

Name.....

Period.....

**Unit 7: Reactions and Stoichiometry.....Time to Over React**

**Skills:**

1. Identify the when a reaction has taken place based on chemical change
2. Use REP table to given balance reactions
3. Identify Single Replacement, Combustion and Decomposition Rxns
4. Complete SR reactions given reactants
5. Balance and ID Double replacement rxns
6. Predict unknown reactants and products
7. Convert between mole quantities

**Unit 7: Vocabulary:**

Complete throughout unit. Due on test day!

<u>Word</u>	<u>Definition</u>
<u>Reaction</u>	
<u>Reactant</u>	
<u>Product</u>	
<u>Chemical Change</u>	
<u>Yield</u>	
<u>Precipitate</u>	
<u>Balanced</u>	
<u>Combustion</u>	
<u>Single Replacement</u>	
<u>Double Replacement</u>	
<u>Stoichiometry</u>	

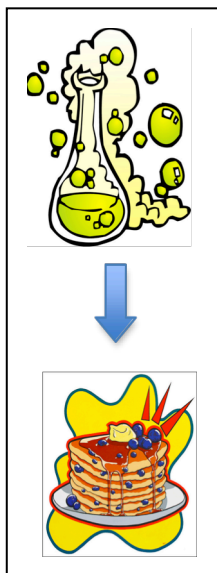
*Unit 7 Resources:*



## Skill 1: Identify occurrence of a chemical reaction based on chemical change indicator

### Chemical Equations

A chemical equation shows what takes place during a chemical reaction. Let's break down the elements of a chemical equation... (hehehe)



Symbol/Vocabulary	Explanation	Pancake Model
	The "Ingredients" of a chemical reaction!	
	The end result!	
	"Yields," separates reactants from products	
(s), (l), (g)		
	Designates an aqueous solution; the substance is dissolved in water.	
Coefficient		

Remember.....

**Chemical** means a breaking and reforming of bonds!

**Physical** means a phase change!

**Determine if a chemical reaction has taken place in the below situations:**

- |   |   |
|---|---|
| <input type="checkbox"/> Breaking Glass _____   | <input type="checkbox"/> Digesting Sugar _____  |
| <input type="checkbox"/> Dissolving Sugar _____ | <input type="checkbox"/> Burning Gasoline _____ |
| <input type="checkbox"/> Rusting iron _____     | <input type="checkbox"/> Forming Ozone _____    |
| <input type="checkbox"/> Boiling Water _____    | <input type="checkbox"/> Cooking Eggs _____     |

**Record all evidence of chemical change that you observe:**

**Reaction 1:**

**Reaction 2:**

**Skill 2: Use REP or other Method to balance Chemical Equations**

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**Problem:** The above chemical reaction breaks the Law of Conservation of Mass:

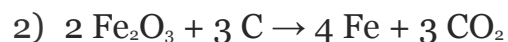
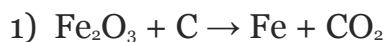
Matter is neither \_\_\_\_\_ or \_\_\_\_\_ in a chemical reaction.

So... the \_\_\_\_\_ of atoms must remain \_\_\_\_\_ in a reaction

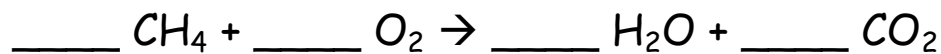
**Solution: Balancing Equations:** \_\_\_\_\_ are used to balance the number of atoms of each element on both sides of the reaction. Coefficients must be the \_\_\_\_\_ whole number that balance the reaction.

