{4+} Tin(IV) Sn^{4+}

Negative Ions (Anions)

1-	2-	3-
Acetate $\text{C}_2\text{H}_3\text{O}_2^-$ Hypochlorite ClO^- Chlorite ClO_2^- Chlorate ClO_3^- Perchlorate ClO_4^- Nitrite NO_2^- Nitrate NO_3^- Carbide C_2^{2-} Hydride H^- Cyanide CN^- Hydroxide OH^- Thiocyanate SCN^- Permanganate MnO_4^- <u>Dihydrogen phosphate H_2PO_4^-</u> <u>Hydrogen oxalate HC_2O_4^-</u> <u>Hydrogen carbonate HCO_3^-</u> <u>Hydrogen sulfide HS^-</u> <u>Hydrogen sulfite HSO_3^- (Bisulfite)</u> <u>Hydrogen sulfate HSO_4^- (Bisulfate)</u>	Silicate SiO_3^{2-} Peroxide O_2^{2-} Chromate CrO_4^{2-} Dichromate $\text{Cr}_2\text{O}_7^{2-}$ <u>Hydrogen phosphate HPO_4^{2-}</u> <u>Oxalate $\text{C}_2\text{O}_4^{2-}$</u> <u>Carbonate CO_3^{2-}</u> <u>Sulfide S^{2-}</u> <u>Sulfite SO_3^{2-}</u> <u>Sulfate SO_4^{2-}</u>	Arsenate AsO_4^{3-} Borate BO_3^{3-} Nitride N^{3-} Phosphide P^{3-} Phosphite PO_3^{3-} <u>Phosphate PO_4^{3-}</u>

[illegible]

NAMING CHEMICAL COMPOUNDS

1. What type of compound do you have?

A. ACIDS

(Starts with H and produces H^+ in water)

2A. Is it a binary acid (H and a nonmetal)?

YES

Name as:
hydro- + root of nonmetal + -ic acid

Example:
 $HCl(aq)$
hydrochloric acid

NO

2B. Oxyacid (containing H, a nonmetal, and O)?

YES

If the anion ends in:
-ate → -ic acid
-ite → -ous acid

Examples:
 HNO_3 nitric acid
 H_2SO_3 sulfurous acid

B. BINARY IONIC COMPOUNDS

(Metal + Nonmetal)
Check if the metal can have more than one oxidation number.

2C. Does the metal have more than one possible oxidation number?

YES

Name as:
metal (oxidation number in Roman numerals) + nonmetal root + -ide

Examples:
 $FeCl_2$ iron(II) chloride
 $FeCl_3$ iron(III) chloride
 Cu_2O copper(I) oxide
 CuO copper(II) oxide

NO

Name as:
metal name + nonmetal root + -ide

Examples:
 $NaCl$ sodium chloride
 MgO magnesium oxide

Determine the oxidation number of the metal using the charge of the nonmetal (monatomic ion).

C. COMPOUNDS WITH POLYATOMIC IONS

(Ionic compounds containing at least one polyatomic ion)

2D. Does the compound contain a polyatomic ion?

YES

Name as:
(1) cation name (use Roman numerals if needed) + (2) polyatomic ion name

Examples:
 $Ca(NO_3)_2$ calcium nitrate
 $Al_2(SO_4)_3$ aluminum sulfate
 $(NH_4)_2CO_3$ ammonium carbonate

NO

Go to Section B (Binary Ionic Compounds)

Common Polyatomic Ions

NO_3^- nitrate	SO_4^{2-} sulfate
NO_2^- nitrite	CO_3^{2-} carbonate
OH^- hydroxide	NH_4^+ ammonium
PO_4^{3-} phosphate	ClO_4^- perchlorate

D. COVALENT (COMPOUNDS)

(Nonmetal + Nonmetal)

2E. Two nonmetals combined?

YES

Name as:
prefix + nonmetal root + prefix + nonmetal root + -ide

Use prefixes:
mono-, di-, tri-, tetra-, penta-, hexa-, hepta-, octa-, nona-, deca-

Examples:
 CO carbon monoxide
 CO_2 carbon dioxide
 N_2O_5 dinitrogen pentoxide

NO

Recheck the formula. It may be ionic (see Sections B or C).

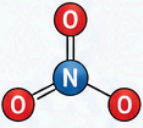
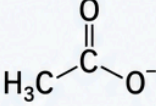
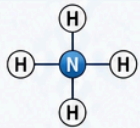
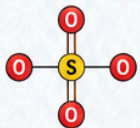
QUICK SUMMARY

- **Acids:** use hydro-...-ic acid (binary) or -ate → -ic acid / -ite → -ous acid (oxyacids)
- **Binary Ionic (metal + nonmetal):** use Roman numerals for metals with more than one oxidation number
- **Polyatomic Ions:** name the cation (with Roman numerals if needed) + polyatomic ion name
- **Covalent (nonmetal + nonmetal):** use prefixes and -ide on the second element

Always check charges and use the periodic table or a reference table of polyatomic ions as needed.

