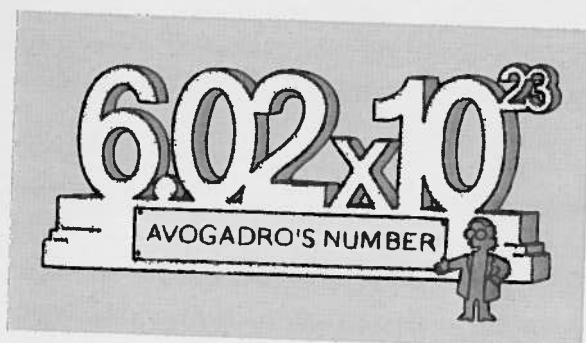


Mass to moles:
 Moles = $\frac{\text{grams}}{1 \text{ mole}} = \text{grams}$
 Moles to mass:
 Grams = $\frac{1 \text{ mole}}{\text{grams}} = \text{moles}$

Unit 8: Stoichiometry & the Mole

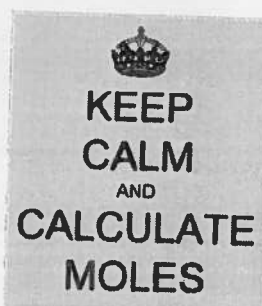


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Unit 8: Stoichiometry Vocabulary

1. Formula mass	
2. Gram formula mass	
3. Mole	
4. Percentage composition	
5. Synthesis reaction	
6. Decomposition reaction	
7. Single replacement reaction	
8. Double replacement reaction	
9. Precipitate	
10. Empirical formula	
11. Molecular formula	
12. Molecule	
13. Qualitative	
14. Quantitative	
15. Avogadro's number	

16. Hydrate	
17. Anhydrous	

--

Formulas and Equations Vocabulary

1. Coefficient	
2. Decomposition	
3. Double replacement	
4. Empirical formula	
5. Molecular formula	
6. Molecule	
7. Polyatomic ion	
8. Product	
9. Qualitative	
10. Quantitative	
11. Reactant	
12. Single replacement	
13. Subscript	
14. Synthesis	

Topic 8: Stoichiometry & the Mole
8.1: Formula and Gram Formula Mass

Aim: _____

- **Formula Mass**

- Formula mass _____

- The sum _____



- **Gram Formula Mass**

- Gram formula mass _____



- **Regents Questions**

- What is the gram formula mass of $Ca(OH)_2$?

- What is the gram molecular mass of the compound with the formula CH_3COOH ?

- What is the formula mass of $MgBr_2 \cdot 6H_2O$?

A. Counting Atoms and Gram Formula Mass

Chemical Formula	Elements present	# of each element	atomic mass of element	Total mass of each element	Gram formula mass of compound
KClO_3					
Na_2SO_4					
$2 \text{Na}_2\text{SO}_4$					
$\text{Mg}(\text{OH})_2$					
$(\text{NH}_4)_3\text{PO}_4$					

Chemical formula	Elements present	# of each element	Atomic mass of element	Total mass of element	Gram formula mass of formula
CH_3COOH					
$\text{CH}_3\text{CH}_2\text{OH}$					
$2 \text{Ca} (\text{SCN})_2$					
$\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$					
$\text{CuCl}_2 \cdot 6\text{H}_2\text{O}$					

Name _____

Date _____

GFM Questions

1. What is the gram formula mass of $\text{Na}_2\text{CO}_3 \cdot 10\text{H}_2\text{O}$?

307

- 1) 106 g
2) 142 g

- 3) 266 g
4) 286 g

2. What is the gram formula mass of $(\text{NH}_4)_2\text{SO}_4$?

- 1) 66.0 g
2) 94.0 g

- 3) 114 g
4) 132 g

3. What is the gram molecular mass of 1 mole of $\text{C}_3\text{H}_7(\text{OH})_3$?

- 1) 48 g
2) 58 g

- 3) 74 g
4) 92 g

4. Which substance has the greatest molecular mass?

- 1) H_2O_2
2) NO

- 3) CF_4
4) I_2

5. The molar mass of $\text{Ba}(\text{OH})_2$ is

- 1) 154.3 g
2) 155.3 g

- 3) 171.3 g
4) 308.6 g

6. The following procedures are carried out during a laboratory activity to determine the mass in grams of CuSO_4 in a hydrated sample of $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$.

- Step 1 Determine the mass in grams of the crucible and $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$.
- Step 2 Determine the mass in grams of the crucible and CuSO_4 .
- Step 3 Determine the mass in grams of $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$.
- Step 4 Determine the mass in grams of the empty crucible.
- Step 5 Determine the mass in grams of CuSO_4 .

Arrange the steps above in the order that the student should use to determine the mass of CuSO_4 in the sample.

Topic 8: Stoichiometry & the Mole
8.2: Percentage Composition of Hydrates

Aim:

• **Percentage Composition**

- Represents _____

- Use _____
- Formula _____
$$\% \text{ composition by mass} = \frac{\text{mass of part}}{\text{mass of whole}} \times 100$$
- What is the percentage of oxygen in potassium chlorate?

• **Hydrates**

- _____: crystals that contain attached water molecules
 - _____: substances without water
- $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$
 - Must include _____
 - Calculate _____
- What is the percentage, by mass, of water in sodium carbonate crystals?

- **Regents Questions**

- What is the percent by mass of nitrogen in NH_4NO_3 ?

- What is the percent by mass of oxygen in magnesium oxide?

- What is the percent by mass of oxygen in Fe_2O_3 ? The formula mass of $\text{Fe}_2\text{O}_3 = 160$ amu.

- What is the percent by mass of water in $\text{BaCl}_2 \cdot 2\text{H}_2\text{O}$ (formula mass = 243 amu)?

- What is the percent by mass of water present in $\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$?

PERCENTAGE COMPOSITION

Name _____

Determine the percentage composition of each of the compounds below.



K = _____

Mn = _____

O = _____



H = _____

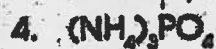
Cl = _____



Mg = _____

N = _____

O = _____



N = _____

H = _____

P = _____

O = _____



Al = _____

S = _____

O = _____

Solve the following problems.

6. How many grams of oxygen can be produced from the decomposition of 100. g of KClO_3 ? _____

7. How much iron can be recovered from 25.0 g of Fe_2O_3 ? _____

8. How much silver can be produced from 125 g of Ag_2S ? _____

Percent Composition: show all work

Equation: $\text{percent composition} = \frac{\text{Mass of part}}{\text{mass of whole}} \times 100$

1. H₂O

% of H _____

% of O _____

2. Mg(OH)₂

% of Mg _____

% of O _____

% of H _____

3. Sodium Bromide

% of sodium _____

% of bromide _____

4. Magnesium Carbonate

% of Mg _____

% of C _____

% of O _____

5. Ammonium Sulfite

% N _____

% H _____

% S _____

% O _____

6. Copper II Chloride

% C _____

% Cl _____

7. Aluminum Acetate

% Al _____

% C _____

% H _____

% O _____

8. $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$

% Cu _____

% S _____

% O _____

% H_2O _____

COMPOSITION OF HYDRATES

Name _____

A hydrate is an ionic compound with water molecules loosely bonded to its crystal structure. The water is in a specific ratio to each formula unit of the salt. For example, the formula $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$ indicates that there are five water molecules for every one formula unit of CuSO_4 . Answer the questions below.

1. What percentage of water is found in $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$?

2. What percentage of water is found in $\text{Na}_2\text{S} \cdot 9\text{H}_2\text{O}$?

3. A 5.0 g sample of a hydrate of BaCl_2 was heated, and only 4.3 g of the anhydrous salt remained. What percentage of water was in the hydrate?

4. A 2.5 g sample of a hydrate of $\text{Ca}(\text{NO}_3)_2$ was heated, and only 1.7 g of the anhydrous salt remained. What percentage of water was in the hydrate?

5. A 3.0 g sample of $\text{Na}_2\text{CO}_3 \cdot \text{H}_2\text{O}$ is heated to constant mass. How much anhydrous salt remains?

6. A 5.0 g sample of $\text{Cu}(\text{NO}_3)_2 \cdot n\text{H}_2\text{O}$ is heated, and 3.9 g of the anhydrous salt remains. What is the value of n ?

Name _____

Date _____

Percent Comp Questions

1. What is the percent by mass of hydrogen in NH_3 (formula mass = 17.0)?

- 1) 5.9% 3) 21.4%
2) 17.6% 4) 82.4%

2. The approximate percent by mass of potassium in KHCO_3 is

- 1) 19% 3) 39%
2) 24% 4) 61%

3. The percent by mass of nitrogen in N_2O is

- 1) 8.0 3) 32
2) 16 4) 64

4. The percent by mass of oxygen in $\text{H}_2\text{C}_2\text{O}_4$ is equal to

- 1) $\frac{90}{64} \times 100$ 3) $\frac{8}{90} \times 100$
2) $\frac{64}{90} \times 100$ 4) $\frac{4}{8} \times 100$

5. A student determining the percent by mass of water in a hydrated sample of salt obtained the following data:

Mass of hydrate 6.25 g

Mass of sample after 1st heating 5.12 g

Mass of sample after 2nd heating 5.12 g

The correct expression for obtaining the percent by mass of water in the sample is

- 1) $\frac{5.12\text{g}}{6.25\text{g}} \times 100$ 3) $\frac{6.25\text{g}}{1.13\text{g}} \times 100$
2) $\frac{6.25\text{g}}{5.12\text{g}} \times 100$ 4) $\frac{1.13\text{g}}{6.25\text{g}} \times 100$

6. What is the approximate percent composition by mass of CaBr_2 (formula mass = 200)?

- 1) 20% calcium and 80% bromine
2) 25% calcium and 75% bromine
3) 30% calcium and 70% bromine
4) 35% calcium and 65% bromine

7. A 60. gram sample of $\text{LiCl} \cdot \text{H}_2\text{O}$ is heated in an open crucible until all of the water has been driven off. What is the total mass of LiCl remaining in the crucible?