**Number and kind of elements on the left (Reactants) is equal to the number and kind on the right (Products)!**

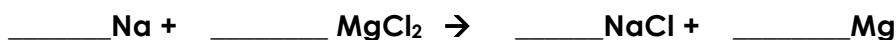
**Determine which of the below reactions is balanced:**



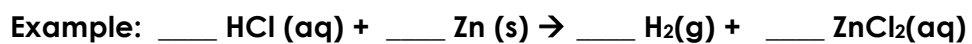
**Balancing Reaction Coefficients:**



**Challenge Balance:**

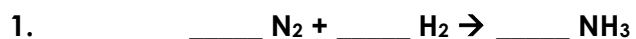


Using the REP Method:



Reactants	Elements	Products
	H	
	Cl	
	Zn	

**Examples:** Balance the following chemical reactions



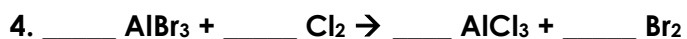
	Elements	



	Elements	



	Elements	



	Elements	

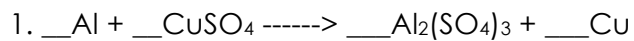


	Elements	



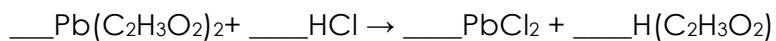
	Elements	

When a polyatomic ion is present AND it stays completely \_\_\_\_\_ during the reaction!



R	E	P
	Al	
	Cu	
	SO <sub>4</sub>	

2.



R	E	P
	Pb	
	H	
	Cl	
	(C <sub>2</sub> H <sub>3</sub> O <sub>2</sub> )	

If a polyatomic ion is present on one side of the equation and not on the other, you are forced to \_\_\_\_\_ it apart and balance each atom.



R	E	P
	S	
	O	
	H	

### Skill 3: Identify Synthesis, Single Replacement, Combustion and Decomposition Rxns

**Synthesis:** When two or more reactants combine to form \_\_\_\_\_ product

□ **General Equation:** \_\_\_\_\_

#### Balancing:

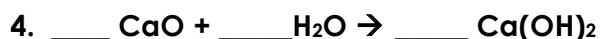
Balance the following reactions:



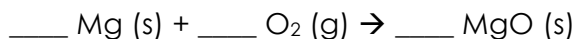
	Elements	



	Elements	



**Real World Example:** Magnesium and Oxygen combine to form Magnesium Oxide!

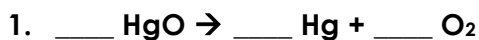


**Decomposition:** A \_\_\_\_\_ compound is \_\_\_\_\_ down ( \_\_\_\_\_ )  
into \_\_\_\_\_ or \_\_\_\_\_ substances

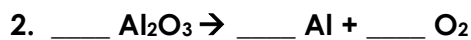
□ **General Equation:** \_\_\_\_\_

#### Balancing:

Balance the following synthesis reactions:



	Elements	



	Elements	



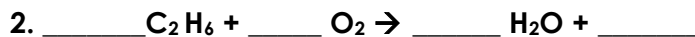
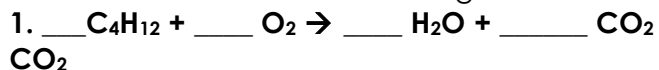
**Real World Example:** Hydrogen peroxide decomposes into water and oxygen!

**Combustion:** An \_\_\_\_\_ compound (contains \_\_\_\_ and \_\_\_\_ ) reacts with \_\_\_\_\_ and creates ONLY \_\_\_\_\_ and \_\_\_\_\_

□ **General Equation:** \_\_\_\_\_

**Balancing:**

Balance the following reactions:



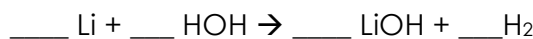
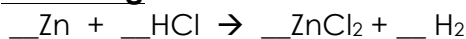
	Elements	

**Skill 4: Complete SR reactions given reactants**

**Single Replacement Reactions:** For a single replacement reaction to occur, the lone metal listed must be \_\_\_\_\_ on Reference Table J than the metal in the compound in order for it to “\_\_\_\_\_” the metal in the compound.

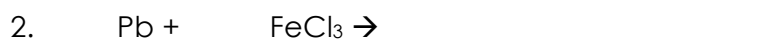
□ **General Equation:** \_\_\_\_\_

**Balancing:**



**Finish the Chemical Reaction:**

Use Table J to see if the following reactions can occur. If it can, write the product and balance the equation (if necessary).



