**Unit 6: Chemical Reactions & Stoichiometry**

*Mrs. Snyder*

*Prep Chemistry*

**Unit Learning Objectives:** By the end of the unit students will be able to…

* Compare physical changes and chemical reactions by listing the key characteristics of each and giving examples.
* Compare the three phases of matter (solid, liquid, and gas) in terms of molecular speed and molecular spacing, and be able to draw a simple diagram for each change.
* Define evaporation/boiling, condensation, melting, freezing, sublimation, and deposition by stating the beginning phase and ending phase for each change.
* Identify the reactants and products of a chemical reaction.
* State the Law of Conservation of Mass
* Balance chemical equations beginning with either chemical names or formulas
* Classify reactions as synthesis, decomposition, single replacement, double replacement, neutralization, or combustion.
* Predict the products of a reaction given the formulas or names of reactants.
* Label the state of a substance in a chemical reaction as solid, liquid, gas, or solution (aq).
* Define stoichiometry
* Determine mole ratios for a reaction from the balanced chemical equation in order to convert between the moles of different substances.
* Perform stoichiometric calculations involving mass of a reactant or product, giving answers with appropriate units and significant figures.

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| **Monday** | **Tuesday** | **Wednesday** | **Thursday** | **Friday** |
|  **26****SUB DAY** Final Review | **27** | **28****SUB DAY**Final Review | **29**Balancing Chemical Reactions |  **30**Predicting Products |
| **December 3****SUB DAY**Predicting Products practice sheets | **4****Quiz: Balancing and predicting products** Mole Conversionproblems | **5**Mole Conversion Problems | **6****Quiz: Stoichiometry**Unit 6 Review | **7****Lab: Stoichiometry** |
| **10****SUB DAY**Unit 6 Review |  **11****UNIT 6** **TEST****UNIT 6 HW packet due** | **12**Final Review | **13**Final Review | **14**Final Review |
| **17****FINAL: Free Response Section in Chemistry** | **18****AM Final** | **19****Per 1 & Per 2** | **20****Per 3 & Per 4** | **21****Per 5 &Per 6** |

**Chemical Reactions:**

A Chemical Reaction is \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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$$Reactants\rightarrow Products$$

In a chemical reaction the number of atoms of each element on the reactants side must be equal to the number of atoms of each element on the product side in a BALANCED chemical equation. This follows the LAW OF CONSERVATION OF MASS.

**The Law of Conservation of Mass:**

* **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**
* **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

The state of a substance in a chemical reaction is given using the following symbols:

* (s) \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
* (l) \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
* (g) \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
* (aq)\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Balancing Chemical Reactions:**

When the number of atoms of each element on the reactants side is not equal to the number of atoms of each elements on the product side, then the equation must be balanced.

*Rules for Balancing Chemical Reactions:*

1. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
2. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
3. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
4. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
5. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Examples: Balance the following chemical reactions.

1. Zinc oxide 🡪 zinc + oxygen
2. Aluminum + iron (III) oxide 🡪 aluminum oxide + iron
3. Calcium nitrate + sodium phosphate 🡪 calcium phosphate + sodium nitrate

(for balancing polyatomic ions, treat them as a single unit!)

**Predicting Products in Chemical Reactions:**

*To predict the products of a reaction:*

1. Determine the type of reaction. (For **Reaction Types**: *See Jig Saw Activity*)
2. Then use the chart in your Jig Saw activity to help you determine the products for the chemical reaction.
3. Balance the chemical reaction.

*Practice*: Classify each reaction, predict the products, and then balance the chemical reaction.

1. Mg + O2 🡪
2. C9H20 + O2 🡪
3. HCl + Sr(OH)2 🡪
4. NCl3 🡪
5. KCl + Pb(NO3)2 🡪
6. ZnCl2  + Na 🡪
7. CaBr2  + O2  🡪

**Stoichiometry**

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**Mole Ratios**

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 For example given the balanced equation

 O2  + 4HBr 🡪 2 H2O + 2 Br2

From the coefficients of the equation, it can be seen that the chemicals must be combined in the following proportions: for every one mole of O2 reacting there must be four moles of HBr reacting and there will be two moles of H2O produced and two moles of Br2 produced.

 1 mole O2 = 4 mole HBr = 2 mole H2O = 2 mole Br2

Given the moles of one substance in a reaction, the moles of any other substance can be determined by multiplying by a mole ratio.

A mole ratio: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Example: If 2.00 moles of HBr react, determine the moles of O2 reacting

O2  + 4HBr 🡪 2 H2O + 2 Br2

Ex: If 0.080 moles of H2O are produced, determine the moles of HBr reacting.

Ex. If 15 moles of Br2 are produced, determine the moles of O2 that are reacting.

*Practice*: Answer the following mole conversion problems using the following balanced reaction.

$$Ni\_{2}\left(SO\_{4}\right)\_{3}+2Na\_{3}PO\_{4}\rightarrow 2NiPO \_{4} +3Na\_{2}SO\_{4}$$

1. If 0.050 mol of $NiPO \_{4}$ are produced, determine the moles of $Ni\_{2}\left(SO\_{4}\right)\_{3}$ reacting.
2. If 2.40 mol of $NiPO \_{4}$ are produced, determine the moles of $Na\_{2}SO\_{4}$ produced.
3. If 10.2 mol of $Na\_{3}PO\_{4}$ are reacted, determine the moles of $Na\_{2}SO\_{4}$ produced.

**Stoichiometry Calculations involving mass:** *Three step conversion problems*

To solve stoichiometric problems when going from mass 🡪 mass:

1. Determine a balanced chemical equation: Write the chemical formulas for each substance, be sure to balance the charges if needed. Add coefficients so that the number of atoms of each element is the same of both side of the reaction.
2. Determine the given information
3. Determine the unknown information.
4. Set up a three step conversion problem.

Example: If 8.40 gram of sodium fluoride are present, what mass of calcium nitrate would be required in the reaction?