Name: _____ Period: _____

Types of Reactions Practice

1. **Identify the type** of each of the reactions (single replacement, double replacement, synthesis, decomposition, combustion).

   a. $AgNO_3$ **+** $H_2S \rightarrow Ag_2S + HNO_3$ **Type:** _____

   b. $Mg + N_2 \rightarrow Mg_3N_2$ **Type:** _____

   c. $Cl_2 + KI \rightarrow KCl + I_2$ **Type:** _____

   d. $Al(OH)_3 \rightarrow Al_2O_3 + H_2O$ **Type:** _____

   e. $C_7H_{16} + O_2 \rightarrow CO_2 + H_2O$ **Type:** _____

Name: Key Period: _____

Types of Reactions Practice

1. **Identify the type** of each of the reactions (single replacement, double replacement, synthesis, decomposition, combustion).

   a. $AgNO_3 + H_2S \rightarrow Ag_2S + HNO_3$ **Type:** DR

   b. $Mg + N_2 \rightarrow Mg_3N_2$ **Type:** S

   c. $Cl_2 + KI \rightarrow KCl + I_2$ **Type:** SR

   d. $Al(OH)_3 \rightarrow Al_2O_3 + H_2O$ **Type:** D

   e. $C_7H_{16} + O_2 \rightarrow CO_2 + H_2O$ **Type:** C

Name:_____ Period: _____

Naming and Writing Compounds Refresher

Part A: The Basics

1. What does the subscript 2 indicate in Cl_2? _____
2. What is implied when there is no subscript? _____
3. Classify C, Fe and Cl as metals or non-metals.
   a. C = _____ Fe = _____ Cl: _____
4. Is the following statement true or false and **<u>why</u>**? "The formulas for elements never contain a subscript."

5. Classify each formula below as an element or a compound (write E for element and C for compound). Use Table 1 as a guide or to refresh your memory.

Table 1
Fe is the elemental form of iron.
C is the elemental form of carbon.
Cl_2 is the elemental form of chlorine.
$FeCl_3$ is a compound formed from the elements iron and chlorine

   a. Co _____ d. Br_2 _____ g. PF_5 _____
   b. $CaCl_2$ _____ e. NaBr _____ h. P_4 _____
   c. CsOH _____ f. SiO_2 _____ i. OF_2 _____

6. How can you tell if a chemical formula represents an element or a compound?

Part B: Types of Compounds

There are two major classes of compounds typically encountered as part of an introductory course: ionic and molecular compounds. It is helpful for you to be able to quickly classify a compound into one category or the other.

Table 2: Examples of Ionic and Molecular Compounds	
Ionic	**Molecular**
$ZnCl_2$	CCl_4
Na_2O	P_2O_5
Fe_2O_3	N_2O_4
CuI	NI_3

Use Table 2 to help you answer questions 1-4:

1. The compound $ZnCl_2$ is considered to be a (an) _____ compound.
2. The compound that contains nitrogen and oxygen is a (an) _____compound.
3. Does the classification seem to be made based on how many atoms of each element are represented in the formula?
4. Compare the types of elements (metal or non-metal) found in each example in Table 2 for the two classes of compounds. Do you see any trend in the type of elements present and the classification? Explain.

5. Classify each of the following as either ionic or molecular. Write (I) for ionic and (M) for molecular.
   a. NaBr _____ d. OF_2 _____ g. CsF_2 _____
   b. SF_6 _____ e. NO_2 _____ h. $CrCl_3$ _____
   c. $CoBr_2$ _____ f. BaS _____ i. CO_2 _____

6. Write a simple rule that will allow you to classify compounds as ionic or molecular.

Part C: What's in a name?
Use Table 3 to help you answer the following questions:

1. Are ALL cations positive ions or negative ions? _____
2. Are ALL anions positive ions or negative ions? _____
3. What is the name of the compound formed by the combination of Li^{+1} and S^{-2} ions? _____
4. When the name of an ionic compound is given, which ion is stated first (cation or anion)? _____

Table 3: Examples of Chemical Names and Formulas

Cation	Anion	Chemical Formula	Compound Name
Na^+	Cl^-	NaCl	sodium chloride
Ca^{+2}	O^{-2}	CaO	calcium oxide
Zn^{+2}	Cl^-	$ZnCl_2$	zinc chloride
Li^+	S^{-2}	Li_2S	lithium sulfide
K^+	N^{-3}	K_3N	potassium nitride

5. Compare the first part of the compound name to the name of the element from the periodic table. How does the name of the cation correspond to the name of the element?

6. Compare the second part of the compound name to the name of the element from the periodic table. How does the name of the anion correspond to the name of the element?

7. From what part of the periodic table do the cations in Table 3 come (metals or non-metals)? _____
8. From what part of the periodic table do the anions in Table 3 come? _____
9. For each of the following, predict whether the ion will likely be a cation or an anion (Just write + or – in the blank).
   a. magnesium ion _____ b. selenide ion _____ c. bromide ion _____ d. cesium ion _____
10. For each ionic compound, identify the cation and the anion (write + or – in each blank below the name).

a. sodium fluoride	b. strontium sulfide	c. lithium iodide	d. barium chloride
____ ____	____ ____	____ ____	____ ____

11. Write a general rule for how you change the name of elements to cations when naming ionic compounds.

12. Write a general rule for how you change the name of elements to anion when naming ionic compounds.

Part D: Predicting Formulas
Use the information in Table 4 to help you answer the following questions.

1. What is the charge on the zinc ion? _____
2. What is the charge on the nitride ion? _____

Table 4

Cation	Anion	Chemical Formula	Compound Name
Na^+	Cl^-	NaCl	sodium chloride
Zn^{+2}	Cl^-	$ZnCl_2$	zinc chloride
Na^+	S^{-2}	Na_2S	sodium sulfide
K^+	N^{-3}	K_3N	potassium nitride

3. What is the charge on the chloride ion? _____
4. What is the charge on the ionic compound, sodium chloride? _____
5. What is the charge on the ionic compound, sodium sulfide? _____
6. How many potassium ions are present in K_3N? _____
7. What does the "2" stand for in the formula for $ZnCl_2$? _____
8. Sodium chloride is NaCl, and zinc chloride is $ZnCl_2$. Why are there more chloride ions than zinc in this formula?

9. Sodium chloride is NaCl, and sodium sulfide is Na_2S. Why are there more sodium ions than sulfide ions in this formula?

10. How many chloride ions would combine with an Al^{+3} ion to form aluminum chloride? _____
11. What charge does the barium ion possess in the compound $BaCl_2$? _____
12. Explain how you determined the number of chloride ions needed in aluminum chloride.

13. From Table 4 and the answers above, what do you know about the overall charge on ALL ionic compounds?

Part E: When in Rome…

When a Group 1 metal forms a cation, it will always form a +1 cation. When a Group 2 metal forms a cation, it will always form a +2 charge. However, as we progress into the transition metals we find that these metals can form cations with different charges under different circumstances. Use Table 5 below to develop some rules that describe how to communicate the charge of the cation.

