**Chemistry Concepts**  Name:

**Chapter 8:** Chemical Equations and Reactions

8-1: Describing Chemical Reactions

*Chemical reaction -*

* *-* original substances
* *products -*
* Law of conservation of mass - total mass of reactants must equal the

**Chemical equation -** represents the identities and relative molecular or molar amounts of the in a chemical reaction.

* + example: The following chemical equation shows that the reactant ammonium dichromate yields the products nitrogen, chromium(III) oxide, and water.

(NH4)2Cr2O7(*s*) → N2(*g*) + Cr2O3(*s*) + 4H2O(*g*)

**Indications of a Chemical Reaction**

* Certain easily observed changes usually indicate that a chemical reaction has occurred.

1. Evolution of energy as
2. Production of a
3. Formation of a precipitate.
   * - solid that is produced as a result of a chemical reaction in solution and that separates from the solution
4. Color change

**Word equation -** equation in which the reactants and products in a chemical reaction are represented by words.

* example: methane + oxygen → carbon dioxide + water

**Formula equation -** represents the reactants and products of a chemical reaction

* example: The formula equation for the reaction of methane and oxygen is

CH4(*g*) + O2(*g*) → CO2(*g*) + H2O(*g*) (not balanced)

**Sample Problem A**

Write word and formula equations for the chemical reaction that occurs when solid sodium oxide is added to water at room temperature and forms sodium hydroxide (dissolved in the water). Include symbols for physical states in the formula equation. Then balance the formula equation to give a balanced chemical equation.

**Balancing Chemical Equations**- The relative amounts of reactants and products represented in the equation must be adjusted so that the

1. Identify the names of the reactants and the products, and write a word equation.

water → hydrogen + oxygen

1. Write a formula equation by substituting correct formulas for the names of the reactants and the products.

H2O(*l*) → H2(*g*) + O2(*g*) (not balanced)

1. Balance the formula equation according to the
   * 1. Balance the different types of atoms one at a time.
     2. First balance the that are combined and that appear only once on each side of the equation.
     3. Balance that appear on both sides of the equation as single units.
     4. Balance H atoms and O atoms after atoms of all other elements have been balanced.

**Sample Problem C**

The reaction of zinc with aqueous hydrochloric acid produces a solution of zinc chloride and hydrogen gas. Write a balanced chemical equation for the reaction.

**Sample Problem D**

Solid aluminum carbide, Al4C3, reacts with water to produce methane gas and solid aluminum hydroxide. Write a balanced chemical equation for this reaction.

8-2: Types of Chemical Reactions

**Five basic types of reactions:**

* 1. Synthesis - also known as a , two or more substances combine to form a new compound.
  + *Oxide -* combination of an element with
  + Almost all react with oxygen to form oxides.
  1. Decomposition - a single compound undergoes a reaction that produces .
  + reactions are the opposite of synthesis reactions.
  + The decomposition of a substance by an electric current is called
  1. Single-displacement - one element replaces a in a compound.
  2. - ions of two compounds exchange places in an aqueous solution to form
  3. - substance combines with oxygen, releasing a large amount of energy in the form of light and heat.

8-3: Activity Series of the Elements

- ability of an element to react

* + The more readily an element reacts with other substances, the its activity is.

- list of elements organized according to the ease with which the elements undergo certain chemical reactions.

* + For metals, greater activity means a greater ease of *loss* of electrons, to form
  + For nonmetals, greater activity means a greater ease of , to form negative ions.
  + The most-active element is placed at the top in the series.
    - It can replace each of the elements below it from a compound in a single-displacement reaction.
  + Activity series are used to help predict whether certain .
  + Activity series are based on .