

Unit 7: Chemical Reactions

Name: _____ Block: _____

Learning Targets

1. I CAN state and describe the Law of Conservation of Matter as it pertains to chemical reactions
2. I CAN explain the significance of the components of a chemical reaction (reactants, products, arrow, states of matter, etc).
3. I CAN write a chemical equation from a description AND describe a chemical reaction from the equation
**This is review from Unit 5: Naming and Bonding*
4. I CAN balance a chemical equation
5. I CAN identify and describe the six types of chemical reactions based on their reactants and products
6. Given a chemical reaction, I CAN classify the type based on the reactants and products
7. I CAN describe the processes of oxidation and reduction; I CAN identify which elements are oxidized and reduced.
8. Given a chemical reaction, I CAN classify the oxidizing agent and the reducing agent.
9. I CAN describe and draw the interactions of compounds molecules in a chemical reaction
**Includes dissolve, dissociate, ionize, and precipitate*
10. I CAN define solubility and determine a compounds solubility in water using "like dissolves like"
11. I CAN use a given chart to determine if a specific compound is soluble or insoluble in water
12. I CAN define precipitate and describe how a precipitate forms
13. I CAN determine whether a reaction goes to completion using a reactivity and solubility chart
14. I CAN predict the products of a chemical reaction
15. I CAN write and balance an entire chemical equation, including states of matter, when given the reactant(s)

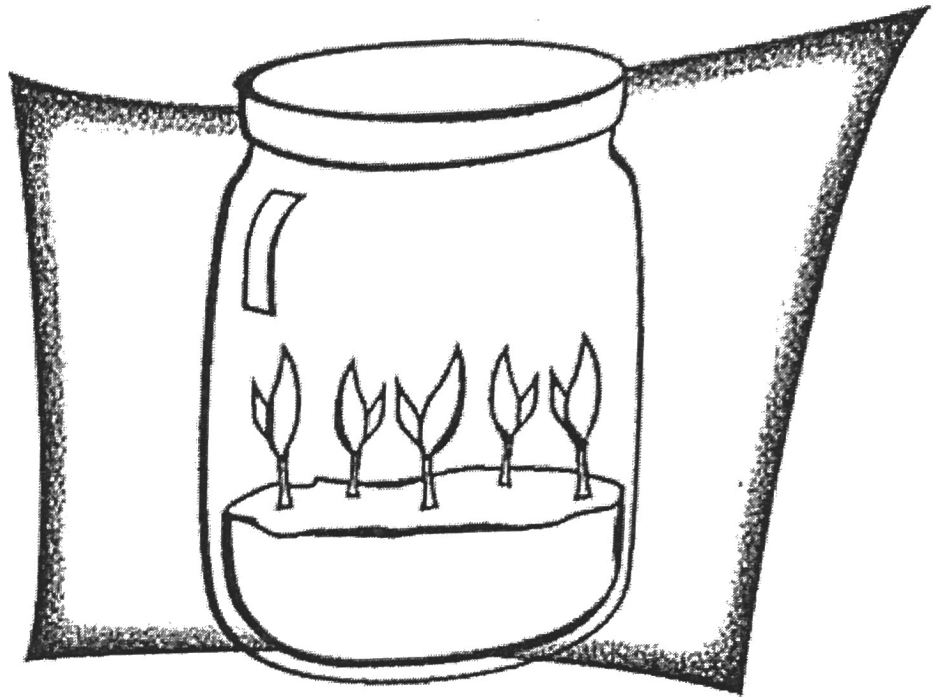
Chemistry Important Dates!

Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
March 6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26

Seedlings in a Jar

Imagine you have a sealed jar containing five bean seeds, air, and a moist paper towel. Nothing can get in or out of the jar. The total mass of the jar and its contents is 500 grams.

Imagine the same jar with its contents 12 days later. During that time the jar remained sealed. Nothing could get in or out of the jar. The seeds have germinated to form 6-centimeter seedlings. The total mass of the jar and its contents after the 12 days is recorded.