Table 5

Chemical Formula	Chemical Name
$FeBr_2$	iron (II) bromide
$FeBr_3$	iron (III) bromide
PbO	lead (II) oxide
PbO_2	lead (IV) oxide
Cu_3N	copper (I) nitride
Cu_3N_2	copper (II) nitride

1. What is the expected charge on the bromide ion? _____
2. What is the expected charge on the oxide ion? _____
3. What is the expected charge on the nitride ion? _____
4. Represent the Roman numeral II as a regular number. _____
5. Represent the Roman numeral III as a regular numeral. _____
6. Represent the Roman numeral IV as a regular numeral. _____
7. What two elements are present in the compounds in the last two rows of Table 5? _____
8. What is different about the *chemical formulas* of these last two compounds in Table 5?

9. What is different about the *compound names* of these last two compounds in Table 5?

10. Use the rules that you developed in Part D to determine the charge on the iron ion in these compounds:
    a. Charge on iron in $FeBr_2$ _____
    b. Charge on iron in $FeBr_3$ _____
11. How is the Roman numeral in the compound name related to the charge on the iron atoms?

12. Does this hold true for all of the compounds in Table 5? Explain.

13. What types of metals require the use of a Roman numeral in the name of their ionic compounds?

14. Where are these metals located on the periodic table?

15. Why do the compounds in Part E require Roman numerals in the name while compounds such as calcium chloride do not?

16. If only the chemical formula were given for the compounds in the above examples, how could you determine the charge on the cation?

17. Complete the table that follows with the proper ions, chemical formulas and compound names. The first row of the table has been completed for you.

Cation	Anion	Chemical Formula	Compound Name
Na^{+}	Cl^{-}	NaCl	sodium chloride
Ba^{+2}	I-	BaI_2	
Mn^{+2}	O^{-2}		manganese (II) oxide
Mg^{+2}	N^{-3}		
			cobalt (III) fluoride
		CrO	
Cu^{+}	S^{-2}		
		Ca_3P_2	
		SnS_2	

18. How do you know when to use a Roman numeral when writing the name of an ionic compound?

Part F: Poly wanna ion?

Thus far we have considered only simple, monatomic cations and anions. There is another class of ions that are often called polyatomic ions. Polyatomic ions are a group of atoms that are bonded together and the entire group of atoms carries the charge. The most common polyatomic ions contain oxygen.

Table 6	
Ion Name	**Ion Name**
N^{-3} nitride	S^{-2} sulfide
NO_2^{-} nitrite	SO_3^{-2} sulfite
NO_3^{-} nitrate	SO_4^{-2} sulfate

Use the information in Table 6 to answer the following questions.

1. What element is associated with the prefix "nitr-"? _____
2. What element is associated with the prefix "sulf-"? _____
3. What is the ending (suffix) when there are no oxygen atoms in the formula? _____
4. What suffixes are used when oxygen is included in the formula? _____
5. Does the suffix of each name depend on the charge of the ion? _____
6. Does the suffix tell you how many oxygen atoms there are? _____
7. Compare nitrate to nitrite - which ion has more oxygen atoms?
8. Compare sulfate to sulfite - which ion has more oxygen atoms?

9. Consider the two polyatomic ions of chlorine, ClO_2^{-1} and ClO_3^{-1} Which ion would have the –ate ending? Write the names of these two polyatomic ions of chlorine.

10. Consider the two polyatomic ions of phosphorus, PO_3^{-3} and PO_4^{-3}. Which ion would have the –ate ending? Write the names of these two polyatomic ions.

11. The last three letters of a name can tell you a lot about a particle! For each of the name endings below, give a general description of what type of ion or particle would be expected to have that ending (cation, monatomic anion, polyatomic anion, metal element, and/or nonmetal element).

    a. –ide _____

    b. –ium _____

    c. –ate _____

    d. –ine _____

    e. –ite _____

Part G: Mix it up!

Now that we have investigated polyatomic ions, we have to consider how this affects the name of a compound and how we write the chemical formula.

1. Write the name, symbol and charge for all of the monatomic ions present in the compounds listed in Table 7.

2. Write the name and formula (including the charge) for all the polyatomic ions in the Table 7.

Table 7

Chemical Formula	Compound Name
$CaSO_4$	calcium sulfate
$CaSO_3$	calcium sulfite
Na_3PO_4	sodium phosphate
Li_2CO_3	lithium carbonate
NH_4Cl	ammonium chloride
$Be(NO_2)_2$	beryllium nitrite
$Mg_3(PO_3)_2$	magnesium phosphite
$Fe(NO_3)_3$	iron (III) nitrate
$Al(OH)_3$	aluminum hydroxide

3. The ammonium cation is the only polyatomic cation in the table. What is the formula and charge of ammonium?

4. How many nitrite ions are present in beryllium nitrite? _____

5. What new feature is used in these chemical formulas? _____
6. Do all polyatomic ions require the use of parenthesis? _____
7. When are parenthesis used?

8. Have the naming/writing rules you established in earlier parts changed? If so, how?

9. How many nitrogen atoms are in beryllium nitrite? _____
10. If the parenthesis were omitted in writing the formula for aluminum hydroxide [$AlOH_3$ instead of $Al(OH)_3$], how would that change the number of atoms of each element present in the compound?

11. Complete the tables below with the proper chemical formulas and compound names. The first row is completed as an example.

Formula	Name
NaCl	sodium chloride
LiCN	
$Ca(OH)_2$	
	iron (II) nitrate
	barium phosphate

Formula	Name
$CrPO_3$	
	potassium sulfate
	ammonium carbonate
$AuPO_4$	
	copper (II) hydroxide

12. Write a rule that can be used to determine whether or not parenthesis is needed when writing a chemical formula.

Part H: Molecular Compounds

We will be using gases and other compounds as illustrations of naming molecular compounds. Molecular compounds are defined as groups of atoms that stay together because of shared electrons in covalent bonds. We will be focusing on naming some of the smaller molecular compounds. The names of molecular compounds are similar to those of the ionic compounds, but there are differences.

Table 9: Covalent Compounds	
Name	**Formula**
phosphorus hexafluoride	PF_6
tetracarbon decahydride	C_4H_{10}
boron trichloride	BCl_3
dinitrogen monoxide	N_2O
carbon monoxide	CO
dinitrogen tetroxide	N_2O_4

1. Where in the periodic table do you find all of the elements used in the Table 9?

2. What suffix is used for all of the compounds? _____
3. Is the name of the first element in each formula changed when writing the name of a molecular compound? _____
4. How is the name of the second element in each name changed as it goes from an individual element to a compound?

5. How many atoms of nitrogen are present in dinitrogen tetroxide? _____

6. How many atoms of fluorine are present in phosphorus hexafluoride? _____

7. Use the table above or your prior knowledge to fill in the following chart with prefixes used to designate the number of each type of atom in a molecular compound.

