Name: _____

Period: _____

The "Laws" and Principles of Chemical Reactions

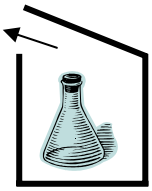
Principle of Definite Proportions

Every compound exists in an exact formula in definite proportions. To make water you need 2 hydrogen and 1 oxygen atoms, no more – no less. Though this may seem simple, it is foundational to other principles of chemistry.

Chemistry: Magic or Science?

When baking soda and vinegar react the amount of product seems to be smaller than the reactants. Did the chemicals disappear? No, they simple *transformed*. The chemicals went somewhere. To investigate this transformation a *closed system* is needed.

Closed system: products are trapped.



Open system: products can escape.

Law of Conservation of Mass

Mass is never created or destroyed only transformed.

In the chemical reaction of baking soda and vinegar bubbles form; meaning a gas was created. If this gas is not captured, it would seem that the products weigh less than the reactants. The Law of Conservation of Mass, however, (and logic) tell us this is not true. So we must use a closed system to "trap" the products.

The Chemical Reaction between Vinegar and Baking Soda

$$HC_2H_3O_2 + NaHCO_3 \rightarrow NaC_2H_3O_2 + H_2O + CO_2$$

Vinegar (Acetic Acid) + Baking Soda produce Sodium Acetate + _____ + _____

Name these compounds

Lab Safety: Wear safety goggles and an apron during the experiment.

Prove it

Setup 1: Open System:
50mL beaker with 5 g (appr. 1 tsp) baking soda;
50mL beaker with 20 mL vinegar.
Balance scale.

Complete weight of Setup 1
(including the beakers): _____

Pour the vinegar into the beaker with the baking soda.

Swirl the beaker to ensure that the reaction has gone to completion (has finished).

Complete weight of Setup 1
(including the beakers): _____

Are the Initial and Final weights equal? _____

Why? _____

Setup 2: Closed System:
Balloon with 5 g (appr. 1 tsp) baking soda
Paperclip to clamp balloon.
125mL flask with 20 mL vinegar. Balance scale.

Initial weight of Setup 2
(including the beaker and balloon): _____

Pour the vinegar into the beaker with the baking soda.

Swirl the beaker to ensure that the reaction has gone to completion.

Final weight of Setup 2
(including the containers): _____

Are the Initial and Final weights equal?_____

Why? _____

Name: _____

Period: _____

Balancing Equations

Find the molecular masses of both sides of this reaction.

$$H_2 + O_2 \rightarrow H_2O$$

Mass of reactants:	Mass of product:

The mass of the reactants and products are *not* the same, but the *Law of Conservation of Mass* says that they must be. So we must **balance the equation.**

How to Balance a Chemical Equation

	$H_2 + O_2 \rightarrow H_2O$	
1. Count up the number of atoms of each element on each side:	2 H 2 O	2 H and 1 O
		Not balanced: not enough oxygens on the product side.
2. Put a coefficient in front of one of the molecules that has too few atoms.	$H_2 + O_2 \rightarrow \underline{2}H_2O$	
3. Recount and see if the reaction is balanced.	2 H 2 O	4 H and 2 O
		Not balanced: not enough hydrogens on the reactant side.
4. Put a coefficient in front of another molecule that has too few atoms.	$\underline{2}H_2 + O_2 \rightarrow 2H_2O$	
5. Recount and see if the reaction is balanced.	4 H 2 O	4 H and 2 O
		Balanced: equal number of atoms on both sides.
6. Finished.	$2H_2 + O_2 \rightarrow 2H_2O$	**Balanced Chemical Equation**

Balancing chemical equations can be a long process depending on how difficult the equations are. Go step-by-step and eventually you will balance the equation.

Balance the following Chemical Equations
(put 1's if no other number is needed)

__ Al + __ Br_2 → __ $AlBr_3$

__ CH_4 + __ O_2 → __ CO_2 + __ H_2O

__ HCl + __ $CaCO_3$ → __ $CaCl_2$ + __ CO_2 + __ H_2O