Circle the statement that is the best comparison of the total mass of the jar and its contents before and after the seeds sprouted to form seedlings:

- A The total mass of the original jar with seeds will be more than the total mass of the jar with the seedlings.
- B The total mass of the original jar with seeds will be less than the total mass of the jar with the seedlings.
- C There will be no change in the total mass of the jar with seedlings after 12 days.**

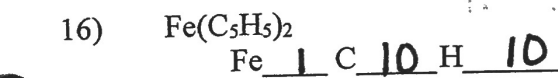
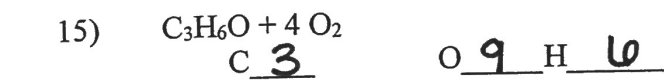
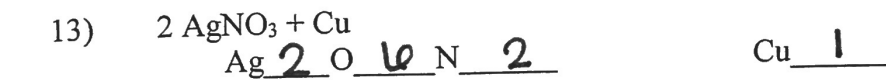
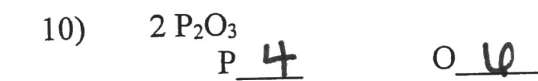
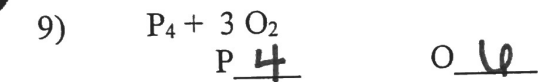
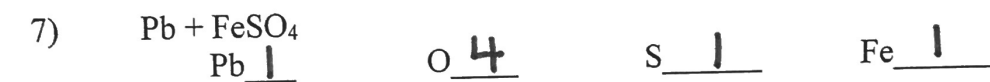
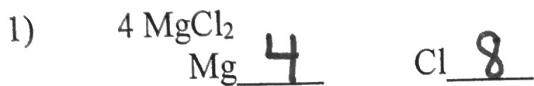
Describe your thinking. Provide an explanation for your answer.

Law of Conservation of Matter: Matter cannot be created or destroyed; it can only be rearranged or transformed.

Any atoms present at the start of a reaction (reactants) must be present in the exact same amounts at the end (products)

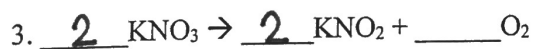
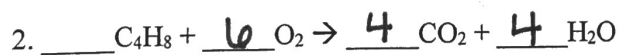
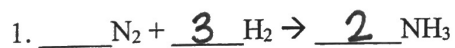
Counting Atoms Practice

How many of each type of atom are in the following?

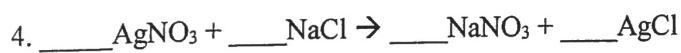


Balancing Equations Practice

Use the methods from the video to balance the following:



↙ already balanced!



ChemBalancer Webquest

Go to Google and search for "Classic ChemBalancer". Click on the first link. Use the simulation to balance each equation. Notice that changing the coefficient in front changes the number of molecules. You must have the same number of atoms on both sides of the equation.



1C) What is the name for FeS?

iron (II) sulfide



2C) What is the name for HCl?

Hydrochloric Acid



3C) What is the name for MgO?

Magnesium oxide



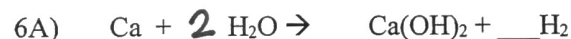
4C) What types of bonds does H₂ have?

Covalent (nonpolar)



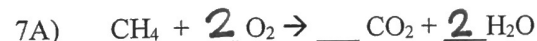
5C) What is the name for HgO?

Mercury (II) oxide



6C) What is the name for Ca(OH)₂?

Calcium hydroxide



7C) What is the name for CH₄?

methane



8C) What is the name for H₂SO₄?

Sulfuric acid



9C) What is the name for NH₃?

Ammonia



10C) What is the name for Al₂O₃?

Aluminum oxide



11C) What is the name for KMnO₄?

potassium permanganate

1B) This reaction would be classified as synthesis

1D) What does Iron mean in Latin?

Ferrier = latin for blacksmith who puts on horse shoes

2B) This reaction would be classified as synthesis

2D) Where is this molecule found?

HCl is found in the stomach acid and breaks down the food you eat

3B) This reaction would be classified as synthesis

3D) When Mg burns, what does it give off?

Mg gives off an intense white light used in fireworks.

4B) This reaction would be classified as synthesis

4D) What did this reaction do?

It blew up the Hindenburg (luxury blimp)

5B) This reaction would be classified as Decomposition

5D) What are some unique things about Hg?

It is a metal that is a liquid at room temperature, used in thermometers.

6B) This reaction would be classified as single displacement

6D) What gas is produced in this reaction?