- 1) 18 g 3) 42 g
2) 24 g 4) 60 g

8. What is the percent by mass of water present in 1.0 mole of $\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$?

- 1) 10.9% 3) 21%
2) 12% 4) 79%

Topic 8: Stoichiometry & the Mole
8.3: Empirical & Molecular Formulas

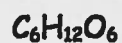
Aim:

• **Molecular Formulas**

- The _____
- Molecule _____
 - $\text{H}_2\text{O}, \text{C}_6\text{H}_{12}\text{O}_6$

• **Empirical Formulas**

- _____
- Divide out _____



• **Finding Molecular Formula from Empirical Formula**

- A compound has a molecular mass of 180 amu and an empirical formula of CH_2O . What is the molecular formula?

- **Regents Question**

- The empirical formula of a compound is CH_4 . The molecular formula of the compound could be:

- A compound with an empirical formula of CH_2 has a molecular mass of 70 amu. What is its molecular formula?

- Vitamin C has an empirical formula of $\text{C}_3\text{H}_4\text{O}_3$ and a molecular mass of 176 amu. What is its molecular formula?

- Why can't a substance have an empirical formula of NO and a gram formula mass of 45g?

Name _____

Date _____

Compounds/Formula

Part I. State whether the given formula is an empirical formula or a molecular formula

1. $S_2H_2 =$ _____
2. $CaCl_2 =$ _____
3. $K_2O =$ _____
4. $C_3H_6O_3 =$ _____
5. $NH_3 =$ _____

Part II. Given the molecular formula determine the empirical formula

1. $S_2H_2 =$ _____
2. $C_3H_6O_3 =$ _____
3. $C_6H_{12}O_6 =$ _____
4. $Al_2Cl_6 =$ _____
5. $N_2O_4 =$ _____

Part III. Determine the formula mass of the given compounds

1. $C_3H_6O_3$
2. Al_2Cl_6

Part IV. Determine the gram formula mass of the given compounds

1. $C_3H_6O_3$
2. N_2O_4

Part V. Determine the gram molecular mass of the given compounds

1. $C_3H_6O_3$
2. C_3H_5

Part VI. Given the empirical formula and the atomic mass of the compound determine the molecular formula

1. Empirical formula: CH_3 ; molecular mass = 78 amu

2. Empirical formula: CH_3 ; molecular mass = 30 amu

Part VII. Percent Composition

1. Determine the percent by mass of oxygen in Fe_2O_3

2. Determine the percent by mass of carbon in $\text{H}_2\text{C}_2\text{O}_4$

3. Determine the percent by mass of water in $\text{BaCl}_2 \cdot 2\text{H}_2\text{O}$

Name _____

Date _____

Empirical and Molecular Formulas Questions

1. Which represents both an empirical and a molecular formula?

- 1) P_2O_3 3) C_2H_5
 2) N_2O_4 4) $C_2H_{12}O_6$

2. Which is an empirical formula?

- 1) CH 3) C_2H_4
 2) C_2H_2 4) C_4H_8

3. What is the empirical formula of a compound with the molecular formula $C_6H_{12}O_6$?

- 1) $C_2H_4O_2$ 3) $C_3H_6O_3$
 2) $C_3H_6O_3$ 4) CH_2O

4. What is the empirical formula of a compound that contains 0.20 mole of nitrogen atoms and 0.40 mole of oxygen atoms?

- 1) NO_2 3) N_2O_4
 2) N_2O 4) N_4O_8

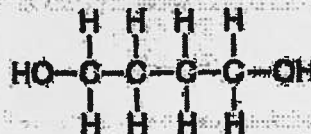
5. What is the total number of atoms represented in the formula $CuSO_4 \cdot 5H_2O$?

- 1) 8 3) 21
 2) 13 4) 27

6. Which list consists of types of chemical formulas?

- 1) atoms, ions, molecules
 2) metals, nonmetals, metalloids
 3) empirical, molecular, structural
 4) synthesis, decomposition, neutralization

7. Given the structural formula:



What is the empirical formula of this compound?

- 1) CH_3O 3) $C_7H_{10}O_2$
 2) C_7H_2O 4) $C_8H_{20}O_4$

8. The empirical formula of a compound is CH_2 . The molecular formula of this compound could be

- 1) CH_4 3) C_2H_4
 2) C_2H_2 4) C_7H_8

9. A compound has the empirical formula NO_2 . Its molecular formula could be

- 1) NO_2 3) N_4O_8
 2) N_2O 4) N_4O_4

10. A compound contains nitrogen and oxygen in the mole ratio of 1:1. The molecular mass of this compound could be

- 1) 14 3) 30
 2) 16 4) 40

11. Which formulas could represent the empirical formula and the molecular formula of a given compound?

- 1) $CH_2O, C_4H_6O_4$ 3) CH_4, C_3H_{12}
 2) $CHO, C_6H_{12}O_4$ 4) CH_2, C_3H_6

12. The formula H_2O_2 is an example of

- 1) a molecular formula 3) an ionic formula
 2) an empirical formula 4) an organic formula

Determining Molecular Formulas

1. What is the molecular formula of a compound with an empirical formula of CH and a molecular mass of 78?

- 1) C_6H_6 3) C_2H_2
 2) C_4H_{10} 4) CH

2. What is the molecular formula of a compound with the empirical formula P_2O_5 and a gram-molecular mass of 284 grams?

- 1) P_2O_5 3) $P_{10}O_4$
 2) P_5O_2 4) P_4O_{10}

3. Vitamin C has an empirical formula of $C_3H_4O_3$ and a molecular mass of 176. What is the molecular formula of vitamin C?

- 1) $C_3H_4O_3$ 3) $C_9H_{12}O_9$
 2) $C_6H_8O_6$ 4) $C_{10}H_8O_3$

4. What is the molecular formula of a compound that has a molecular mass of 42 and an empirical formula of CH ?

- 1) CH_2 3) C_3H_6
 2) C_2H_4 4) C_4H_{12}

5. A compound has an empirical formula of CH_2 and a molecular mass of 56. What is its molecular formula?

- 1) CH_2 3) C_2H_6
 2) C_2H_4 4) C_4H_8

6. If the empirical formula for an organic compound is CH_2O , then the molecular mass of the compound could be

- 1) 135 3) 45
 2) 60 4) 15

Topic 8: Stoichiometry & the Mole
8.4: The Mole

Aim:

• The Mole

- Collective _____
- The number of atoms in _____
- _____
- Cannot count _____
 - 1 mole H_2O = _____
 - How much would one mole of NaCl weigh in grams? How many particles of NaCl would be found in 1 mol?

• Mole Calculations

- Table T
- Converting Grams to Moles
 - How many moles are equivalent to 4.75g of sodium hydroxide (NaOH)?
- Converting Moles to Grams
 - How many grams are present in 40.5 mol of sulfuric acid (H_2SO_4)?

• **Regents Questions**

- How many moles are equivalent to 39 g of LiF?
- What is the total mass of 0.75 mol of SO_2 ?
- The mass in grams of 2 mole of sulfuric acid is?
- The mass of a mole of nitrogen gas is?
- How many moles are in 168g of KOH? (gram formula mass = 56g)
- How many moles of oxygen atoms are in one mole of $\text{Mg}_3(\text{PO}_4)_2$?

The Mole

Converting Moles to Mass

Table T Equation: Number of moles = $\frac{\text{given mass (grams)}}{\text{Gram Formula Mass}}$

1. What is the mass of ----?

- | | |
|----------------------------|-------------------------------|
| a. 1 mole of sodium atoms | d. 10 moles of iodine atoms |
| b. 2 moles of sodium atoms | e. .5 moles of nitrogen atoms |
| c. 3 moles of sodium atoms | f. 2.5 moles of oxygen |

2. What is the mass of the following compounds

- | | |
|-------------------------------|--------------------------------|
| a. 1 mole of Carbon dioxide | d. 3 moles of HNO ₃ |
| b. .5 moles of carbon dioxide | e. 5 moles of HCl |
| c. 3 moles of water | d. 10 moles of NaOH |

3. What is the mass of ...?

- | | |
|----------------------------------|--|
| a. 0.1 moles of Copper I oxide | d. 0.05 moles of Al ₂ O ₃ |
| b. 0.01 moles of Sulfuric Acid | e. 0.58 moles of NaOH |
| c. 0.2 moles of calcium chloride | f. 0.25 moles of MgSO ₄ · 7H ₂ O |

Converting Mass to Moles

4. How many moles are there in...?

- a. 2 grams of Helium atoms
- b. 6 grams of Carbon atoms
- c. 16 grams of Helium atoms
- d. 4 g of Sulfur atoms
- e. 16 g of oxygen atoms
- f. 0.8 g of oxygen atoms

5. How many moles are there in...?

- a. 88 g of Carbon dioxide
- b. 58 g of Sodium Chloride
- c. 72 g of Hydrochloric acid
- d. 8 g of Hydrogen molecules
- e. 213 g of Chlorine molecules
- f. 4 g of Oxygen molecules

6. How many moles are there in ...?

- a. 40.5 g of zinc oxide
- b. 32 g of CH_3OH
- c. 37 g of $\text{Ca}(\text{OH})_2$
- d. 8 g of NH_4NO_3

Moles and Mass

Directions: Determine the number of moles in each of the quantities below.