Molecular Prefixes

Prefix	Number of Atoms
mono	
di	
tri	
tetra	
penta	
hexa	
hepta	
octa	
nona	
deca	

8. Complete the following tables:

Compound Name	Molecular Formula
sulfur difluoride	
	PCl_3
silicon dioxide	
	H_2S

Compound Name	Molecular Formula
Carbon tetrachloride	
	$SiBr_2$
	P_4O_{10}
Carbon dioxide	

Name: KEY Period: 2017-2018

Naming and Writing Compounds Refresher

Part A: The Basics

1. What does the subscript 2 indicate in Cl_2? # of chlorine atoms
2. What is implied when there is no subscript? There is only 1 atom
3. Classify C, Fe and Cl as metals or non-metals.
   a. C = NM Fe = M Cl: NM
4. Is the following statement true or false and **why**? "The formulas for elements never contain a subscript."
   False - diatomic BrINClHOF gases
5. Using the information in Table 1 (right) as a guide, classify each formula below as an element or a compound.
   a. Co E
   b. $CaCl_2$ C
   c. CsOH C
   d. Br_2 E
   e. NaBr C
   f. SiO_2 C
   g. PF_5 C
   h. P_4 E
   i. OF_2 C

Table 1:

Fe is the elemental form of iron.
C is the elemental form of carbon.
Cl_2 is the elemental form of chlorine.
$FeCl_3$ is a compound formed from the elements iron and chlorine

6. How can you tell if a chemical formula represents an element or a compound?
   1 symbol = Element 2 or more symbols = compound

Part B: Types of Compounds

There are two major classes of compounds typically encountered as part of an introductory course: ionic and molecular compounds. The concepts describing how these compounds are held together will be discussed later this semester. Before you get to those concepts you must be able to quickly classify a compound into one class or the other. In other words, your ability to classify compounds will guide how you will think about bigger ideas.

Table 2: Examples of Ionic and Molecular Compounds

Ionic	Molecular
$ZnCl_2$	CCl_4
Na_2O	P_2O_5
Fe_2O_3	N_2O_4
CuI	NI_3

Use Table 3 to help you answer the following questions:

1. Are ALL cations positive ions or negative ions? +
2. Are ALL anions positive ions or negative ions? −
3. What is the name of the compound formed by the combination of Li^{+1} and S^{-2} ions? Li_2S
4. When the name of an ionic compound is given, which ion is stated first? cation
5. Compare the first part of the compound name to the name of the element from the periodic table. How does the name of the cation correspond to the name of the element?

   stays the same
6. Compare the second part of the compound name to the name of the element from the periodic table. How does the name of the anion correspond to the name of the element?

   ending changes to "-ide"
7. From what part of the periodic table do the cations in Table 3 come (metals or non-metals)?

   Left of Staircase
8. From what part of the periodic table do the anions in Table 3 come?

   Right of staircase
9. For each of the following, predict whether the ion will likely be a cation or an anion.

   a. Magnesium ion cation

   b. Selenide ion anion

   c. Bromide ion anion

   d. Cesium ion cation
10. For each ionic compound, identify the cation and the anion.

    a. Sodium fluoride C A

    b. Strontium sulfide C A

    c. Lithium iodide C A

    d. Barium chloride C A
11. Write a general rule for how you change the name of elements to cations when naming ionic compounds.

    stays the same
12. Write a general rule for how you change the name of elements to anion when naming ionic compounds.

    -ide

1. What is the expected charge on the bromide ion? -1
2. What is the expected charge on the oxide ion? -2
3. What is the expected charge on the nitride ion? -3
4. Represent the Roman numeral II as an Arabic (regular) number. 2
5. Represent the Roman numeral III as an Arabic numeral. 3
6. Represent the Roman numeral IV as an Arabic numeral. 4
7. What two elements are present in the compounds in the last two rows of Table 4? N & Cu #5
8. What is different about the *chemical formulas* of these last two compounds in Table 4? subscripts differ #5
9. What is different about the *compound names* of these last two compounds in Table 4? roman numeral #5
10. Use your rules that you developed in Part D to determine the charge on the iron ion in these compounds:
    a. Charge on iron in $FeBr_2$ +2
    b. Charge on iron in $FeBr_3$ +3
11. How is the Roman numeral in the compound name related to the charge on the iron atoms? Roman numeral = charge
12. Does this hold true for all of the compounds in Table 5? yes
13. What types of metals require the use of a Roman numeral in the name of their ionic compounds? transition metals
14. Where are these metals located on the periodic table? "D" block / center
15. Why do the compounds in this activity require Roman numerals in the name while compounds such as calcium chloride do not? they have more than 1 possible charge.
16. If only the chemical formula were given for the compounds in the above examples, how could you determine the charge on the cation? based on the charge and # of anions present

8. Compare sulfate to sulfite. Which ion has more oxygen atoms?

sulfate

9. Consider the two polyatomic ions of chlorine, ClO_2^- and ClO_3^-. Which ion would have the –ate ending? Write the names of these two polyatomic ions of chlorine.

ClO_3^{-1} chlorate chlorite

10. Consider the two polyatomic ions of phosphorus, PO_3^{-3} and PO_4^{-3}. Which ion would have the –ate ending? Write the names of these two polyatomic ions.

phosphate phosphite

11. The last three letters of a name can tell you a lot about a particle! For each of the name endings below, give a general description of what type of ion or particle would be expected to have that ending (cation, monatomic anion, polyatomic anion, metal element, and/or nonmetal element).
    a. –ide - ion / anion
    b. –ium metal ion or atom
    c. –ate polyatomic
    d. –ine non-metal atom
    e. –ite polyatomic

Part G: Mix it up!

Now that we have investigated polyatomic ions, we have to consider how this affects the name of a compound and how we write the chemical formula.

Table 7 – All types of ionic compounds

Chemical Formula	Compound Name
$CaSO_4$	calcium sulfate
$CaSO_3$	calcium sulfite
Na_3PO_4	sodium phosphate
Li_2CO_3	lithium carbonate
NH_4Cl	ammonium chloride
$Be(NO_2)_2$	beryllium nitrite
$Mg_3(PO_3)_2$	magnesium phosphite
$Fe(NO_3)_3$	iron (III) nitrate
$Al(OH)_3$	aluminum hydroxide

1. Write the name and the symbol for all of the monatomic ions in Table 7.

Ca^{+2} calcium Na^{+1} sodium Li^{+1} lithium Cl^{-1} chloride Be^{+2} beryllium Mg^{+2} magnesium Fe^{+3} iron (III) Al^{+3} aluminum

2. Write the name and formula (including the charge) for all the polyatomic ions in the Table 7.

NH_4^{+1} ammonium SO_4^{-2} sulfate PO_4^{-3} phosphate NO_3^{-1} nitrate PO_3^{-3} phosphite

SO_3^{-2} sulfite CO_3^{-2} carbonate NO_2^{-1} nitrite OH^{-1} hydroxide

3. The ammonium cation is the only polyatomic cation in the table. What are the formula and charge of the ammonia cation?