Hydrogen gas

7B) This reaction would be classified as combustion

7D) Where is CH₄ found?

methane is found in natural gas

8B) This reaction would be classified as Double Displacement

8D) What is H₂O₂ and what is it used for?

Hydrogen peroxide is used to sterilize contact lenses.

9B) This reaction would be classified as Synthesis

9D) What is ammonia used for?

Fertilizer and explosives

10B) This reaction would be classified as synthesis

10D) When Aluminum oxidizes, it's called?

Rust

11B) This reaction would be classified as Decomposition

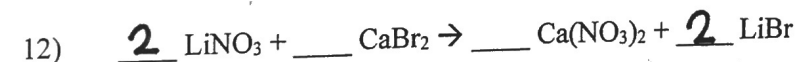
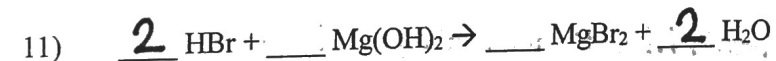
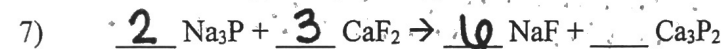
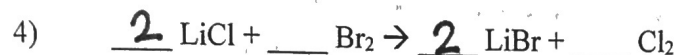
11D) What does "Pyrolysis" mean?

To breakdown with fire

Balancing Equations Practice



Balanced!



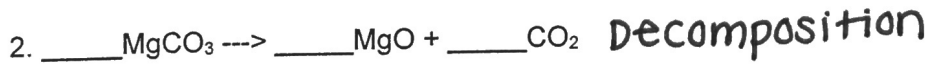
Balanced!

Types of Reactions Practice

Balance and identify the types of reactions for each of the following:



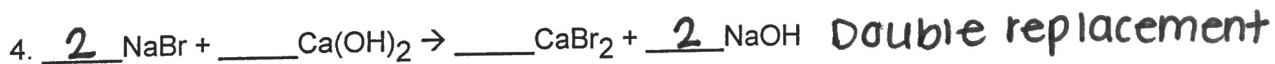
Synthesis



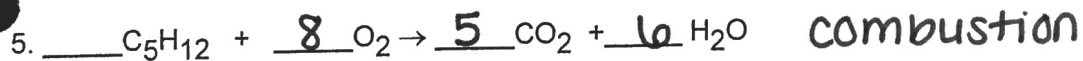
Decomposition



single replacement



Double replacement



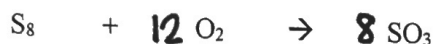
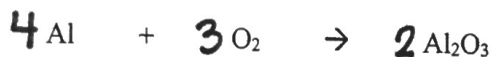
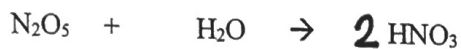
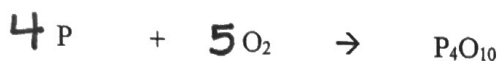
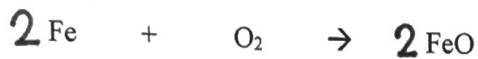
combustion

Types of Chemical Reactions

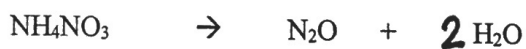
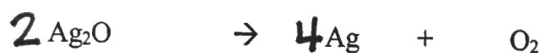
Directions:

- Balance the elements one at a time using coefficients. A coefficient is a whole number that appears in front of a formula in an equation. When no coefficient is written, it is assumed to be 1. It is best to begin with an element other than Hydrogen or Oxygen. These two elements often occur more than twice in an equation.
- Do NOT balance an equation by changing the subscripts in a chemical formula.
- Check each atom or polyatomic ion to be sure that the equation is balanced.
- Make sure that all the coefficients are in the lowest possible ratio.
- Find the commonalities in the set of reactions and label that set with the appropriate name.

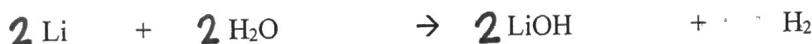
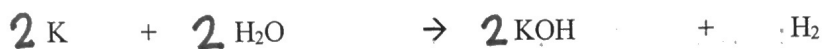
Type: synthesis. Two or more substance react to form a single substance.



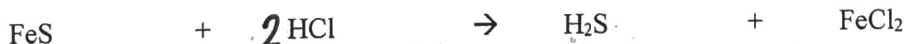
Type: decomposition. A single compound is broken down into two or more products.