Most Active	Metals	Nonmetals	Most Active
	Li	F <sub>2</sub>	
	Rb	Cl <sub>2</sub>	
	K	Br <sub>2</sub>	
	Cs	I <sub>2</sub>	
	Ba		
	Sr		
	Ca		
	Na		
	Mg		
	Al		
	Ti		
	Mn		
	Zn		
	Cr		
	Fe		
	Co		
	Ni		
	Sn		
	Pb		
	H <sub>2</sub>		
	Cu		
	Ag		
	Au		
Least Active			Least Active

\*\*Activity Series is based on the hydrogen standard. H<sub>2</sub> is *not* a metal.

## Skill 5: Balance and ID Double replacement rxns with Table F

### Language Double Replacement Reactions:

**Solubility:** How well substances \_\_\_\_\_ in water.

**Insoluble (s):** Substances that \_\_\_\_\_ dissolve...precipitate!

**Soluble (aq):** A substances that \_\_\_\_\_ dissolve

### Double Replacement Rule:

**Table F**  
**Solubility Guidelines for Aqueous Solutions**

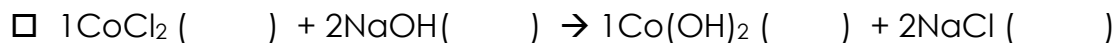
Ions That Form Soluble Compounds	Exceptions	Ions That Form Insoluble Compounds*	Exceptions
Group 1 ions (Li <sup>+</sup> , Na <sup>+</sup> , etc.)		carbonate (CO <sub>3</sub> <sup>2-</sup> )	when combined with Group 1 ions or ammonium (NH <sub>4</sub> <sup>+</sup> )
ammonium (NH <sub>4</sub> <sup>+</sup> )		chromate (CrO <sub>4</sub> <sup>2-</sup> )	when combined with Group 1 ions, Ca <sup>2+</sup> , Mg <sup>2+</sup> , or ammonium (NH <sub>4</sub> <sup>+</sup> )
nitrate (NO <sub>3</sub> <sup>-</sup> )		phosphate (PO <sub>4</sub> <sup>3-</sup> )	when combined with Group 1 ions or ammonium (NH <sub>4</sub> <sup>+</sup> )
acetate (C <sub>2</sub> H <sub>3</sub> O <sub>2</sub> <sup>-</sup> or CH <sub>3</sub> COO <sup>-</sup> )		sulfide (S <sup>2-</sup> )	when combined with Group 1 ions or ammonium (NH <sub>4</sub> <sup>+</sup> )
hydrogen carbonate (HCO <sub>3</sub> <sup>-</sup> )		hydroxide (OH <sup>-</sup> )	when combined with Group 1 ions, Ca <sup>2+</sup> , Ba <sup>2+</sup> , Sr <sup>2+</sup> , or ammonium (NH <sub>4</sub> <sup>+</sup> )
chlorate (ClO <sub>3</sub> <sup>-</sup> )			
halides (Cl <sup>-</sup> , Br <sup>-</sup> , I <sup>-</sup> )	when combined with Ag <sup>+</sup> , Pb <sup>2+</sup> , or Hg <sub>2</sub> <sup>2+</sup>		
sulfates (SO <sub>4</sub> <sup>2-</sup> )	when combined with Ag <sup>+</sup> , Ca <sup>2+</sup> , Sr <sup>2+</sup> , Ba <sup>2+</sup> , or Pb <sup>2+</sup>		

\*compounds having very low solubility in H<sub>2</sub>O

Used to determine if a substance is soluble or not!