1. 25 grams of NaCl	2. 125 grams of H ₂ SO ₄
3. 100 grams of KMnO ₄	4. 74 grams of KCl
5. 35 grams of CuSO ₄ ·5H ₂ O	

Directions: Determine the number of grams in each of the quantities below

6. 2.5 moles of NaCl	7. 0.50 moles of H ₂ SO ₄
8. 1.70 moles of KMnO ₄	9. 0.25 moles of KCl
10. 3.2 moles of CuSO ₄ ·5H ₂ O	

Moles Practice

- Which quantity is equivalent to 39 g of LiF?
(1) 0.50 mol (3) 1.5 mol
(2) 1.0 mol (4) 2.0 mol
- What is the total mass of 0.75 mol of SO_2 ?
(1) 16 g (2) 24 g (3) 32 g (4) 48 g
- The mass of 1 mol of NaNO_3 is
(1) 42 g (2) 53 g (3) 85 g (4) 116 g
- What is the number of moles of potassium chloride (gram formula mass = 74 g) present in 148 g of KCl?
(1) 2.0 mol (3) 3.0 mol
(2) 2.5 mol (4) 3.5 mol
- What is the mass of 4.5 mol of KOH?
(1) 0.080 g (3) 56 g
(2) 36 g (4) 252 g
- What is the mass of 0.50 mol of $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$?
(1) 47.8 g (3) 125 g
(2) 95.6 g (4) 250 g
- The term mole is a unit used to represent
(1) density of particles (3) number of particles
(2) kinds of particles (4) reactivity of particles
- One mole of carbon and one mole of neon both have the same
(1) mass (3) number of particles
(2) volume (4) number of protons
- The mass of a mole of O_2 (g) is
(1) 8.0 g (2) 16.0 g (3) 24.0 g (4) 32.0 g
- What is the total number of moles in 80.0 grams of $\text{C}_2\text{H}_5\text{Cl}$ (gram-formula mass = 64.5 grams/mole)
(1) 0.806 (2) 1.24 (3) 2.48 (4) 5.16

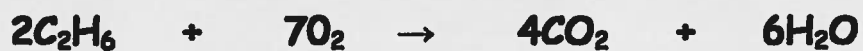
Topic 8: Stoichiometry & the Mole
8.5: Mole Relationships

Aim:

• **Chemical Equations**

- Qualitative information _____
- Quantitative information _____
- Coefficients
 - _____
 - Set up a _____
 - How many molecules of each , How many moles of each

• **Mole Ratios**



Moles C_2H_6	Moles O_2	Moles CO_2	Moles H_2O

- How many moles of water will be produced from the complete combustion of 3.0 mol of ethane according to the following equation?

• **Regents Questions**

- Given the reaction $4\text{Al}(s) + 3\text{O}_2(g) \rightarrow 2\text{Al}_2\text{O}_3(s)$, what is the minimum number of moles of oxygen gas required to produce 1.00 mol of aluminum oxide?

- Given the reaction $2\text{KClO}_3(s) \rightarrow 2\text{KCl}(s) + 3\text{O}_2(g)$, what is the total number of moles of KClO_3 needed to produce 6 mol of O_2 ?

- Make a drawing of 6 molecules of hydrogen gas (H_2) in a container. Using a different symbol, add the correct number of nitrogen gas (N_2) molecules to form ammonia according to the following equation.



In a second drawing, show the number and composition of ammonia molecules in the container after the reaction has been completed.

Moles Practice

1. How many atoms of oxygen are in one molecule of $\text{Mg}_3(\text{PO}_4)_2$?
2. How many moles of oxygen are in one mole of $\text{Mg}_3(\text{PO}_4)_2$?
3. What is the mass of one mole of $\text{Mg}_3(\text{PO}_4)_2$?
4. How many moles of LiF are equal to 39 grams?
5. Given the equation: $4\text{Al} + 3\text{O}_2 \rightarrow 2\text{Al}_2\text{O}_3$, how many aluminum atoms are found in the products?
6. Given the equation: $4\text{Al} + 3\text{O}_2 \rightarrow 2\text{Al}_2\text{O}_3$, how many moles of aluminum oxide are found in the products?

7. If you have 50 grams of H_2O , how many moles of water do you have?

8. What is the mass of 4.5 mol of KOH ?

9. What is the mass of 0.50 mol of $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$?

10. How many moles are in 168 grams of KOH ?

11. Given the equation $4\text{Al} + 3\text{O}_2 \rightarrow 2\text{Al}_2\text{O}_3$, what is the number of moles of oxygen that is needed to produce 1.00 mole of aluminum oxide?

12. Given the equation $4\text{Al} + 3\text{O}_2 \rightarrow 2\text{Al}_2\text{O}_3$, what is the number of moles of aluminum that is needed to produce 1.00 mole of aluminum oxide?

Name _____

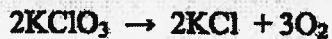
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Moles/Equations Worksheet

1. How many moles of H_2O will be produced from the combustion of 3 moles of ethane?



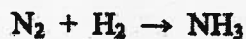
2. How many moles of oxygen are produced by the decomposition of six molecules of potassium chlorate?



3. How many moles of oxygen are necessary to react completely with four moles of propane?

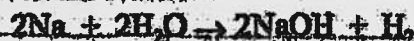


4. How many grams of NH_3 are produced by 2 mole of N_2 ? (Make sure to balance the equation first!!!)



Mole-Mole Calculations

1. Given the reaction:



What is the total number of moles of hydrogen produced when 4 moles of sodium react completely?

- (1) 1 (3) 3
(2) 2 (4) 4

2. Given the reaction:



What is the minimum number of moles of O_2 required to produce one mole of CO_2 ?

- (1) 1.0 (3) 0.25
(2) 2.0 (4) 0.50

3. Given the equation:



How many moles of HCl would be required to produce a total of 2 moles of H_2 ?

- (1) 0.5 (3) 3
(2) 2 (4) 4

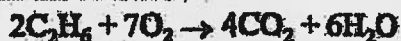
4. Given the reaction:



What is the total number of moles of $\text{KClO}_3(\text{s})$ needed to produce 6 moles of $\text{O}_2(\text{g})$?

- (1) 1 (3) 3
(2) 2 (4) 4

5. Given the reaction:



What is the total number of moles of CO_2 produced when one mole of C_2H_6 is completely reacted?

- (1) 1 (3) 3
(2) 2 (4) 4

6. Given the equation:



How many moles of carbon dioxide are produced for each mole of butane consumed?

- (1) 1 (3) 8
(2) 2 (4) 4

7. Given the reaction:

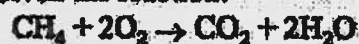


What is the total number of moles of NaOH needed to react completely with 2 moles of H_2SO_4 ?

- (1) 1 (3) 0.5
(2) 2 (4) 4

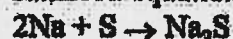
For questions 8-13 please show your work in the space provided. This assignment continues on the other side of the worksheet.

8. Given the reaction:



What amount of oxygen is needed to completely react with 1 mole of CH_4 ?

9. Given the balanced equation:



What is the total number of moles of S that reacted when 4.0 moles of Na were completely consumed?

10. Given the reaction:



What is the maximum number of moles of H_2O that can be produced when 2.0 moles of NH_3 are completely reacted?

11. Given the reaction:



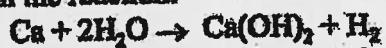
What is the total number of moles of CO_2 produced by the complete combustion of 5.0 moles of C_2H_6 ?

12. Given the reaction:



How many moles of H_2O are needed to react completely with 2.0 moles of Ca?

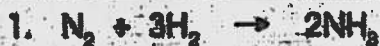
13. Given the reaction:



How many moles of H_2O are needed to exactly react with 2.0 moles of Ca?

STOICHIOMETRY: MOLE-MOLE PROBLEMS

Name _____



How many moles of hydrogen are needed to completely react with two moles of nitrogen?



How many moles of oxygen are produced by the decomposition of six moles of potassium chlorate?



How many moles of hydrogen are produced from the reaction of three moles of zinc with an excess of hydrochloric acid?



How many moles of oxygen are necessary to react completely with four moles of propane (C_3H_8)?



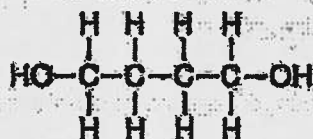
How many moles of potassium nitrate are produced when two moles of potassium phosphate react with two moles of aluminum nitrate?

Name _____

Date _____

Moles Practice

1. Given the structural formula:



What is the empirical formula of this compound?

- (A) CH_3O (C) $\text{C}_4\text{H}_{10}\text{O}_2$
 (B) $\text{C}_2\text{H}_5\text{O}$ (D) $\text{C}_8\text{H}_{20}\text{O}_4$

2. The formula H_2O_2 is an example of

- (A) a molecular formula
 (B) an empirical formula
 (C) an ionic formula
 (D) an organic formula

3. A compound has a gram formula mass of 56 grams per mole. What is the molecular formula for this compound?

- (A) CH_2 (C) C_3H_6
 (B) C_2H_4 (D) C_4H_8

4. The empirical formula of a compound is CH_3 . The molecular formula of this compound could be

- (A) CH_4 (C) C_2H_6
 (B) C_2H_4 (D) C_3H_6

5. A compound has an empirical formula of HCO_2 and a molecular mass of 90. grams per mole. What is the molecular formula of this compound?