Type: Single Replacement. Atoms of an element replace the atoms of a second element in a compound.



Type: Double Replacement. Involves an exchange of positive ions between two compounds.



* These are acid-base reactions which are a specific type of d.r. that always produce salt (ionic compound) and water!

Type: Combustion. Oxygen reacts with a hydrocarbon producing carbon dioxide and water (and energy in the form of heat and light)



Types of Reactions Practice

Section 1: Identify the type of reaction

For the following reactions, indicate whether the following are examples of synthesis, decomposition, combustion, single displacement, double displacement, or acid base.

- 1) $\text{Na}_3\text{PO}_4 + 3 \text{KOH} \rightarrow 3 \text{NaOH} + \text{K}_3\text{PO}_4$ double displacement
- 2) $\text{MgCl}_2 + \text{Li}_2\text{CO}_3 \rightarrow \text{MgCO}_3 + 2 \text{LiCl}$ double displacement
- 3) $\text{C}_6\text{H}_{12} + 9 \text{O}_2 \rightarrow 6 \text{CO}_2 + 6 \text{H}_2\text{O}$ Combustion
- 4) $\text{Pb} + \text{FeSO}_4 \rightarrow \text{PbSO}_4 + \text{Fe}$ Single displacement
- 5) $\text{CaCO}_3 \rightarrow \text{CaO} + \text{CO}_2$ decomposition
- 6) $\text{P}_4 + 3 \text{O}_2 \rightarrow 2 \text{P}_2\text{O}_3$ Synthesis
- 7) $2 \text{RbNO}_3 + \text{BeF}_2 \rightarrow \text{Be}(\text{NO}_3)_2 + 2 \text{RbF}$ double displacement
- 8) $\text{O}_3 \rightarrow \text{O} + \text{O}_2$ decomposition
- 9) $\text{C}_3\text{H}_6\text{O} + 4 \text{O}_2 \rightarrow 3 \text{CO}_2 + 3 \text{H}_2\text{O}$ Combustion
- 10) $2 \text{C}_5\text{H}_5 + \text{Fe} \rightarrow \text{Fe}(\text{C}_5\text{H}_5)_2$ Synthesis

Section 2: Practicing equation balancing

Balance these equations, Then Classify!

- 1) $\underline{2} \text{C}_6\text{H}_6 + \underline{\quad} \text{O}_2 \rightarrow \underline{6} \text{H}_2\text{O} + \underline{\quad} \text{CO}_2$ combustion
- 2) $\underline{4} \text{NaI} + \underline{\quad} \text{Pb}(\text{SO}_4)_2 \rightarrow \underline{\quad} \text{PbI}_4 + \underline{2} \text{Na}_2\text{SO}_4$ double displacement
- 3) $\underline{4} \text{NH}_3 + \underline{5} \text{O}_2 \rightarrow \underline{4} \text{NO} + \underline{6} \text{H}_2\text{O}$ double displacement
- 4) $\underline{2} \text{Fe}(\text{OH})_3 \rightarrow \underline{\quad} \text{Fe}_2\text{O}_3 + \underline{3} \text{H}_2\text{O}$ decomposition
- *5) $\underline{2} \text{HNO}_3 + \underline{\quad} \text{Mg}(\text{OH})_2 \rightarrow \underline{2} \text{H}_2\text{O} + \underline{\quad} \text{Mg}(\text{NO}_3)_2$ acid-base
- 6) $\underline{\quad} \text{H}_3\text{PO}_4 + \underline{3} \text{NaBr} \rightarrow \underline{3} \text{HBr} + \underline{\quad} \text{Na}_3\text{PO}_4$ double displacement
- 7) $\underline{3} \text{C} + \underline{4} \text{H}_2 \rightarrow \underline{\quad} \text{C}_3\text{H}_8$ synthesis
- 8) $\underline{2} \text{CaO} + \underline{\quad} \text{MnI}_4 \rightarrow \underline{\quad} \text{MnO}_2 + \underline{2} \text{CaI}_2$ double displacement
- 9) $\underline{\quad} \text{Fe}_2\text{O}_3 + \underline{3} \text{H}_2\text{O} \rightarrow \underline{2} \text{Fe}(\text{OH})_3$ synthesis
- 10) $\underline{\quad} \text{C}_2\text{H}_2 + \underline{2} \text{H}_2 \rightarrow \underline{\quad} \text{C}_2\text{H}_6$ synthesis
- 11) $\underline{2} \text{VF}_5 + \underline{10} \text{HI} \rightarrow \underline{\quad} \text{V}_2\text{I}_{10} + \underline{10} \text{HF}$ double displacement