NH_4^{+1}

Part H: Molecular Compounds

We will be using gases and other compounds as illustrations of naming molecular compounds. Molecular compounds are defined as groups of atoms that stay together because of shared electrons in chemical bonds. There are an infinite number of molecular compounds. Here, we will be focusing on naming some of the smaller molecular compounds. The names of molecular compounds are similar to those of the ionic compounds, but there are differences.

Table 9 – Covalent Compounds

Compound Name	Compound Molecular Formula
phosphorus hexafluoride	PF_6
tetracarbon decahydride	C_4H_{10}
boron trichloride	BCl_3
dinitrogen monoxide	N_2O
carbon monoxide	CO
dinitrogen tetroxide	N_2O_4

1. Where in the periodic table do you find all of the elements used in the Table 9?

   Right

2. What suffix is used for all of the compounds? ide

3. Is the name of the first element in each formula changed as it goes from an individual element to a compound?

   no

4. How is the name of the second element in each name changed as it goes from an individual element to a compound?

   always changed to -ide

5. How many atoms of nitrogen are present in dinitrogen tetroxide?

   2

6. How many atoms of fluorine are present in phosphorus hexafluoride?

   6

7. Use the table above to fill in the following chart with prefixes used to designate the number of each type of atom in a molecular compound.

Molecular Prefixes

Prefix	Number of Atoms
Mono	1
Di	2
Tri	3
Tetra	4
Penta	5
Hexa	6
Hepta-	7
Octa	8
Nona	9
Deca	10

Name: _____ Period: _____

Balancing Equations #1

1. Translate the following word equations into skeleton equations:

   a. $iron_{(s)}$ + $chlorine_{(g)}$ → iron(III) $chloride_{(s)}$

   b. $hydrogen_{(g)}$ + $bromine_{(g)}$ → $hydrogen\ bromide_{(g)}$

   c. $carbon\ monoxide_{(g)}$ + $oxygen_{(g)}$ → $carbon\ dioxide_{(g)}$

2. Translate the following skeleton equations in to word equations:

   a. $KClO_{3(s)} \rightarrow KCl_{(s)} + O_{2(g)}$

   b. $Mg_{(s)} + O_{2(g)} \rightarrow MgO_{(s)}$

   c. $PbCl_{2(aq)} + NaC_2H_3O_{2(aq)} \rightarrow Pb(C_2H_3O_2)_{2(aq)} + NaCl_{(aq)}$

3. Balance the following equations:

   a. $Fe_{(s)} + Cl_{2(g)} \rightarrow FeCl_{3(s)}$

   b. $N_{2(g)} + H_{2(g)} \rightarrow NH_{3(g)}$

   c. $CH_{4(g)} + O_{2(g)} \rightarrow CO_{2(g)} + H_2O_{(l)}$

   d. $H_2O_{2(aq)} \rightarrow H_2O_{(l)} + O_{2(g)}$

   e. $CO_{2(g)} + H_2O_{(l)} \rightarrow O_{2(g)} + C_6H_{12}O_{6(s)}$

   f. $NH_{3(g)} + O_{2(g)} \rightarrow NO_{(g)} + H_2O_{(g)}$

4. Determine whether each equation is balanced or not. If so, write "yes" - if not, write "no" **then balance** it. If an equation has incorrect coefficients, cross them out and replace them with the correct ones.

   Balanced?

   a. $Al + 3\ HCl \rightarrow AlCl_3 + H_2$ _____

   b. $Ba(ClO_3)_2 \rightarrow BaCl_2 + 2\ O_2$ _____

   c. $3\ Sn(SO_4)_2 + 4\ K_3PO_4 \rightarrow Sn_3(PO_4)_4 + 6\ K_2SO_4$ _____

   d. $C_5H_{12} + 11\ O_2 \rightarrow 5\ CO_2 + 12\ H_2O$ _____

5. Write a **balanced** chemical equation for each reaction described below and **identify the reaction type**. Include **states of matter** for each substance (Treat all ionic compounds as aqueous solutions unless otherwise indicated**).**

   a. Potassium hydroxide is added to silver nitrate and forms potassium nitrate and solid silver hydroxide.

      Type? _____

   b. Solid iron metal is added to copper II sulfate which reacts to produce iron II sulfate and solid copper metal.

      Type? _____

   c. Solid sodium chlorate breaks down to form solid sodium chloride and oxygen gas.

      Type? _____

   d. Solid zinc metal is exposed to oxygen gas and reacts to form a layer of powdered zinc oxide.

      Type? _____

   e. Aluminum sulfate and barium chloride solutions are mixed to form aluminum chloride and solid barium sulfate.

      Type? _____

   f. Sodium hydrogen carbonate breaks down to form solid sodium carbonate and gases of carbon dioxide and water.

      Type? _____

g. Solid ammonium nitrite decomposes when heated to form nitrogen gas and liquid water.

Type? _____

h. Solid iron III oxide and carbon monoxide gas react to form solid iron and carbon dioxide gas.

Type? _____

i. Chlorine gas and sodium iodide crystals react to form a sodium chloride solid and iodine gas.

Type? _____

j. Phosphoric acid (H_3PO_4) and magnesium hydroxide react to form solid magnesium phosphate crystals and liquid water.

Type? _____

k. Hydrochloric acid (HCl) and sodium hydroxide neutralize each other and yield aqueous sodium chloride and liquid water.

Type? _____

l. Hexane (C_6H_{14}) gas burns in air to produce carbon dioxide gas and water vapor.

Type? _____

6. **Identify the reaction type** and **<u>BALANCE</u> the following equations.**
Use the abbreviations below for each reaction type:
S = Synthesis **D** = Decomposition **C** = Combustion **SR** = Single Replacement **DR** = Double Replacement