- (A) HCO (C) $\text{H}_4\text{C}_4\text{O}_8$
 (B) $\text{H}_2\text{C}_2\text{O}_4$ (D) $\text{H}_6\text{C}_6\text{O}_{12}$

6. The percentage by mass of Br in the compound AlBr_3 is closest to

- (A) 10% (C) 75%
 (B) 25% (D) 90%

7. What is the mass of 4.76 moles of Na_3PO_4 (gram-formula mass = 164 grams/mole)?

8. What is conserved during a chemical reaction?

- (A) energy, only
 (B) matter, only
 (C) both matter and energy
 (D) neither matter nor energy

9. Given the balanced equation:

What is the total number of moles of $\text{O}_2(g)$ that must react completely with 8.0 moles of $\text{Al}(s)$ in order to form $\text{Al}_2\text{O}_3(s)$?

10. Base your answer to the following question on the information below.

A scientist in a chemistry laboratory determined the molecular formulas for two compounds containing nitrogen and oxygen to be NO_2 and N_2O_5 .

In the space provided in your answer booklet, show a correct numerical setup for calculating the percent composition by mass of oxygen in NO_2 .

11. What is the gram-formula mass of $(\text{NH}_4)_2\text{CO}_3$? Use atomic masses rounded to the nearest whole number.

12. Given the equation:



If 8.0 moles of O_2 are completely consumed, what is the total number of moles of H_2O produced?

13. Base your answer to the following question on the information below.

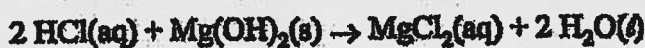
The decomposition of sodium azide, $\text{NaN}_3(\text{s})$, is used to inflate airbags. On impact, the $\text{NaN}_3(\text{s})$ is ignited by an electrical spark, producing $\text{N}_2(\text{g})$ and $\text{Na}(\text{s})$. The $\text{N}_2(\text{g})$ inflates the airbag.

What is the total number of moles present in a 52.0-gram sample of $\text{NaN}_3(\text{s})$ (gram-formula mass = 65.0 gram/mole)?

14. Write the empirical formula for the compound $\text{C}_6\text{H}_{12}\text{O}_6$.

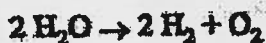
15. Base your answer to the following question on the information and equation below.

Antacids can be used to neutralize excess stomach acid. Brand Antacid contains the acid-neutralizing agent magnesium hydroxide, $\text{Mg}(\text{OH})_2$. It reacts with $\text{HCl}(\text{aq})$ in the stomach, according to the following balanced equation:



If a person produces 0.050 mole of excess HCl in the stomach, how many moles of $\text{Mg}(\text{OH})_2$ are needed to neutralize this excess hydrochloric acid?

Base your answers to questions 16 and 17 on the balanced chemical equation below.



16. What is the total number of moles of O_2 produced when 8 moles of H_2O is completely consumed?

17. How does the balanced chemical equation show the Law of Conservation of Mass?

18. Base your answer to the following question on the information below.

Gypsum is a mineral that is used in the construction industry to make drywall (sheetrock). The chemical formula for this hydrated compound is $\text{CaSO}_4 \cdot 2 \text{H}_2\text{O}$. A hydrated compound contains water molecules within its crystalline structure. Gypsum contains 2 moles of water for each 1 mole of calcium sulfate.

What is the gram formula mass of $\text{CaSO}_4 \cdot 2 \text{H}_2\text{O}$?

19. In a laboratory experiment, a student determined the mass of the product, NaCl(s), to be 1.84 grams.

a Calculate the gram formula mass of NaCl(s). Round atomic masses from the Periodic Table to the nearest tenth. [Show all work. Indicate the correct answer, including an appropriate unit.]

b Calculate the number of moles of NaCl(s) produced. Show all work. Indicate the correct answer.

20. Given the compound $C_4H_{10}O_8$,

a Calculate the molar mass of the compound.

b Calculate the number of moles in 17.7 grams of the compound.

c What is the empirical formula for this compound?

Name _____

Date _____

Moles Questions

1. Which quantity can correctly be represented by the symbol "He"?

- 1) 1 mole of atoms 3) 3×10^{23} atoms
2) 10 grams of atoms 4) 11.2 liters of atoms

2. What is the total number of moles of atoms present in 1 mole of $\text{Ca}_3(\text{PO}_4)_2$?

- 1) 13 3) 8
2) 10 4) 5

3. In a sample of oxygen gas at STP, which represents the greatest number of molecules?

- 1) one mole 3) one molecule
2) one gram 4) one liter

4. Which represents the greatest mass of chlorine?

- 1) 1 mole of chlorine 3) 1 gram of chlorine
2) 1 atom of chlorine 4) 1 molecule of chlorine

5. In the compound Al_2O_3 , the ratio of aluminum to oxygen is

- 1) 2 grams of aluminum to 3 grams of oxygen
2) 3 grams of aluminum to 2 grams of oxygen
3) 2 moles of aluminum to 3 moles of oxygen
4) 3 moles of aluminum to 2 moles of oxygen

6. Which quantity of particles is correctly represented by the formula H_2SO_4 ?

- 1) 1.0 moles of ions 3) 6.0×10^{23} ions
2) 1.0 moles of molecules 4) 6.0×10^{23} atoms

7. Which quantity is equivalent to 39 grams of LiF ?

- 1) 1.0 mole 3) 0.50 mole
2) 2.0 moles 4) 1.5 moles

8. What is the mass in grams of 1.00 mole of O_2 gas?

- 1) 11.2 3) 22.4
2) 16.0 4) 32.0

9. What is the total mass in grams of 0.75 mole of SO_2 ?

- 1) 16 g 3) 32 g
2) 24 g 4) 48 g

10. In a laboratory experiment, a student determined the mass of the product, $\text{CaCl}_2(\text{s})$, to be 45.5 grams.

a. Calculate the gram formula mass of $\text{CaCl}_2(\text{s})$. Round atomic masses from the Periodic Table to the nearest tenth. [Show all work. Indicate the correct answer in proper significant figures and include an appropriate unit.]

b. Calculate the number of moles of $\text{CaCl}_2(\text{s})$ produced. [Show all work. Indicate the correct answer in proper significant figures.]

11. In a laboratory experiment, a student determined the mass of the product, $\text{NH}_4\text{NO}_3(\text{s})$, to be 7.89 grams.

a. Calculate the gram formula mass of $\text{NH}_4\text{NO}_3(\text{s})$. Round atomic masses from the Periodic Table to the nearest tenth. [Show all work. Indicate the correct answer in proper significant figures and include an appropriate unit.]

b. Calculate the number of moles of $\text{NH}_4\text{NO}_3(\text{s})$ produced. [Show all work. Indicate the correct answer in proper significant figures.]

Practice #1

1. What is the total number of oxygen atoms in the formula $\text{MgSO}_4 \cdot 7 \text{H}_2\text{O}$? [The \cdot represents seven units of H_2O attached to one unit of MgSO_4 .]

A) 11 B) 7 C) 5 D) 4
2. What is the total number of moles of atoms present in 1 gram formula mass of $\text{Pb}(\text{C}_2\text{H}_3\text{O}_2)_2$?

A) 9 B) 14 C) 3 D) 15
3. What is the total number of moles of hydrogen atoms contained in 1 mole of $(\text{NH}_4)_2\text{C}_2\text{O}_4$?

A) 6 B) 2 C) 8 D) 4
4. What is the total number of atoms of oxygen in the formula $\text{Al}(\text{ClO}_3)_3 \cdot 6\text{H}_2\text{O}$?

A) 6 B) 9 C) 10 D) 15
5. In the compound Al_2O_3 , the ratio of aluminum to oxygen is

A) 2 grams of aluminum to 3 grams of oxygen
 B) 3 grams of aluminum to 2 grams of oxygen
 C) 2 moles of aluminum to 3 moles of oxygen
 D) 3 moles of aluminum to 2 moles of oxygen
6. What is the total number of moles of atoms in one mole of $(\text{NH}_4)_2\text{SO}_4$?

A) 10 B) 11 C) 14 D) 15
7. What is the gram-formula mass of $(\text{NH}_4)_3\text{PO}_4$?

A) 112 g/mol B) 121 g/mol
 C) 149 g/mol D) 242 g/mol
8. The sum of the atomic masses of the atoms in one molecule of $\text{C}_3\text{H}_6\text{Br}_2$ is called the

A) formula mass B) isotopic mass
 C) percent abundance D) percent composition
9. The gram-formula mass of NO_2 is defined as the mass of

A) one mole of NO_2
 B) one molecule of NO_2
 C) two moles of NO
 D) two molecules of NO
10. The molar mass of $\text{Ba}(\text{OH})_2$ is

A) 154.3 g B) 155.3 g
 C) 171.3 g D) 308.6 g
11. What is the percent composition by mass of sulfur in the compound MgSO_4 (gram-formula mass = 120. grams per mole)?

A) 20% B) 27% C) 46% D) 53%
12. What is the percent composition by mass of hydrogen in NH_4HCO_3 (gram-formula mass = 79 grams/mole)?