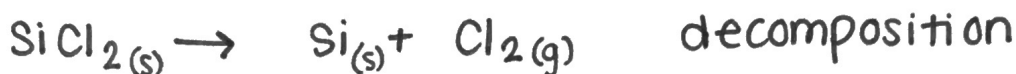
Translating Practice

Create an equation from these reaction sentences. Once you have written the reaction, balance it and classify it.

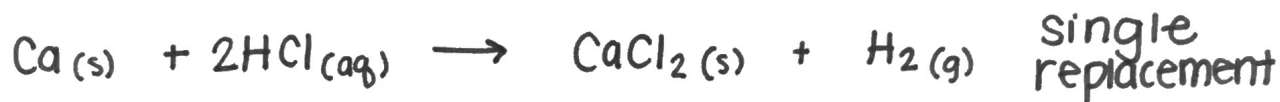
1. Hydrogen reacts with oxygen to produce water.



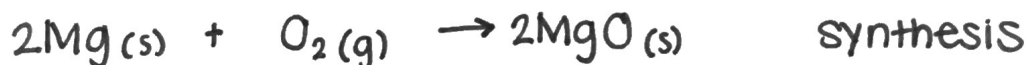
2. Silicon chloride decomposes to silicon and chlorine.



3. Calcium combines with hydrochloric acid to produce calcium chloride and hydrogen gas.



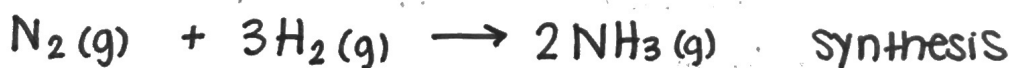
4. Magnesium reacts with oxygen to produce magnesium oxide.



5. Iron combines with fluorine to produce iron (III) fluoride.



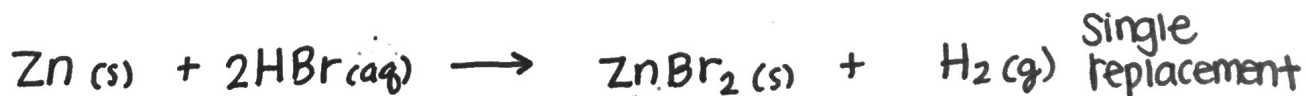
6. Nitrogen gas and hydrogen gas react to form ammonia gas. (NH_3)



7. Barium reacts with sulfur to form barium sulfide.



8. Zinc metal reacts with hydrobromic acid to form zinc (II) bromide and hydrogen gas.



9. Gold (III) oxide decomposes into gold and oxygen.



Oxidation and Reduction Practice

1. Determine the oxidation number of each atom in the following substances

a. NaF Name of compound: sodium fluoride Ox #: N +1 F -1

b. K₂CO₃ Name of compound: potassium carbonate Ox #: K +1 CO₃ -2

c. Fe(NO₃)₂ Name of compound: iron (II) nitrate Ox #: Fe +2 NO₃ -1

d. HCl Name of compound: hydrochloric acid Ox #: H +1 Cl -1

2. For the following balanced redox reaction answer the following questions



a. What is the oxidation number of Magnesium when in a bond? +2

b. What is the element that is oxidized? Na

c. What is the element that is reduced? Mg

d. What is the reducing agent? Na

e. What part of the equation does not change its charge? NO₃⁻¹ (nitrate ion)

Oxidation/Reduction Practice

Give the oxidation number of each kind of atom or ion.

a. SO_4^{2-}	b. Sn	c. S^{2-}	d. Fe^{3+}	e. Sn^{4+}	f. NO_3^{1-}	g. NH_4^+
-2	0	-2	+3	+4	-1	+1

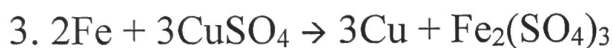
Determine the oxidation numbers of each element below. Use that information to identify what has been oxidized and reduced, and what is the oxidizing agent and reducing agent.