TYPE

a. _____ $Al_2(SO_4)_3 + Ca(OH)_2 \rightarrow Al(OH)_3 + CaSO_4$

b. _____ $C_2H_2 + O_2 \rightarrow CO_2 + H_2O$

c. _____ $Mg + AgNO_3 \rightarrow Mg(NO_3)_2 + Ag$

d. _____ $Ba(NO_3)_2 + H_3PO_4 \rightarrow Ba_3(PO_4)_2 + HNO_3$

e. _____ $Mg(ClO_3)_2 \rightarrow MgCl_2 + O_2$

f. _____ $Be + O_2 \rightarrow BeO$

g. _____ $K + Br_2 \rightarrow KBr$

h. _____ $H_2 + O_2 \rightarrow H_2O$

i. _____ $C_7H_{16} + O_2 \rightarrow CO_2 + H_2O$

j. _____ $SiO_2 + HF \rightarrow SiF_4 + H_2O$

k. _____ $KClO_3 \rightarrow KCl + O_2$

l. __N/A__ $H_2SO_4 + HI \rightarrow H_2S + I_2 + H_2O$

m. _____ $H_3PO_4 \rightarrow H_4P_2O_7 + H_2O$

n. _____ $H_3AsO_4 \rightarrow As_2O_5 + H_2O$

o. _____ $FeCl_3 + NH_4OH \rightarrow Fe(OH)_3 + NH_4Cl$

p. _____ $H_3BO_3 \rightarrow H_4B_6O_{11} + H_2O$

Name: Key Period: _____

Balancing Equations #1

1. Translate the following word equations into skeleton equations:

   a. iron$_{(s)}$ + chlorine$_{(g)}$ → iron(III) chloride$_{(s)}$

   $Fe + Cl_2 \rightarrow FeCl_3$

   b. hydrogen$_{(g)}$ + bromine$_{(g)}$ → hydrogen bromide$_{(g)}$

   $H_2 + Br_2 \rightarrow HBr$

   c. carbon monoxide$_{(g)}$ + oxygen$_{(g)}$ → carbon dioxide$_{(g)}$

   $CO + O_2 \rightarrow CO_2$

2. Translate the following skeleton equations in to word equations:

   a. $KClO_{3(s)} \rightarrow KCl_{(s)} + O_{2(g)}$

   potassium chlorate → potassium chloride + oxygen gas

   b. $Mg_{(s)} + O_{2(g)} \rightarrow MgO_{(s)}$

   magnesium + oxygen gas → magnesium oxide

   c. $PbCl_{2(aq)} + NaC_2H_3O_{2(aq)} \rightarrow Pb(C_2H_3O_2)_{2(aq)} + NaCl_{(aq)}$

   lead (II) chloride + sodium acetate → lead (II) acetate + sodium chloride

3. Balance the following equations:

   a. $2\,Fe_{(s)} + 3\,Cl_{2(g)} \rightarrow 2\,FeCl_{3(s)}$

   b. $N_{2(g)} + 3\,H_{2(g)} \rightarrow 2\,NH_{3(g)}$

   c. $CH_{4(g)} + 2\,O_{2(g)} \rightarrow CO_{2(g)} + 2\,H_2O_{(l)}$

   d. $2\,H_2O_{2(aq)} \rightarrow 2\,H_2O_{(l)} + O_{2(g)}$

   e. $6\,CO_{2(g)} + 6\,H_2O_{(l)} \rightarrow 6\,O_{2(g)} + C_6H_{12}O_{6(s)}$

   f. $4\,NH_{3(g)} + 5\,O_{2(g)} \rightarrow 4\,NO_{(g)} + 6\,H_2O_{(g)}$

4. Determine whether each equation is balanced or not. If so, write "yes" - if not, write "no" **then balance** it. If an equation has incorrect coefficients, cross them out and replace them with the correct ones.

		Balanced?
a.	$2\,Al + ~~3~~\,6\,HCl \rightarrow 2\,AlCl_3 + 3\,H_2$	No
b.	$Ba(ClO_3)_2 \rightarrow BaCl_2 + ~~2~~\,3\,O_2$	No
c.	$3\,Sn(SO_4)_2 + 4\,K_3PO_4 \rightarrow Sn_3(PO_4)_4 + 6\,K_2SO_4$	Yes
d.	$C_5H_{12} + ~~11~~\,8\,O_2 \rightarrow 5\,CO_2 + ~~12~~\,6\,H_2O$	No

5. Write a **balanced** chemical equation for each reaction described below and **identify the reaction type**. Include **states of matter** for each substance (Treat all ionic compounds as aqueous solutions unless otherwise indicated).

a. Potassium hydroxide is added to silver nitrate and forms potassium nitrate and solid silver hydroxide.

Type? DR

$KOH_{(aq)} + AgNO_{3(aq)} \rightarrow KNO_{3(aq)} + AgOH_{(s)}$

(balanced)

b. Solid iron metal is added to copper II sulfate which reacts to produce iron II sulfate and solid copper metal.

Type? SR

$Fe_{(s)} + CuSO_{4(aq)} \rightarrow FeSO_{4(aq)} + Cu_{(s)}$

(balanced)

c. Solid sodium chlorate breaks down to form solid sodium chloride and oxygen gas.

Type? Decomposition

$2\,NaClO_{3(s)} \rightarrow 2\,NaCl_{(s)} + 3\,O_{2(g)}$

d. Solid zinc metal is exposed to oxygen gas and reacts to form a layer of powdered zinc oxide.

Type? Synthesis

$2Zn_{(s)} + O_{2(g)} \rightarrow 2ZnO_{(s)}$

e. Aluminum sulfate and barium chloride solutions are mixed to form aluminum chloride and solid barium sulfate.

Type? DR

$Al_2(SO_4)_{3(aq)} + 3BaCl_{2(aq)} \rightarrow 2AlCl_{3(aq)} + 3BaSO_{4(s)}$

f. Sodium hydrogen carbonate breaks down to form solid sodium carbonate and gases of carbon dioxide and water.

Type? Decomposition

$2NaHCO_{3(s)} \rightarrow Na_2CO_{3(s)} + CO_{2(g)} + H_2O_{(g)}$

g. Solid ammonium nitrite decomposes when heated to form nitrogen gas and liquid water.

Type? Decomposition

$NH_4NO_{2(s)} \rightarrow N_{2(g)} + H_2O_{(l)}$

h. Solid iron III oxide and carbon monoxide gas react to form solid iron and carbon dioxide gas.

Type? _____

$Fe_2O_{3(s)} + 3CO_{(g)} \rightarrow 2Fe_{(s)} + 3CO_{2(g)}$

i. Chlorine gas and sodium iodide crystals react to form a sodium chloride solid and iodine gas.

Type? SR

$Cl_{2(g)} + 2NaI_{(s)} \rightarrow 2NaCl_{(s)} + I_{2(g)}$

j. Phosphoric acid (H_3PO_4) and magnesium hydroxide react to form solid magnesium phosphate crystals and liquid water.

Type? DR

$2H_3PO_{4(aq)} + 3Mg(OH)_{2(aq)} \rightarrow Mg_3(PO_4)_2 + 6H_2O_{(l)}$

k. Hydrochloric acid (HCl) and sodium hydroxide neutralize each other and yield aqueous sodium chloride and liquid water.

Type? DR

$HCl_{(aq)} + NaOH_{(aq)} \rightarrow NaCl_{(aq)} + H_2O_{(l)}$

l. Hexane (C_6H_{14}) gas burns in air to produce carbon dioxide gas and water vapor.

$\Rightarrow O_2$!!