**Examples:** CuNO<sub>3</sub> \_\_\_\_\_ HCl \_\_\_\_\_ Ca<sub>3</sub>(PO<sub>4</sub>)<sub>2</sub> \_\_\_\_\_ Ba(OH)<sub>2</sub> \_\_\_\_\_

### DR Reactions:





## Skill 6: Predict unknown reactants and products

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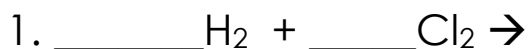
### General Equations

- Synthesis:  $A + B \rightarrow AB$
- Decomposition:  $AB \rightarrow A + B$
- Single Replacement:  $A + BX \rightarrow B + AX$
- Double Replacement:  $AX_{(aq)} + BY_{(aq)} \rightarrow AY + BX$
- Combustion: Organic Compound +  $O_2 \rightarrow CO_2 + H_2O$

Remember: Diatomic Elements are elements that come in pairs!

**BRINCIHOF**

### Synthesis:



- 1) From your notes, write the GENERAL reaction for given type.

- 2) Determine if a reaction will occur. Explain.

- 3) Predict products (above).

- 4) Balance reaction (above)

### Single Replacement



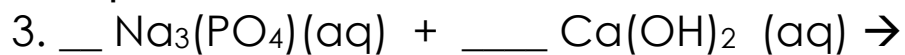
- 1) From your notes, write the GENERAL reaction for given type.

- 2) Determine if a reaction will occur. Explain.

- 3) Predict products (above).

- 4) Balance reaction (above)

### Double Replacement



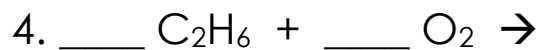
- 1) From your notes, write the GENERAL reaction for given type.

- 2) Determine if a reaction will occur. Explain.

- 3) Predict products (above).

- 4) Balance reaction (above)

### Combustion:



- 1) From your notes, write the GENERAL reaction for given type.

- 2) Determine if a reaction will occur. Explain.

- 3) Predict products (above).

- 4) Balance reaction (above)

## Skill 7: Convert between mole quantities

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**Stoichiometry:** This is the word for that part of chemistry that involves the mass and volume relationships in chemical changes.

### Four Steps:

1. Write the balanced equation.
2. Identify the number of moles of the given substance (from the question!)
3. Circle the coefficients of required substance to moles of given substance (Mole Ratio).

4. Set up: *Given*  $\circ \frac{\text{Coefficient of what you want}}{\text{Coefficient of what you are given}} = \text{_____ mols}$

**Example 1:** \_\_\_\_ H<sub>2</sub> + \_\_\_\_ O<sub>2</sub> → \_\_\_\_ H<sub>2</sub>O

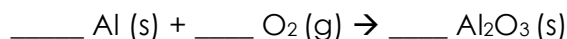
- How many moles of each of the substances? \_\_\_\_ H<sub>2</sub> \_\_\_\_ O<sub>2</sub> \_\_\_\_ H<sub>2</sub>O
- What is the mole ratio of O<sub>2</sub> to H<sub>2</sub>? 

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- If I want to burn 5 moles of O<sub>2</sub>, how many moles of H<sub>2</sub> gas is needed?

**Example 2:** How many moles of ammonia (NH<sub>3</sub>) are produced when 0.60 mole of nitrogen reacts with hydrogen? (First balance!)

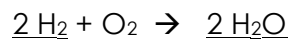


**Example 3:** How many moles of aluminum are needed to form 3.7 mol of Al<sub>2</sub>O<sub>3</sub>? (first balance)



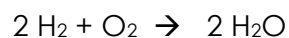
**PRACTICE:**

1. Given the balanced equation:



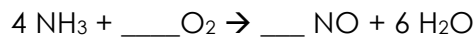
**How much water will be produced  
if 5 moles of  $\text{H}_2$  is completely reacted?**

2. Given the balanced equation:



**How much oxygen will be consumed  
if 5 moles of  $\text{H}_2$  is completely reacted?**

3. Given the unbalanced equation:



**If 12 moles of  $\text{O}_2$  are consumed, how  
Many moles of  $\text{NO}$  are produced?**

4. Given the unbalanced equation:



**If 3 moles of  $\text{O}_2$  are completely  
consumed, how Many moles of  $\text{NH}_3$   
are consumed?**