Oxidized: **Sr** Reduced: **O** Oxidizing Agent: **O** Reducing Agent: **Sr**



Oxidized: **Li** Reduced: **S** Oxidizing Agent: **S** Reducing Agent: **Li**



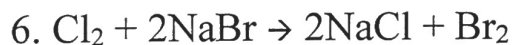
Oxidized: **Fe** Reduced: **Cu** Oxidizing Agent: **Cu** Reducing Agent: **Fe**



Oxidized: **Mg** Reduced: **N** Oxidizing Agent: **N** Reducing Agent: **Mg**



Oxidized: **Fe** Reduced: **O** Oxidizing Agent: **O** Reducing Agent: **Fe**



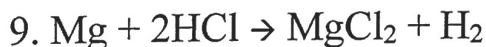
Oxidized: **Br** Reduced: **Cl** Oxidizing Agent: **Cl** Reducing Agent: **Br**



Oxidized: **Si** Reduced: **F** Oxidizing Agent: **F** Reducing Agent: **Si**



Oxidized: **K** Reduced: **Al** Oxidizing Agent: **Al** Reducing Agent: **K**



Oxidized: **Mg** Reduced: **H** Oxidizing Agent: **H** Reducing Agent: **Mg**

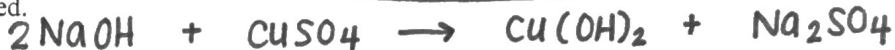


Oxidized: **H** Reduced: **Na** Oxidizing Agent: **Na** Reducing Agent: **H**

Chemical Processes Practice

1. For the following reactions, underline the reactants and circle the products. *If the reaction is written in words, re-write it using chemical formulas:*

a. In the reaction of sodium hydroxide and copper (II) sulfate, copper (II) hydroxide is precipitated and a solution of sodium sulfate is produced.



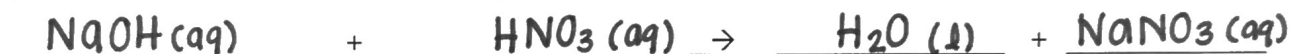
b. Cu(OH)₂ → CuO + H₂O

c. Dinitrogen tetraoxide can be decomposed into two molecules of nitrogen dioxide.



d. HCl + KOH → KCl + H₂O

2. Write an equation for the reaction of aqueous sodium hydroxide with a solution of nitric acid to produce water and aqueous sodium nitrate. Then circle what chemical process that has done (has the substance has dissolved, dissociated, ionized, or precipitated?). Next, draw the solutions interacting with water in the beakers below.

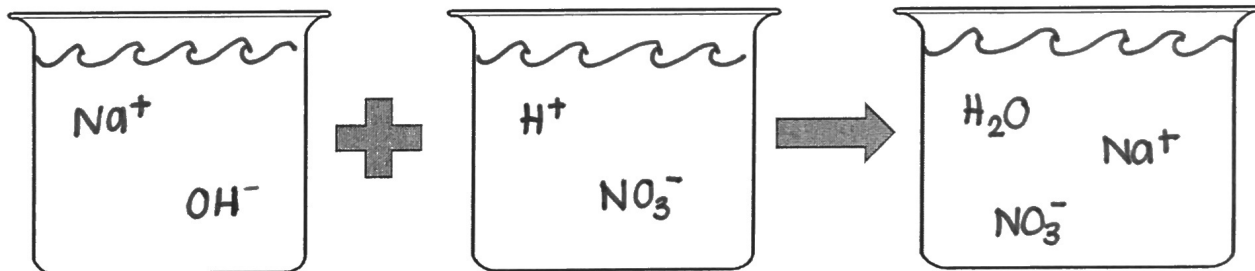


dissolve
dissociate
ionize
precipitate
no interaction

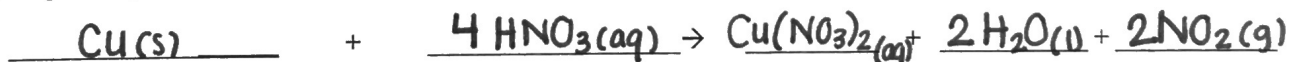
dissolve
dissociate
ionize
precipitate
no interaction

dissolve
dissociate
ionize
precipitate
no interaction

dissolve
dissociate
ionize
precipitate
no interaction



3. Write an equation for the reaction of solid copper with a solution of nitric acid to produce aqueous copper (II) nitrate, nitrogen dioxide gas, and water. Then circle what chemical process that has done (has the substance has dissolved, dissociated, ionized, or precipitated?). Next, draw the solutions interacting with water in the beakers below.