Type? Combustion

$2C_6H_{14(l)} + 19O_{2(g)} \rightarrow 12CO_{2(g)} + 14H_2O_{(g)}$

6. **Identify the reaction type** and **BALANCE the following equations.**
Use the abbreviations below for each reaction type:

S = Synthesis **D** = Decomposition **C** = Combustion **SR** = Single Replacement **DR** = Double Replacement

	TYPE	
a.	DR	$Al_2(SO_4)_3 + 3\,Ca(OH)_2 \rightarrow 2\,Al(OH)_3 + 3\,CaSO_4$
b.	C	$2\,C_2H_2 + 5\,O_2 \rightarrow 4\,CO_2 + 2\,H_2O$
c.	SR	$Mg + 2\,AgNO_3 \rightarrow Mg(NO_3)_2 + 2\,Ag$
d.	DR	$3\,Ba(NO_3)_2 + 2\,H_3PO_4 \rightarrow Ba_3(PO_4)_2 + 6\,HNO_3$
e.	D	$Mg(ClO_3)_2 \rightarrow MgCl_2 + 3\,O_2$
f.	S	$2\,Be + O_2 \rightarrow 2\,BeO$
g.	S	$2\,K + Br_2 \rightarrow 2\,KBr$
h.	S	$2\,H_2 + O_2 \rightarrow 2\,H_2O$
i.	C	$C_7H_{16} + 11\,O_2 \rightarrow 7\,CO_2 + 8\,H_2O$
j.	DR	$SiO_2 + 4\,HF \rightarrow SiF_4 + 2\,H_2O$
k.	D	$2\,KClO_3 \rightarrow KCl + 3\,O_2$
l.	N/A	$H_2SO_4 + 8\,HI \rightarrow H_2S + 4\,I_2 + 4\,H_2O$
m.	D	$2\,H_3PO_4 \rightarrow H_4P_2O_7 + H_2O$
n.	D	$2\,H_3AsO_4 \rightarrow As_2O_5 + 3\,H_2O$
o.	DR	$FeCl_3 + 3\,NH_4OH \rightarrow Fe(OH)_3 + 3\,NH_4Cl$
p.	D	$6\,H_3BO_3 \rightarrow H_4B_6O_{11} + 7\,H_2O$

Name: _____ Period: _____

Balancing Equations #2

Directions: Identify the type of reaction (S, D, C, SR, DR) then balance each equation below. If the reaction is already balanced, write "BALANCED" under the equation.

1. $C_3H_{8(g)} + O_{2(g)} \rightarrow CO_{2(g)} + H_2O_{(g)}$ **Type _____**

2. $Al_{(s)} + O_{2(g)} \rightarrow Al_2O_{3(s)}$ **Type _____**

3. $Fe_2O_{3(s)} + H_{2(g)} \rightarrow Fe_{(s)} + H_2O_{(l)}$ **Type _____**

4. $CaCO_{3(s)} \rightarrow CaO_{(s)} + CO_{2(g)}$ **Type _____**

5. $Al_{(s)} + Pb(NO_3)_{2(aq)} \rightarrow Pb_{(s)} + Al(NO_3)_{3(aq)}$ **Type _____**

6. $KClO_{4(s)} \rightarrow KCl_{(s)} + O_{2(g)}$ **Type _____**

7. $FeS_{(s)} + HCl_{(aq)} \rightarrow H_2S_{(g)} + FeCl_{2(aq)}$ **Type _____**

8. $KI_{(aq)} + Pb(NO_3)_{2(aq)} \rightarrow PbI_{2(s)} + KNO_{3(aq)}$ **Type _____**

9. $F_{2(g)} + NaCl_{(aq)} \rightarrow NaF_{(aq)} + Cl_{2(g)}$ **Type _____**

10. $Rb_{(s)} + S_{8(s)} \rightarrow Rb_2S_{(s)}$ **Type _____**

11. $C_8H_{18(g)} + O_{2(g)} \rightarrow CO_{2(g)} + H_2O_{(g)}$ **Type _____**

Directions: Write a **balanced** equation for the reactions described below.

1. Potassium metal and chlorine gas combine to form potassium chloride.

2. Zinc and lead (II) nitrate react to form zinc nitrate and lead.

3. Copper and sulfuric acid (H_2SO_4) react to form copper (II) sulfate and water and sulfur dioxide.

4. Sodium phosphate and calcium chloride react to form calcium phosphate and sodium chloride.

5. When aluminum nitrate and sodium hydroxide solutions are mixed, solid aluminum hydroxide forms. The other product is sodium nitrate.

6. When solid copper (II) oxide and hydrogen gas react, metallic copper and water form.

7. Liquid pentane (C_5H_{12}) burns in the presence of oxygen, producing water vapor and carbon dioxide.

8. Beryllium chloride reacts with silver nitrate and beryllium nitrate and silver chloride are created.

9. Sodium hydroxide reacts with sulfuric acid (H_2SO_4) to produce sodium sulfate and water.

10. Fluorine gas reacts with calcium metal to produce calcium fluoride.

Name: Key Period: _____

Balancing Equations #2

Directions: Identify the type of reaction (S, D, C, SR, DR) then balance each equation below. If the reaction is already balanced, write "BALANCED" under the equation.

1. $C_3H_{8(g)} + 5\,O_{2(g)} \rightarrow 3\,CO_{2(g)} + 4\,H_2O_{(g)}$ **Type** C

2. $4\,Al_{(s)} + 3\,O_{2(g)} \rightarrow 2\,Al_2O_{3(s)}$ **Type** S

3. $Fe_2O_{3(s)} + 3\,H_{2(g)} \rightarrow 2\,Fe_{(s)} + 3\,H_2O_{(l)}$ **Type** SR

4. $CaCO_{3(s)} \rightarrow CaO_{(s)} + CO_{2(g)}$ balanced **Type** D

5. $2\,Al_{(s)} + 3\,Pb(NO_3)_{2(aq)} \rightarrow 3\,Pb_{(s)} + 2\,Al(NO_3)_{3(aq)}$ **Type** SR

6. $KClO_{4(s)} \rightarrow KCl_{(s)} + 2\,O_{2(g)}$ **Type** D

7. $FeS_{(s)} + 2\,HCl_{(aq)} \rightarrow H_2S_{(g)} + FeCl_{2(aq)}$ **Type** DR

8. $2\,KI_{(aq)} + Pb(NO_3)_{2(aq)} \rightarrow PbI_{2(s)} + 2\,KNO_{3(aq)}$ **Type** DR

9. $F_{2(g)} + 2\,NaCl_{(aq)} \rightarrow 2\,NaF_{(aq)} + Cl_{2(g)}$ **Type** SR

10. $16\,Rb_{(s)} + S_{8(s)} \rightarrow 8\,Rb_2S_{(s)}$ **Type** S

11. $2\,C_8H_{18(g)} + 25\,O_{2(g)} \rightarrow 16\,CO_{2(g)} + 18\,H_2O_{(g)}$ **Type** C

Directions: Write a **balanced** equation for the reactions described below.