A) 5.1% B) 6.3% C) 10.% D) 50%
13. The percent composition by mass of magnesium in MgBr_2 (gram-formula mass = 184 grams/mole) is equal to

A) $\frac{24}{184} \times 100$ B) $\frac{160.}{184} \times 100$
 C) $\frac{184}{24} \times 100$ D) $\frac{184}{160.} \times 100$
14. Which sample contains a mole of atoms?

A) 23 g Na B) 24 g C
 C) 42 g Kr D) 78 g K
15. The total number of moles represented by 20 grams of CaCO_3 is

A) 1 B) 2 C) 0.1 D) 0.2
16. What is the mass in grams of 2.0 moles of NO_2 ?

A) 92 B) 60. C) 46 D) 30.
17. What is the total mass of iron in 1.0 mole of Fe_2O_3 ?

A) 160 g B) 112 g C) 72 g D) 56 g
18. Which quantity is equivalent to 39 grams of LiF ?

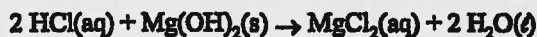
A) 1.0 mole B) 2.0 moles
 C) 0.50 mole D) 1.5 moles
19. Which equation shows a conservation of mass?

A) $\text{Na} + \text{Cl}_2 \rightarrow \text{NaCl}$ B) $\text{Al} + \text{Br}_2 \rightarrow \text{AlBr}_3$
 C) $\text{H}_2\text{O} \rightarrow \text{H}_2 + \text{O}_2$ D) $\text{PCl}_5 \rightarrow \text{PCl}_3 + \text{Cl}_2$

1. What is the mass of 4.76 moles of Na_3PO_4 (gram-formula mass = 164 grams/mole)?
2. Show a correct numerical setup for calculating the number of moles of CO_2 (gram-formula mass = 44 g/mol) present in 11 grams of CO_2 .

3. Base your answer to the following question on the information and equation below.

Antacids can be used to neutralize excess stomach acid. Brand Antacid contains the acid-neutralizing agent magnesium hydroxide, $\text{Mg}(\text{OH})_2$. It reacts with $\text{HCl}(\text{aq})$ in the stomach, according to the following balanced equation:



Show a correct numerical setup for calculating the number of moles of $\text{Mg}(\text{OH})_2$ (gram-formula mass = 58.3 grams/mole) in an 8.40-gram sample.

4. In a laboratory experiment, a student determined the mass of the product, $\text{NaCl}(\text{s})$, to be 1.84 grams.

a Calculate the gram formula mass of $\text{NaCl}(\text{s})$. Round atomic masses from the Periodic Table to the nearest tenth. [Show all work. Indicate the correct answer, including an appropriate unit.]

b Calculate the number of moles of $\text{NaCl}(\text{s})$ produced. Show all work. Indicate the correct answer.

5. Given the compound $\text{C}_4\text{H}_{10}\text{O}_8$,

a Calculate the molar mass of the compound.

b Calculate the number of moles in 17.7 grams of the compound.

c What is the empirical formula for this compound?

6. Base your answers to the following questions on the information below.

Sodium is an essential ingredient in the human diet. The Federal Food and Drug Administration recommends that the average adult daily requirement for sodium is 2.4 grams. Sodium is ingested through consuming plant and animal tissues, but another good source is table salt, sodium chloride.

a) Write the chemical formula of sodium chloride.

b) What is the gram-formula mass of a mole of sodium chloride?

c) How many moles of table salt, sodium chloride would need to be consumed in order to ingest the 2.4 grams? [Show all work]

7. In a laboratory experiment, a student determined the mass of the product, $\text{LiCl}(\text{s})$, to be 0.333 grams.

a Calculate the gram formula mass of $\text{LiCl}(\text{s})$. Round atomic masses from the Periodic Table to the nearest tenth. [Show all work. Indicate the correct answer in proper significant figures and include an appropriate unit.]

b Calculate the number of moles of $\text{LiCl}(\text{s})$ produced. [Show all work. Indicate the correct answer in proper significant figures]

Topic 8: Stoichiometry & the Mole
8.6: Types of Reactions

Aim: _____

• **Chemical Reactions**

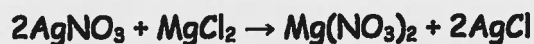
- There is always a conservation of _____

▪ Mass in _____

• Number _____

▪ _____ in reactants = _____ in products

▪ Charge _____



- **4 major types**

▪ Synthesis, Decomposition, Single replacement, Double replacement

• **Synthesis Reactions**

- Two or more reactants _____

○ Synthesis _____

○ Happens _____

○ $A + B \rightarrow$

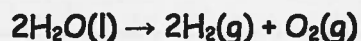


• **Decomposition Reactions**

- Reverse of _____

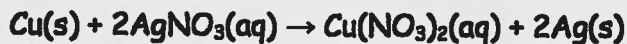
○ Single compound is _____

○ Decomposition _____



• **Single Replacement Reactions**

- One element _____
- Involves _____
- $A + BX \rightarrow$



• **Table J**

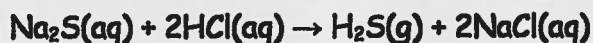
- Elements at the top of the table are _____
 - More reactive _____
 - More _____
 - Li can replace _____
 - Fe can replace _____
 - Can Ag replace _____
 - Why? _____
 - Can Mn replace _____?
 - Why? _____
- Will Zn replace Cu? Why?
 - $\text{Zn} + \text{Cu(NO}_3)_2 \rightarrow$ _____
- Will Cu replace Zn? Why?
 - $\text{Cu} + \text{Zn(NO}_3)_2 \rightarrow$ _____
- Will chlorine replace fluorine? Why?
 - $\text{Cl}_2 + \text{NaF} \rightarrow$ _____
- Will fluorine replace chlorine? Why?
 - $\text{F}_2 + \text{NaCl} \rightarrow$ _____

• **Double Replacement Reactions**

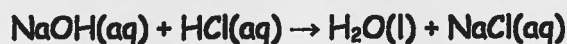
- _____
- Two _____
 - Precipitate (_____), Gas, Molecular compound (_____)
- $AB + CD \rightarrow$
- Occur _____
 - Use Table F
 - Will this reaction occur? Why? $\text{AgNO}_3 + \text{NaCl} \rightarrow$ _____

- Occur if one of the products is a gas

- $H_2, O_2, N_2, CO_2, H_2S, H_2O$

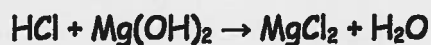
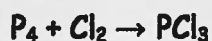
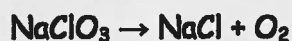
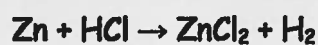


- Occur if a molecular substance such as water is formed



- **Regents Questions**

- Identify each reaction



- Write the equation and state if the reaction would occur

Sodium bromide and silver nitrate form sodium nitrate and silver bromide

Potassium carbonate and calcium nitrate form potassium nitrate and calcium carbonate

CLASSIFYING CHEMICAL REACTIONS Name _____

Classify the following reactions as synthesis, decomposition, single replacement or double replacement.

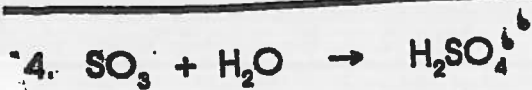
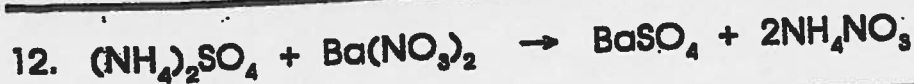
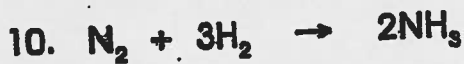
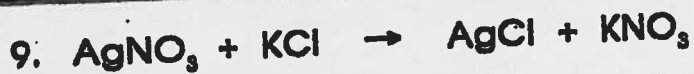
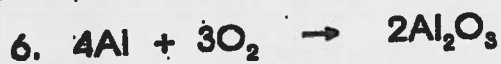
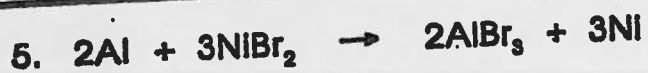
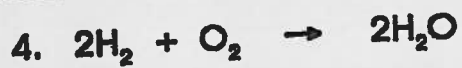
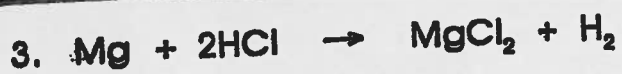
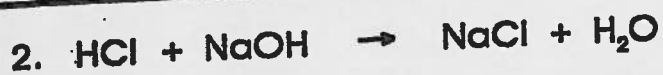


Table 3-3. Types of Chemical Reactions

Type of Reaction	Description/Typical Equation
Synthesis	Atoms of elements combine to form a compound. $4\text{Fe} + 3\text{O}_2 \rightarrow 2\text{Fe}_2\text{O}_3$
Decomposition (analysis)	Compound is broken down into its component elements or a simpler compound. $2\text{HgO} \rightarrow 2\text{Hg} + \text{O}_2$ $2\text{KClO}_3 \rightarrow 2\text{KCl} + 3\text{O}_2$
Single replacement	Element reacts with a compound to set free a different element and form a new compound. $\text{Cu} + 2\text{AgNO}_3 \rightarrow \text{Cu}(\text{NO}_3)_2 + 2\text{Ag}$
Double replacement	Two compounds react (usually in water solution) to produce two new compounds. $\text{Ca}(\text{OH})_2 + \text{H}_2\text{SO}_4 \rightarrow 2\text{H}_2\text{O} + \text{CaSO}_4$