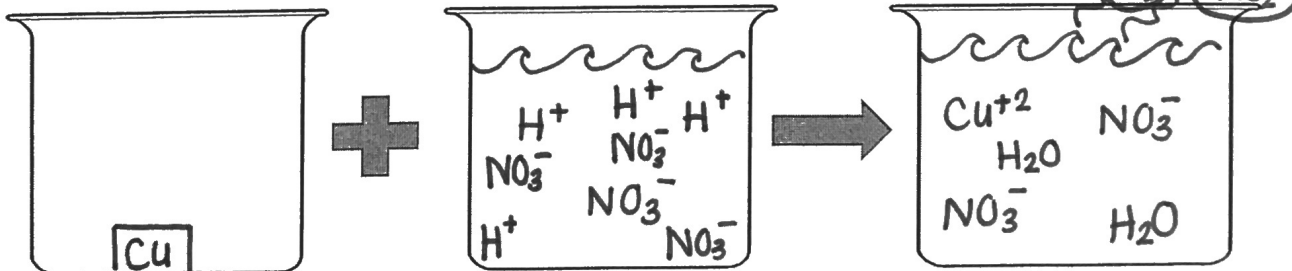
dissolve
dissociate
ionize
precipitate
no interaction

dissolve
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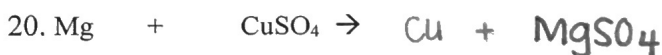
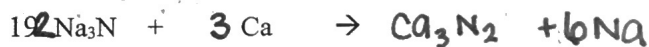
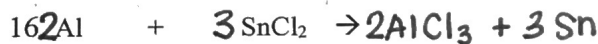
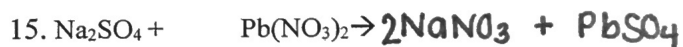
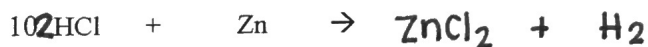
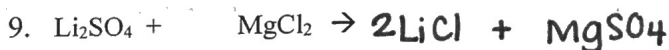
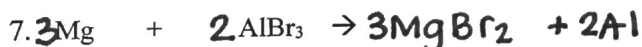
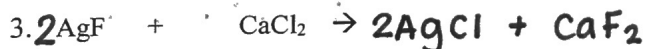


Predicting Products Practice

Complete the reactions by writing the products. Remember: when you form an element, don't forget about the 7 diatomic gases (Br_2 , I_2 , N_2 , Cl_2 , H_2 , O_2 , F_2) and balance ionic formulas!

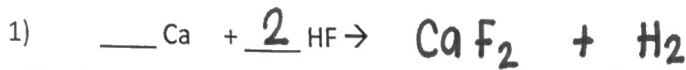
Synthesis (addition) Reactions:	Decomposition Reactions:	Single Replacement Reactions:
$2Na + Cl_2 \rightarrow 2NaCl$	$2MgO \rightarrow 2Mg + O_2$	$2AgCl + Mg \rightarrow 2Ag + MgCl_2$
$O_2 + 4K \rightarrow 2K_2O$	$2AlCl_3 \rightarrow 2Al + 3Cl_2$	$3Ca + 2FeF_3 \rightarrow 3CaF_2 + 2Fe$
$H_2 + F_2 \rightarrow 2HF$	$2H_2O \rightarrow 2H_2 + O_2$	$6HCl + 2Al \rightarrow 2AlCl_3 + 3H_2$
$6Li + N_2 \rightarrow 2Li_3N$	$CaS \rightarrow Ca + S$	$KBr + Li \rightarrow LiBr + K$
$Ca + Cl_2 \rightarrow CaCl_2$	$2NF_3 \rightarrow N_2 + 3F_2$	$6Cl_2 + 2Al_2O_3 \rightarrow 4AlCl_3 + 3O_2$
Double Replacement Reactions:	Combustion Reactions:	
$3CaCl_2 + Al_2O_3 \rightarrow 2AlCl_3 + 3CaO$	$CH_4 + 2O_2 \rightarrow CO_2 + 2H_2O$	
$2LiCl + Pb(NO_3)_2 \rightarrow 2LiNO_3 + PbCl_2$	$C_5H_{12} + 8O_2 \rightarrow 5CO_2 + 6H_2O$	
$Na_2SO_4 + CaCl_2 \rightarrow 2NaCl + CaSO_4$	$2C_6H_6 + 15O_2 \rightarrow 12CO_2 + 6H_2O$	
$3HCl + K_3PO_4 \rightarrow H_3PO_4 + 3KCl$	$C_2H_5OH + 3O_2 \rightarrow 2CO_2 + 3H_2O$	
$2HBr + Ca(OH)_2 \rightarrow 2H_2O + CaBr_2$	$C_{12}H_{22}O_{11} + 11O_2 \rightarrow 11CO_2 + 11H_2O$	