1. Potassium metal and chlorine gas combine to form potassium chloride.

$$2K + Cl_2 \rightarrow 2KCl$$

2. Zinc and lead (II) nitrate react to form zinc nitrate and lead.

$$Zn + Pb(NO_3)_2 \rightarrow Zn(NO_3)_2 + Pb$$

3. Copper and sulfuric acid (H_2SO_4) react to form copper (II) sulfate and water and sulfur dioxide.

$$Cu + 2H_2SO_4 \rightarrow CuSO_4 + 2H_2O + SO_2$$

4. Sodium phosphate and calcium chloride react to form calcium phosphate and sodium chloride.

$$2Na_3PO_4 + 3CaCl_2 \rightarrow Ca_3(PO_4)_2 + 6NaCl$$

5. When aluminum nitrate and sodium hydroxide solutions are mixed, solid aluminum hydroxide forms. The other product is sodium nitrate.

$$Al(NO_3)_3 + 3NaOH \rightarrow Al(OH)_3 + 3NaNO_3$$

6. When solid copper (II) oxide and hydrogen gas react, metallic copper and water form.

$$CuO + H_2 \rightarrow Cu + H_2O$$

7. Liquid pentane (C_5H_{12}) burns in the presence of oxygen, producing water vapor and carbon dioxide.

$$C_5H_{12} + 8O_2 \rightarrow 5CO_2 + 6H_2O$$

8. Beryllium chloride reacts with silver nitrate and beryllium nitrate and silver chloride are created.

$$BeCl_2 + 2AgNO_3 \rightarrow Be(NO_3)_2 + 2AgCl$$

9. Sodium hydroxide reacts with sulfuric acid (H_2SO_4) to produce sodium sulfate and water.

$$2NaOH + H_2SO_4 \rightarrow Na_2SO_4 + 2H_2O$$

10. Fluorine gas reacts with calcium metal to produce calcium fluoride.

$$F_2 + Ca \rightarrow CaF_2$$

Name: _____ Period: _____

Predicting the Products of Chemical Reactions

Predicting Products: Combustion, Synthesis and Decomposition Reactions
Directions: Predict the products and write the **BALANCED EQUATION** for each for each of the following reactions based on what you know about the reaction pattern of each type.

COMBUSTION:

1. $C_2H_{4\,(g)}$ + $O_{2\,(g)}$ →
2. $C_6H_{12}O_{6\,(s)}$ + $O_{2\,(g)}$ →
3. $C_2H_5OH_{\,(l)}$ + $O_{2\,(g)}$ →
4. $C_5H_{12\,(l)}$ + $O_{2\,(g)}$ →

SYNTHESIS:

5. $Sr_{(s)}$ + $CuSO_{4\,(aq)}$ →
6. $Na_{(s)}$ + $O_{2\,(g)}$ →
7. $K_{(s)}$ + $Cl_{2\,(g)}$ →
8. $Ca_{(s)}$ + $F_{2\,(g)}$ →

DECOMPOSITION:

9. $MgBr_{2\,(l)}$ →
10. $AlCl_{3\,(l)}$ →
11. $H_2O_{(l)}$ →
12. $KI_{(l)}$ →

MIXED BAG:

13. $C_6H_{6\,(l)}$ + $O_{2\,(g)}$ →
14. $Cu_{\,(s)}$ + $Cl_{2\,(g)}$ →
15. $PCl_{3\,(l)}$ + $Cl_{2\,(g)}$ →
16. $CoBr_{2\,(l)}$ →
17. $Sr_{\,(s)}$ + $N_{2\,(g)}$ →
18. $Al_{\,(s)}$ + $O_{2\,(g)}$ →

Single Replacement

Directions: Use the Activity Series to predict if the following reactions will occur. If they do not, write NR (no reaction) and you are done. If they do occur, predict the products of the reaction and **balance** the equation.

1. $Al + Pb(NO_3)_2 \rightarrow$

2. $Cl_2 + NaI \rightarrow$

3. $Fe + AgC_2H_3O_2 \rightarrow$

4. $Al + CuCl_2 \rightarrow$

5. $Br_2 + CaI_2 \rightarrow$

6. $Al + HCl \rightarrow$

7. $Mg + HCl \rightarrow$

8. $Zn + H_2SO_4 \rightarrow$

9. $Fe + CuSO_4 \rightarrow$

10. $Cl_2 + MgI_2 \rightarrow$

Double Replacement:

Directions: **Predict the products** in the following double replacement reactions then **balance**. Use solubility rules to **determine the state of matter** of each product. If a reaction occurs, write YES in the last column. If there is not a reaction, write NO REACTION (NR).

							Reaction?
1.	$NaOH_{(aq)}$	+	$CaBr_{2\ (aq)}$	→	_____	+ _____	_____
2.	$Pb(NO_3)_{2\ (aq)}$	+	$HCl_{\ (aq)}$	→	_____	+ _____	_____
3.	$Na_2CO_{3\ (aq)}$	+	$KF_{(aq)}$	→	_____	+ _____	_____
4.	$AgNO_{3\ (aq)}$	+	$CuSO_{4\ (aq)}$	→	_____	+ _____	_____
5.	$NaC_2H_3O_{2\ (aq)}$	+	$H_2SO_{4\ (aq)}$	→	_____	+ _____	_____
6.	$Pb(OH)_{2\ \ (aq)}$	+	$Hg_2S_{(aq)}$	→	_____	+ _____	_____
7.	$Ca(OH)_{2\ (aq)}$	+	$H_3PO_{4\ (aq)}$	→	_____	+ _____	_____
8.	$K_2CO_{3\ (aq)}$	+	$BaCl_{2\ (aq)}$	→	_____	+ _____	_____
9.	$Cd_3(PO_4)_{2\ (aq)}$	+	$(NH_4)_2S_{\ (aq)}$	→	_____	+ _____	_____
10.	$Co(OH)_{3\ \ (aq)}$	+	$HNO_{3\ (aq)}$	→	_____	+ _____	_____
11.	$AgNO_{3\ (aq)}$	+	$KCl_{\ (aq)}$	→	_____	+ _____	_____
12.	$Na_2CO_{3\ \ (aq)}$	+	$H_2SO_{4(aq)}$	→	_____	+ _____	_____
13.	$Al(OH)_{3\ \ (aq)}$	+	$HC_2H_3O_{2(aq)}$	→	_____	+ _____	_____
14.	$Al_2(SO_4)_{3\ (aq)}$	+	$Ca_3(PO_4)_{2\ (aq)}$	→	_____	+ _____	_____
15.	$Cr_2(SO_3)_{3\ (aq)}$	+	$H_2SO_{4\ (aq)}$	→	_____	+ _____	_____
16.	$AgC_2H_3O_{2(aq)}$	+	$K_2CrO_{4(aq)}$	→	_____	+ _____	_____

Name: Key Period: _____

Predicting the Products of Chemical Reactions

Predicting Products: Combustion, Synthesis and Decomposition Reactions
Directions: Predict the products and write the **BALANCED EQUATION** for each for each of the following reactions based on what you know about the reaction pattern of each type.