Identify the type of equation then BALANCE

TYPE





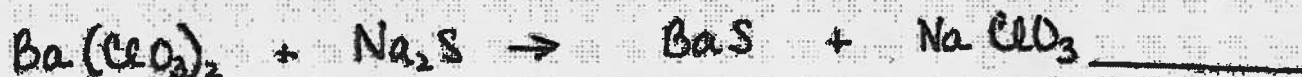
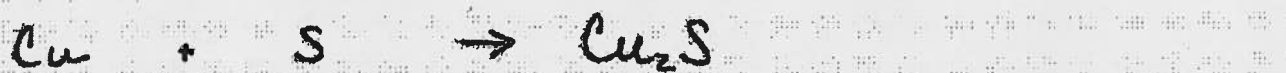
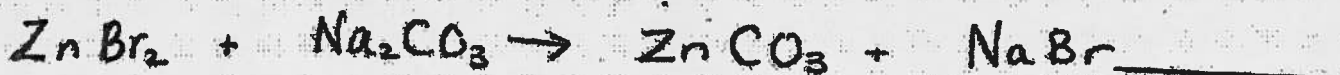
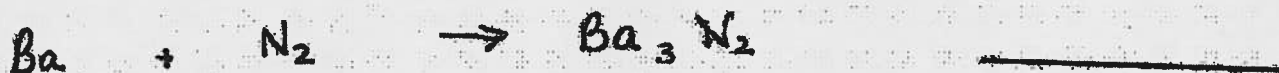
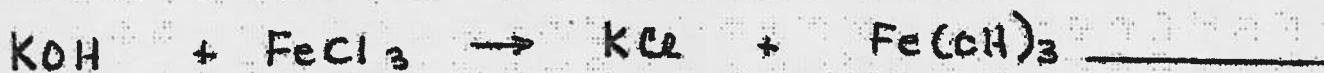
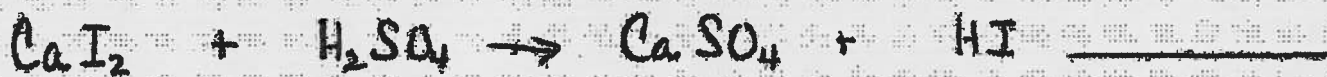












Balance and total the coefficients of the equation!



Topic 8: Stoichiometry & the Mole
8.7: Balancing Chemical Equations

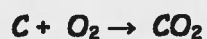
AIM: _____

• **Chemical Equations**

○ The number _____

○ The law of _____

▪ The number _____

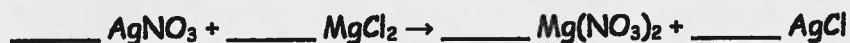


▪ _____ = show ratio of different atoms _____

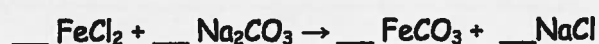
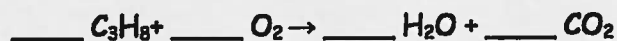
▪ Must balance using coefficients = _____

• Coefficient applies to _____

○ Along with polyatomic ions



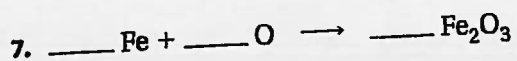
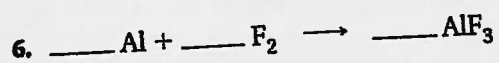
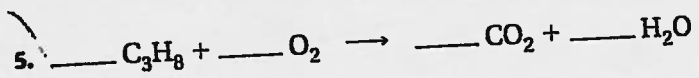
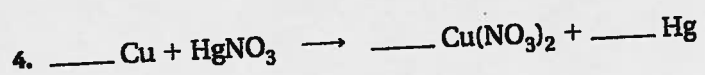
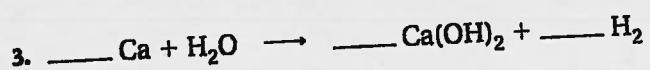
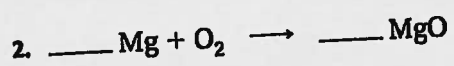
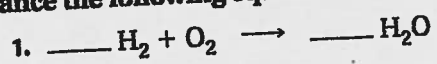
○ Balance the following equations

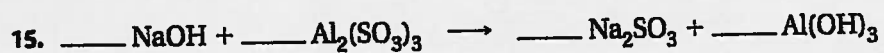
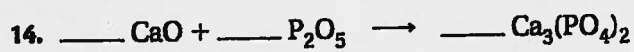
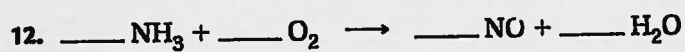
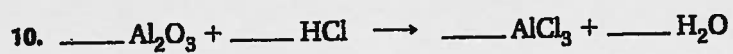
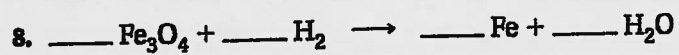


Name _____ Period _____ Date _____

SUPPLEMENT: BALANCING EQUATIONS

Balance the following equations.





IS IT BALANCED?

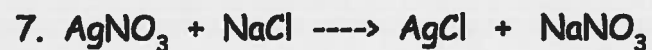
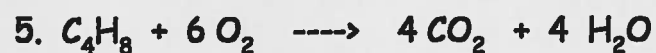
For the chemical statements written below, do an atom inventory for each one. Determine if it is a balanced equation. Number 1 is an example



___ K ___

___ H ___

___ O ___



FunBased Learning Chemistry > Classic Chembalancer >
Worksheet

Worksheet to teach balancing equations

Name _____

Directions:

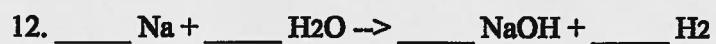
1. Start Internet Explorer go to Classic Chembalancer.
2. Click 'Directions'. Read and understand the directions.
3. Click 'OK'.
4. Click on 'Start Game'
5. Try entering some numbers in the text boxes in front of each molecule. What happens?
6. If you forget the directions, click on the 'How to Play the Game' link. Click 'OK' when you finish reading them to return to the game.
7. When you think you have typed the right numbers in all the boxes, click the 'Balanced' button.
8. If you didn't get it right, try again.
9. If you did get it right, then fill in the correct answers on this worksheet for #1.
10. Repeat steps 7-9 for the other 10 questions.
11. Now do the two problems on the back of this worksheet. You can draw the molecules just like the program did to figure out the answer.

Questions

Fill in the blanks below as you go through the game. This is so I have a record that you did your assignment.

1. ____ Fe + ____ S --> ____ FeS
2. ____ H₂ + ____ Cl₂ --> ____ HCl
3. ____ Mg + ____ O₂ --> ____ MgO
4. ____ O₂ + ____ H₂ --> ____ H₂O
5. ____ HgO --> ____ Hg + ____ O₂
6. ____ Ca + ____ H₂O --> ____ Ca(OH)₂ + ____ H₂
7. ____ CH₄ + ____ O₂ --> ____ CO₂ + ____ H₂O
8. ____ Na₂O₂ + ____ H₂SO₄ --> ____ Na₂SO₄ + ____ H₂O₂
9. ____ N₂ + ____ H₂ --> ____ NH₃
10. ____ Al + ____ O₂ --> ____ Al₂O₃
11. ____ KMnO₄ --> ____ K₂O + ____ MnO + ____ O₂

Draw the molecules just like the program did to figure out the answer to #12 and #13.



Fact for #12: Sodium metal, Na, is stored in kerosene so it won't react with water vapour. When added to water it reacts quickly to make hydrogen gas.



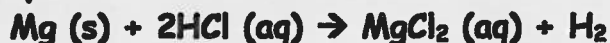
Fact for #13: This is an example of an acid base reaction. Acid + base → Salt + Water

Chemical Equations

When a piece of magnesium is added to dilute hydrochloric acid, fizzing occurs and hydrogen gas is released from the mixture. The fizzing is evidence that a(n) (1) _____ has occurred between magnesium and hydrochloric acid. The name given to either magnesium or hydrochloric acid in this case is (2) _____, and the hydrogen gas that is released is called a(n) (3) _____ of the reaction. Some other indications that reactions have occurred might be change of color or (4) _____, or formation of a solid (5) _____.

If a thermometer is placed into a mixture undergoing chemical reaction, you might observed that the temperature has gone up or down, indicating that (6) _____ was being released or absorbed. The short hand form by which a reaction is represented is called a(n) (7) _____. In using this method of representation, you must satisfy the (8) _____, a principle that states that matter is neither created nor destroyed. In order to satisfy this principle, you normally select the proper numerical (9) _____ to indicate the number of units of each substance taking part in the chemical change.

Explain in words each of the symbols



10. Mg _____

15. (aq) _____

11. (s) _____

16. \rightarrow _____

12. + _____

17. $\text{MgCl}_2\text{(aq)}$ _____

13. 2 _____

18. H_2 _____

14. HCl (aq) _____

19. (g) _____

Write a word and balanced equation for the reactions below

20. Aluminum metal burns in pure oxygen to produce solid aluminum oxide.

Word equation _____

Chemical equation _____

21. When solid mercury (II) oxide is heated, it breaks down to form liquid mercury and oxygen gas.

Word equation _____

Chemical equation _____

22. A solution of ammonium sulfate added to a solution of lead (II) nitrate, forms soluble ammonium nitrate and solid lead (II) sulfate.