Identify the type of reaction and determine the products for the following reactions (Use reactivity and solubility charts!)



Unit 7 Review:

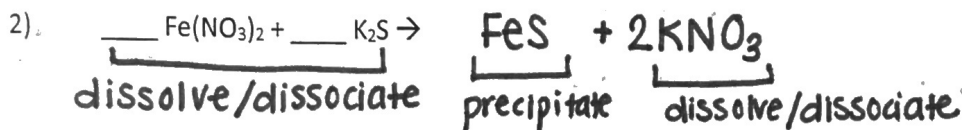
For each of the following reactions, determine what the products of each reaction will be. Then balance, then translate into words, then classify the type of reaction. Determine if it is a redox reaction. If it is a double displacement or acid-base reaction, describe the chemical processes of each reactant and product.



Redox Reaction. Ca is oxidized
H is reduced

Type of reaction: single replacement

Calcium reacts with hydrofluoric acid to produce calcium fluoride and hydrogen gas.



Type of reaction: double replacement

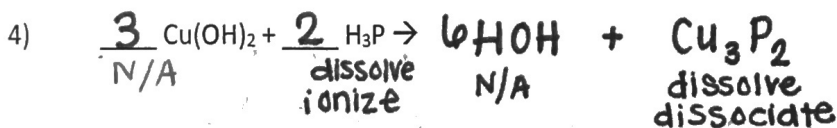
iron (II) nitrate reacts with potassium sulfide to yield iron(II) sulfide and potassium nitrate.



Redox Reaction. Na is oxidized
Cl is reduced

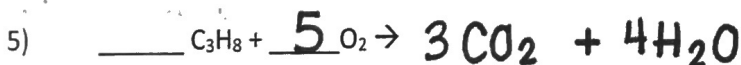
Type of reaction: Synthesis

Sodium metal and chlorine gas are reacted to produce sodium chloride.



Type of reaction: acid-base

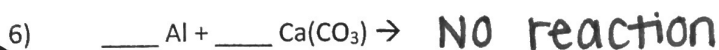
copper (II) hydroxide and hydrophosphoric acid react to produce water and copper (II) phosphide.



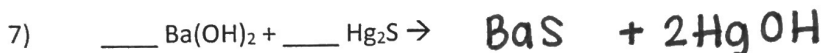
Redox Reaction.

Type of reaction: Combustion

propane reacts with oxygen gas to produce carbon dioxide and water.

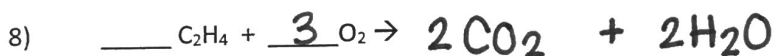


Type of reaction: _____



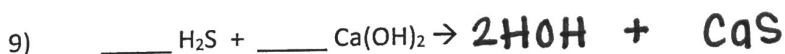
Type of reaction: double replacement

Barium hydroxide reacts with mercury (I) sulfide to produce Barium sulfide and mercury (I) hydroxide.



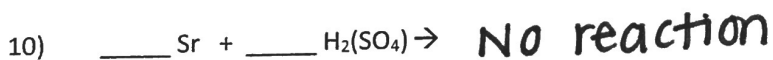
Type of reaction: Combustion

dicarbon tetrahydride combusts with oxygen gas to produce carbon dioxide and water.



Type of reaction: acid-base

Hydrosulfuric acid reacts with calcium hydroxide to produce water and calcium sulfide.



Type of reaction: _____