COMBUSTION:

1. $C_2H_{4\,(g)} + 3O_{2\,(g)} \rightarrow 2CO_2 + 2H_2O$
2. $C_6H_{12}O_{6\,(s)} + 6O_{2\,(g)} \rightarrow 6CO_2 + 6H_2O$
3. $C_2H_5OH_{\,(l)} + 3O_{2\,(g)} \rightarrow 2CO_2 + 3H_2O$
4. $C_5H_{12\,(l)} + 8O_{2\,(g)} \rightarrow 5CO_2 + 6H_2O$

SYNTHESIS:

5. $2Sr_{(s)} + O_2 \rightarrow 2SrO$
6. $4Na_{(s)} + O_{2\,(g)} \rightarrow 2Na_2O$
7. $2K_{(s)} + Cl_{2\,(g)} \rightarrow 2KCl$
8. $Ca_{(s)} + F_{2\,(g)} \rightarrow CaF_2$ (balanced)

DECOMPOSITION:

9. $MgBr_{2\,(l)} \rightarrow Mg + Br_2$ (balanced)
10. $2AlCl_{3\,(l)} \rightarrow 2Al + 3Cl_2$
11. $2H_2O_{(l)} \rightarrow 2H_2 + O_2$
12. $2KI_{(l)} \rightarrow 2K + I_2$

MIXED BAG:

13. $2C_6H_{6\,(l)} + 15O_{2\,(g)} \rightarrow 12CO_2 + 6H_2O$
14. $2Cu_{\,(s)} + Cl_{2\,(g)} \rightarrow 2CuCl$
    $Cu + Cl_2 \rightarrow CuCl_2$
15. $PCl_{3\,(l)} + Cl_{2\,(g)} \rightarrow PCl_5$ (balanced)
16. $CoBr_{2\,(l)} \rightarrow Co + Br_2$ (balanced)
17. $3Sr_{\,(s)} + N_{2\,(g)} \rightarrow Sr_3N_2$
18. $4Al_{\,(s)} + 3O_{2\,(g)} \rightarrow 2Al_2O_3$

Single Replacement

Directions: Use the Activity Series to predict if the following reactions will occur. If they do not, write NR (no reaction) and you are done. If they do occur, predict the products of the reaction and **balance** the equation.

1. $2Al + 3Pb(NO_3)_2 \rightarrow 2Al(NO_3)_3 + 3Pb$

2. $Cl_2 + 2NaI \rightarrow 2NaCl + I_2$

3. $Fe + 2AgC_2H_3O_2 \rightarrow Fe(C_2H_3O_2)_2 + 2Ag$
   $Fe + 3AgC_2H_3O_2 \rightarrow Fe(C_2H_3O_2)_3 + 3Ag$

4. $2Al + 3CuCl_2 \rightarrow 2AlCl_3 + 3Cu$

5. $Br_2 + CaI_2 \rightarrow CaBr_2 + I_2$ (balanced)

6. $2Al + 6HCl \rightarrow 2AlCl_3 + 3H_2$

7. $Mg + 2HCl \rightarrow MgCl_2 + H_2$

8. $Zn + H_2SO_4 \rightarrow ZnSO_4 + H_2$ (balanced)

9. $Fe + CuSO_4 \rightarrow FeSO_4 + Cu$ (balanced)
   $2Fe + 3CuSO_4 \rightarrow Fe_2(SO_4)_3 + 3Cu$

10. $Cl_2 + MgI_2 \rightarrow MgCl_2 + I_2$ (balanced)

Double Replacement:

Directions: **Predict the products** in the following double replacement reactions then **balance**. Use solubility rules to **determine the state of matter** of each product. If a reaction occurs, write YES in the last column. If there is not a reaction, write NO REACTION (NR).

							Reaction?
1.	$NaOH_{(aq)}$	+	$CaBr_{2\ (aq)}$	→	$NaBr_{(aq)}$	+ $Ca(OH)_{2(s)}$	Y
2.	$Pb(NO_3)_{2\ (aq)}$	+	$HCl_{\ (aq)}$	→	$PbCl_{2(s)}$	+ $HNO_{3(aq)}$	Y
3.	$Na_2CO_{3\ (aq)}$	+	$KF_{(aq)}$	→	$NaF_{(aq)}$	+ $K_2CO_{3(aq)}$	Y
4.	$AgNO_{3\ (aq)}$	+	$CuSO_{4\ (aq)}$	→	$Ag_2SO_{4(s)}$	+ $Cu(NO_3)_{2(aq)}$	Y
5.	$NaC_2H_3O_{2\ (aq)}$	+	$H_2SO_{4\ (aq)}$	→	$Na_2SO_{4(aq)}$	+ $HC_2H_3O_{2(aq)}$	NR
6.	$Pb(OH)_{2\ (aq)}$	+	$Hg_2S_{(aq)}$	→	$PbS_{(s)}$	+ $Hg_2(OH)_{2(s)}$	Y
7.	$Ca(OH)_{2\ (aq)}$	+	$H_3PO_{4\ (aq)}$	→	$Ca_3(PO_4)_{2(s)}$	+ + $HOH_{(l)}$ (H_2O)	Y
8.	$K_2CO_{3\ (aq)}$	+	$BaCl_{2\ (aq)}$	→	$KCl_{(aq)}$	+ $BaCO_{3(s)}$	Y
9.	$Cd_3(PO_4)_{2\ (aq)}$	+	$(NH_4)_2S_{\ (aq)}$	→	$CdS_{(s)}$	+ $(NH_4)_3PO_{4(aq)}$	Y
10.	$Co(OH)_{3\ (aq)}$	+	$HNO_{3\ (aq)}$	→	$Co(NO_3)_{3(aq)}$	+ $HOH_{(l)}$ (H_2O)$_{(l)}$	Y
11.	$AgNO_{3\ (aq)}$	+	$KCl_{\ (aq)}$	→	$AgCl_{(s)}$	+ $KNO_{3(aq)}$	Y
12.	$Na_2CO_{3\ \ (aq)}$	+	$H_2SO_{4(aq)}$	→	$Na_2SO_{4(aq)}$	+ $H_2CO_{3(aq)}$	NR
13.	$Al(OH)_{3\ \ (aq)}$	+	$HC_2H_3O_{2(aq)}$	→	$Al(C_2H_3O_2)_{3(aq)}$	+ $HOH_{(l)}$ ($H_2O_{(l)}$)	Y
14.	$Al_2(SO_4)_{3\ (aq)}$	+	$Ca_3(PO_4)_{2\ (aq)}$	→	$AlPO_{4(s)}$	+ $CaSO_{4(aq)}$	Y
15.	$Cr_2(SO_3)_{3\ (aq)}$	+	$H_2SO_{4\ (aq)}$	→	$Cr_2(SO_4)_{3(aq)}$	+ $H_2SO_{3(aq)}$	NR
16.	$AgC_2H_3O_{2(aq)}$	+	$K_2CrO_{4(aq)}$	→	$Ag_2CrO_{4(s)}$	+ $KC_2H_3O_{2(aq)}$	Y