Word equation _____

Chemical equation _____

23. Copper metal and iron (II) nitrate in solution are formed when iron metal is added to a solution of copper (II) nitrate.

Word equation _____

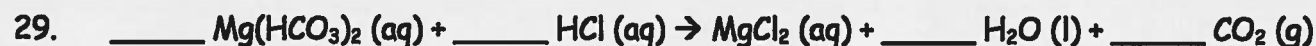
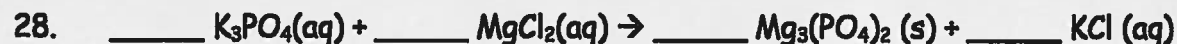
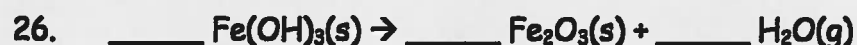
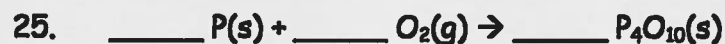
Chemical equation _____

24. Hydrogen sulfide gas reacts with oxygen gas to form water vapor and solid sulfur.

Word equation _____

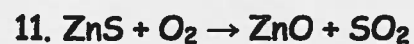
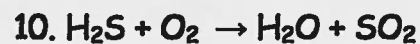
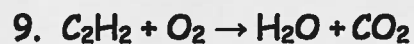
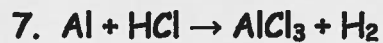
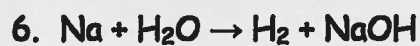
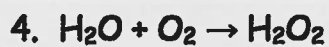
Chemical equation _____

Balance the following

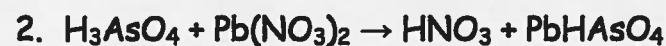
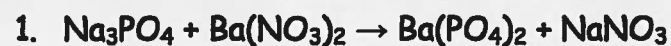


Balancing Equations

Write the correctly balanced equation in the blank below it:



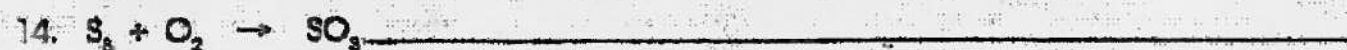
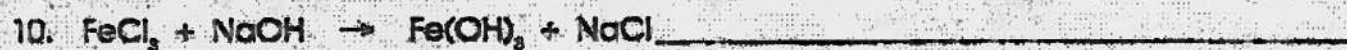
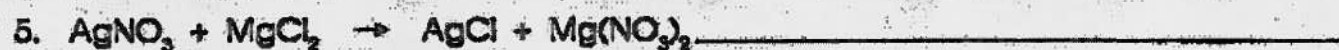
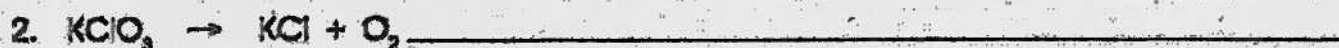
Extra Credit (5 pts each)



BALANCING CHEMICAL EQUATIONS

Name _____

Rewrite and balance the equations below.



CONSERVATION OF MASS

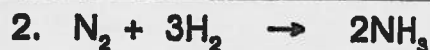
Name _____

In chemical reactions, mass is neither gained nor lost. The total mass of all the reactants equals the total mass of all the products. Atoms are just rearranged into different compounds.

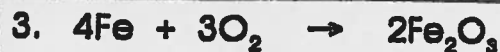
Using this idea, solve the following problems.



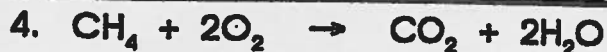
If 500 g of KClO_3 decomposes and produces 303 g of KCl , how many grams of O_2 are produced?



How many grams of H_2 are needed to react with 100 g of N_2 to produce 121 g of NH_3 ?



How many grams of oxygen are needed to react with 350 g of Iron to produce 500 g of Fe_2O_3 ?



16 g of CH_4 react with 64 g of O_2 , producing 44 g of CO_2 . How many grams of water are produced?



How much CO_2 is produced from the decomposition of 200 g of CaCO_3 if 112 g of CaO are produced?

WORD EQUATIONS

Name _____

Write and balance the following chemical equations.

1. Hydrogen plus oxygen yield water.
2. Nitrogen plus hydrogen yield ammonia.
3. Aluminum bromide plus chlorine yield aluminum chloride and bromine.
4. Hydrochloric acid plus sodium hydroxide yield sodium chloride plus water.
5. Iron plus lead (II) sulfate react forming iron (II) sulfate plus lead.
6. Potassium chlorate when heated produces potassium chloride plus oxygen gas.
7. Sulfuric acid decomposes to form sulfur trioxide gas plus water.
8. Sodium oxide combines with water to make sodium hydroxide.
9. Potassium iodide reacts with bromine forming potassium bromide plus iodine.
10. Sodium phosphate reacts with calcium nitrate to produce sodium nitrate plus calcium phosphate.
11. Zinc reacts with iron (III) chloride yielding zinc chloride plus iron precipitate.
12. Ammonium carbonate and magnesium sulfate react to yield ammonium sulfate plus magnesium carbonate.
13. Phosphoric acid plus calcium hydroxide react forming solid calcium phosphate plus water.
14. Aluminum plus oxygen gas form aluminum oxide under certain conditions.
15. Nitrogen gas plus oxygen gas react and form dinitrogen pentoxide.

PREDICTING PRODUCTS OF CHEMICAL REACTIONS

Name _____

Predict the products of the reactions below. Then, write the balanced equation and classify the reaction.

1. magnesium bromide + chlorine

2. aluminum + iron (III) oxide

3. silver nitrate + zinc chloride

4. hydrogen peroxide (catalyzed by manganese dioxide)

5. zinc + hydrochloric acid

6. sulfuric acid + sodium hydroxide

7. sodium + hydrogen

8. acetic acid + copper

60

Name _____

Date _____

Formulas and Equations Review

1. If X represents an element of Group 1, the formula of its oxide would be

- 1) XO 3) XO_2
2) X_2O 4) X_2O_2

2. Chlorine combines with element M to form a compound with the formula MCl_2 . Which group in the Periodic Table contains element M ?

- 1) 16 3) 13
2) 2 4) 17

3. Element X is in Group 2 and element Y is in Group 17. A compound formed between these two elements is most likely to have the formula

- 1) X_2Y 3) X_2Y_7
2) XY_2 4) X_7Y_2

4. The oxide of metal X has the formula XO . Which group in the Periodic Table contains metal X ?

- 1) Group 1 3) Group 13
2) Group 2 4) Group 17

5. According to the Periodic Table, which element has more than one positive oxidation state?

- 1) cadmium 3) silver
2) iron 4) zinc

6. If M represents a Group 1 metal, what is the formula for the compound formed by M and oxygen?

- 1) MO_2 3) M_2O_3
2) M_2O 4) M_3O_2

7. Which formula correctly represents the composition of iron (III) oxide?

- 1) FeO_3 3) Fe_2O
2) Fe_2O_3 4) Fe_3O_4

8. What is the chemical formula for copper(II) hydroxide?

- 1) $CuOH$ 3) $Cu_2(OH)$
2) $CuOH_2$ 4) $Cu(OH)_2$

9. Element X reacts with iron to form two different compounds with the formulas Fe_2X and Fe_3X_2 . To which group on the Periodic Table does element X belong?

- 1) Group 3 3) Group 13
2) Group 2 4) Group 16

10. What is the total number of different elements present in NH_4NO_3 ?

- 1) 7 3) 3
2) 9 4) 4

11. In which compound is the ratio of metal ions to nonmetal ions 1 to 2?

- 1) calcium bromide 3) calcium phosphide
2) calcium oxide 4) calcium sulfide

12. Which formula contains only two elements?

- 1) KOH 3) Al_2S_3
2) $NaClO_3$ 4) $Bi(NO_3)_3$

13. What is the correct formula of potassium hydride?

- 1) KH 3) KOH
2) KH_2 4) $K(OH)_2$

14. Which formula represents the compound aluminum iodide?

- 1) AlI 3) Al_2I
2) AlI_3 4) Al_3I_2

15. What is the correct name of the compound with the formula NH_4NO_2 ?

- 1) ammonia nitrite 3) ammonia nitrate
2) ammonium nitrite 4) ammonium nitrate

16. What is the correct name for the compound with the formula $CrPO_4$?

- 1) chromium (II) phosphate
2) chromium (III) phosphate
3) chromium (II) phosphide
4) chromium (III) phosphide

17. Which equation shows a conservation of mass?

- 1) $Na + Cl_2 \rightarrow NaCl$ 3) $H_2O \rightarrow H_2 + O_2$
2) $Al + Br_2 \rightarrow AlBr_3$ 4) $PCl_5 \rightarrow PCl_3 + Cl_2$

18. Given the balanced equation representing a reaction:
 $H^+(aq) + OH^-(aq) \rightarrow H_2O(l) + 55.8 \text{ kJ}$

In this reaction there is conservation of

- 1) mass, only 3) mass and energy, only
2) mass and charge, only 4) mass, charge, and energy

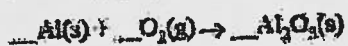
19. When the equation



is completely balanced using the smallest whole numbers, the coefficient of the O_2 will be

- 1) 1 3) 3
2) 2 4) 4

20. When the equation



is correctly balanced using the smallest whole numbers, the coefficient of Al(s) is

- 1) 1
- 2) 2
- 3) 3
- 4) 4

21. Given the unbalanced equation:



When the equation is correctly balanced using smallest whole numbers, the coefficient of the lithium is