GENERAL SOLUBILITY RULES

Use these rules to predict whether ionic compounds are soluble (dissolve in water) or insoluble. (Exceptions are listed below the rules.)

RULE	IF THE COMPOUND CONTAINS...	THEN IT IS...	EXCEPTIONS
1 All common nitrates are soluble.	NO_3^- nitrate 	SOLUBLE (in water)	NONE
2 All common acetates are soluble.	$\text{C}_2\text{H}_3\text{O}_2^-$ acetate 	SOLUBLE (in water)	NONE
3 All common Group 1 metal salts are soluble.	Group 1 metals: $\text{Li}^+, \text{Na}^+, \text{K}^+, \text{Rb}^+, \text{Cs}^+$	SOLUBLE (in water)	NONE
4 All common ammonium salts are soluble.	NH_4^+ ammonium 	SOLUBLE (in water)	NONE
5 All common chlorides, bromides, and iodides are soluble.	$\text{Cl}^-, \text{Br}^-, \text{I}^-$ chloride, bromide, iodide	SOLUBLE (in water)	EXCEPT when combined with Ag^+ , Pb^{2+} , or Hg_2^{2+} (mercury(I)).
6 All common sulfates are soluble.	SO_4^{2-} sulfate 	SOLUBLE (in water)	EXCEPT when combined with Ba^{2+} , Sr^{2+} , Pb^{2+} , or Ca^{2+} (slightly soluble).
7 All common hydroxides are insoluble .	OH^- hydroxide 	INSOLUBLE (in water)	EXCEPT when combined with Group 1 metals or NH_4^+ (ammonium) (Ca^{2+} , Sr^{2+} , and Ba^{2+} are slightly soluble).
8 All common sulfides are insoluble .	S^{2-} sulfide 	INSOLUBLE (in water)	EXCEPT when combined with Group 1 metals or NH_4^+ (ammonium) or Ca^{2+} , Sr^{2+} , Ba^{2+} (slightly soluble).



Ionic compounds that are **soluble** are strong electrolytes in water.
Insoluble compounds are not strong electrolytes.

COMMON SOLUBLE COMPOUNDS

- ✓ All nitrates (NO_3^-)
- ✓ All acetates ($\text{C}_2\text{H}_3\text{O}_2^-$)
- ✓ All Group 1 metal salts (Li^+ , Na^+ , K^+ , Rb^+ , Cs^+)
- ✓ All ammonium salts (NH_4^+)
- ✓ Most chlorides, bromides, iodides (Cl^- , Br^- , I^-)
- ✓ Most sulfates (SO_4^{2-})

COMMON INSOLUBLE COMPOUNDS

- ✗ Most hydroxides (OH^-)
- ✗ Most sulfides (S^{2-})
- ✗ Carbonates (CO_3^{2-})
- ✗ Phosphates (PO_4^{3-})
- ✗ Chromates (CrO_4^{2-})
- ✗ Most oxides (O^{2-})

NOTE

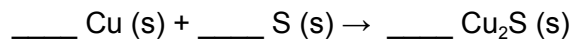
Solubility can vary with temperature.
"Slightly soluble" means small amounts will dissolve.

These rules apply to aqueous solutions at room temperature (~25 °C).
When in doubt, consult a solubility table for specific compounds.



The Limiting Reactant Worksheet

1. Given the following reaction, a student heated 5.52g of copper and 10.1 g of sulfur.

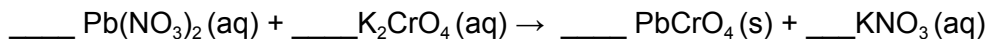


a. What is the limiting reactant? Show work.

b. What mass of the product Cu_2S is formed?

c. How much of the excess reactant will be left over?

2. Given the following unbalanced reaction, if a student mixed 1.350g of $\text{Pb}(\text{NO}_3)_2$ and 0.9875g of K_2CrO_4 , determine the following values:

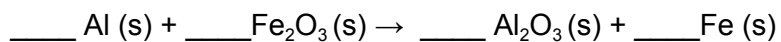


a. What is the limiting reactant?

b. What mass of PbCrO_4 is produced?

c. How much of the excess reactant will be left over?

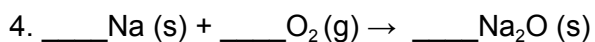
3. In the following unbalanced equation, the production of solid iron is made from iron (III) oxide and solid aluminum with the addition of tremendous heat:



a. Balance the reaction.

b. In a reaction where 2.75 grams of iron (III) oxide is reacted with 15.5 grams of aluminum, which is the limiting reactant?

c. Calculate the mass of iron formed.



a) What is the maximum number of grams of Na_2O that can be formed when 64.0 g of Na reacts with 28.54 g O_2 ?

b) What is the percent yield if 14.55 grams of sodium oxide is produced during an experiment?