- 1) 1
- 2) 2
- 3) 3
- 4) 6

Name _____

Date _____

Stoichiometry Review

1. What is the empirical formula of a compound with the molecular formula $C_8H_{12}O_4$?

- 1) C_2H_3O 3) $C_2H_4O_2$
2) $C_3H_5O_2$ 4) CH_2O

2. The empirical formula of a compound is CH_2 . The molecular formula of this compound could be

- 1) CH_4 3) C_2H_4
2) C_2H_2 4) C_2H_6

3. Which formulas could represent the empirical formula and the molecular formula of a given compound?

- 1) $CH_2O, C_6H_6O_6$ 3) CH_4, C_3H_{12}
2) $CHO, C_6H_{12}O_6$ 4) CH_2, C_3H_6

4. What is the gram formula mass of $Na_2CO_3 \cdot 10H_2O$?

- 1) 106 g 3) 266 g
2) 142 g 4) 286 g

5. Which quantity can correctly be represented by the symbol "He"?

- 1) 1 mole of atoms 3) 3×10^{23} atoms
2) 10 grams of atoms 4) 11.2 liters of atoms

6. What is the total number of moles of atoms in one mole of $(NH_4)_2SO_4$?

- 1) 10 3) 14
2) 11 4) 15

7. In a sample of oxygen gas at STP, which represents the greatest number of molecules?

- 1) one mole 3) one molecule
2) one gram 4) one liter

8. What is the total number of moles of hydrogen in 1 mole of $(NH_4)_2HPO_4$?

- 1) 5 3) 8
2) 7 4) 9

9. In the compound Al_2O_3 , the ratio of aluminum to oxygen is

- 1) 2 grams of aluminum to 3 grams of oxygen
2) 3 grams of aluminum to 2 grams of oxygen
3) 2 moles of aluminum to 3 moles of oxygen
4) 3 moles of aluminum to 2 moles of oxygen

10. What is the total mass in grams of 0.75 mole of SO_2 ?

- 1) 16 g 3) 32 g
2) 24 g 4) 48 g

11. What is the molecular formula of a compound with the empirical formula P_2O_3 and a gram-molecular mass of 284 grams?

- 1) P_2O_3 3) $P_{10}O_5$
2) P_5O_8 4) P_4O_{10}

12. The approximate percent by mass of potassium in $KHCO_3$ is

- 1) 19% 3) 39%
2) 24% 4) 61%

13. Which equation illustrates conservation of mass?

- 1) $H_2 + Cl_2 \rightarrow HCl$ 3) $H_2 + O_2 \rightarrow H_2O$
2) $H_2 + Cl_2 \rightarrow 2HCl$ 4) $H_2 + O_2 \rightarrow 2H_2O$

14. Given the reaction:



What is the total number of moles of hydrogen produced when 4 moles of sodium react completely?

- 1) 1 3) 3
2) 2 4) 4

15. Given the unbalanced equation:



balance the equation using smallest whole number coefficients.

16. Given the unbalanced equation:



Balance the equation using smallest whole number coefficients.

17. What is the total number of moles in 80.0 grams of $C_2H_2Cl_2$ (gram-formula mass = 64.5 grams/mole)?

18. In a laboratory experiment, a student determined the mass of the product, $\text{KNO}_3(s)$, to be 19.8 grams.

a Calculate the gram formula mass of $\text{KNO}_3(s)$. Round atomic masses from the Periodic Table to the nearest tenth. [Show all work. Indicate the correct answer in proper significant figures and include an appropriate unit.]

b Calculate the number of moles of $\text{KNO}_3(s)$ produced. [Show all work. Indicate the correct answer in proper significant figures.]

19. In a laboratory experiment, a student determined the mass of the product, $\text{NH}_4\text{Cl}(s)$, to be 0.372 grams.

a Calculate the gram formula mass of $\text{NH}_4\text{Cl}(s)$. Round atomic masses from the Periodic Table to the nearest tenth. [Show all work. Indicate the correct answer in proper significant figures and include an appropriate unit.]

b Calculate the number of moles of $\text{NH}_4\text{Cl}(s)$ produced. [Show all work. Indicate the correct answer in proper significant figures.]

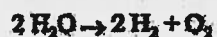
20. Given the compound $\text{C}_4\text{H}_{10}\text{O}_2$,

a Calculate the molar mass of the compound.

b Calculate the number of moles in 17.7 grams of the compound.

c What is the empirical formula for this compound?

21. Base your answer to the following question on the balanced chemical equation below.



What is the total number of moles of O_2 produced when 8 moles of H_2O is completely consumed?

22. Base your answer to the following question on the information below.

Gypsum is a mineral that is used in the construction industry to make drywall (sheetrock). The chemical formula for this hydrated compound is $\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$. A hydrated compound contains water molecules within its crystalline structure. Gypsum contains 2 moles of water for each 1 mole of calcium sulfate.

Show a correct numerical setup for calculating the percent composition by mass of water in this compound *and* record your answer.

Name _____ Date _____

S'Mores Equations

Introduction:

Chemical reactions involve reactants (the materials you put into the reaction) which are found to the left of the arrow and products (the materials you get out of the reaction) which are found to the right of the arrow. But, what happens when you run out of one of the reactants? In this lab you will see just that... what happens when you run out of something.

Purpose:

1. To gain an understanding of reactants and products in a chemical reaction
2. To perform calculations similar to those that will be done in stoichiometry
3. To describe what a limiting reagent is and what it does in a chemical reaction

Safety:

Students must wear safety goggles when performing the lab and using the Bunsen burner. All loose clothing and hair must be pulled back. Closed toe shoes must be worn.

Materials:

Your teacher will provide an amount of graham crackers, chocolate bars, and marshmallows to be used to make as many s'mores as possible

Bunsen burner

Paper towels

Roasting tool

Procedure:

1. Weigh one of each of the reactants and record the mass to the nearest 0.01 gram. Record these masses in the data table.
2. Record the following symbols to be used for each reactant with the data
M = marshmallow
G₂ = graham crackers (whole, not broken in half)
Cs = chocolate square (broken into pieces for each s'more)
3. Perform the chemical reaction with the resulting product taking the form that you and your partner agree on. Write out a balanced equation for the reaction
4. Cause this reaction to go to completion by making as many of the product as you possibly can. Mass and record one of the representative products
5. Count and record how many products you were able to make
6. Record the mass of the left over reactants and record in the table
7. Clean up your lab station and answer the questions
8. Enjoy!!

Data:

Material	Symbol	Mass (g) of each Material	Number of Materials Starting	Starting Mass (g)	Number of Materials Ending	Ending Mass (g)
Marshmallow						
Graham Cracker						
Chocolate Square						
Product			0	0		

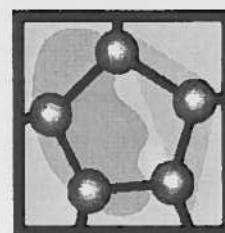
Balanced Equation:

Calculations:

1. What was the total mass of the reactants? What was the total mass of the products?

Balancing Chemical Equations Activity

LP _____ Date _____



Objectives :

- to read chemical equations
- to identify elements by their chemical symbol
- to count atoms
- to identify the coefficients and subscripts in a chemical equation.
- to label the reactants and products of a chemical equation
- to balance chemical equations

Materials: Set of pre-made index cards

Pre Lab Questions: Answer the following before you begin the activity:

- 5H_2
1. What number represents the **Coefficient**? _____
 2. What number represents the **Subscript**? _____
 3. What element is represented by the letter "**H**"? _____
 4. How many "**H**'s" do you have? _____



Procedure :

1. Using your set of index cards, replicate the chemical equation onto your desk.
2. Label the reactant side and the product side.

Record the following results into Table 1:

3. Identify the elements on the reactant side.
4. Count the number of atoms for each element.
5. Identify the elements on the product side.
6. Count the number of atoms on the product side.
7. Are the 2 sides equal? If not, the equation is not balanced.
8. The index cards numbered 2 - 7 are your **coefficients**. They can **ONLY** be placed in front of the elements. You can **not** change the subscripts.
9. Choose an element that is not balanced and **begin** to balance the equations.
10. Continue until you have worked through all the elements.
11. Once they are balance, count the final number of Reactants and Products.
12. Write the balanced equation.
13. Can your equation be simplified?

Data: Table 1: Chemical Equations

Make the following Equations on your desk	Reactants	Products	Reactants - Final	Products - Final	Balanced Equation
$H_2 + O_2 \rightarrow H_2O$					
$H_2O_2 \rightarrow H_2O + O_2$					
$Na + O_2 \rightarrow Na_2O$					
$N_2 + H_2 \rightarrow NH_3$					
$P_4 + O_2 \rightarrow P_4O_{10}$					
$Fe + H_2O \rightarrow Fe_3O_4 + H_2$					
$C + H_2 \rightarrow CH_4$					
$Na_2SO_4 + CaCl_2 \rightarrow$ $CaSO_4 + NaCl$					
$C_2H_6 + O_2 \rightarrow CO_2 + H_2O$					
$Al_2O_3 \rightarrow Al + O_2$					



Analysis/Results:

1. What does " \rightarrow " mean?

2. What side of the equation are the reactants found? _____ products? _____

3. Why must all chemical equations be balanced?

4. Why can't the subscripts be changed?

5. What does it mean to "simplify" the equation?

Conclusion: 2-3 sentences on what you learned.

