

Types of Chemical Reactions in Chemistry

SCH3U_2015

A chemical equation is a representation of a chemical reaction.

Chemical equations of a reaction illustrate what is made (product) when certain ingredients (reactants) are combined.

A skeleton equation represents a chemical reaction by using chemical formulas for the reactants and the products and symbols for the physical states, (s), (l), (g), (aq).

A balanced chemical equation using chemical formulas and the coefficients to show the number of particles of each substance that is involved in the chemical reaction and thus satisfies the Law of Conservation of Mass.

Many of the reaction you will encounter in chemistry can be classified under four reaction types.

I. Synthesis or Combination reactions are those in which a compound is formed from simpler substances.

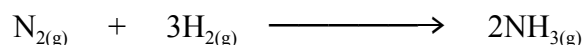
Their general format is: $A + B \longrightarrow AB$

In a synthesis reaction:

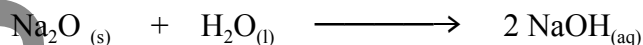
1. A **metal and a non-metal** may react to form a **binary ionic** compound.



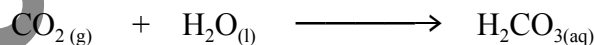
2. A **non-metal and a non-metal** may react to form a **molecular covalent** compound.



3. A **metal oxide** may dissolve in water to form a **base** (metal hydroxide)



4. A **non-metal oxide** may dissolve in water to form an **acidic** solution

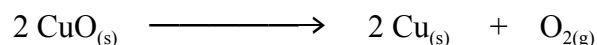


II. Decomposition reactions are the opposite of synthesis reactions and consist of a binary compound breaking down into simpler substances or smaller units.

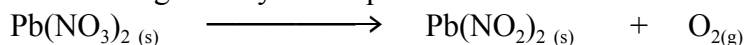
Their general format is: $AB \longrightarrow A + B$

Types of decomposition reaction:

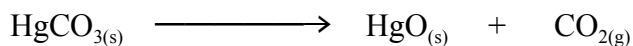
1. A metal oxide generally decompose into into elements:



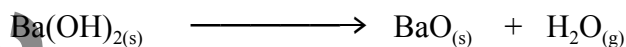
2. A metal nitrate generally decomposes into a metal nitrite and oxygen gas.



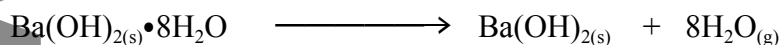
3. A metal carbonate generally decomposes into a metal oxide and carbon dioxide gas.



4. A metal hydroxide generally decomposes into a metal oxide and water.



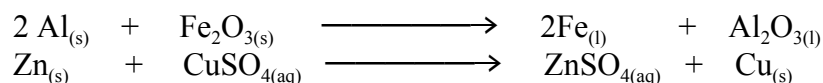
5. A hydrate decomposes into its ionic compound and water.



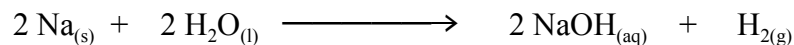
III. Single Displacement reactions involve one element or atom taking the place, i.e. replacing, another element in a compound.

Their general format is: $\text{A} + \text{BC} \longrightarrow \text{AC} + \text{B}$

1. a. A single displacement reaction will only occur when the uncombined element is a more reactive metal, i.e. higher in the **Activity Series of Metals** than the metal it would replace in the compound. (See Activity Series of Metals)

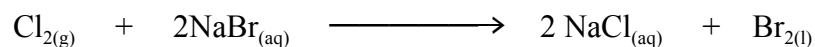


b. A reactive metal high in the Activity Series will also react with water to form hydrogen gas and a basic solution, (a metal hydroxide):



2. The order or reactivity of the halogens can be used to predict whether a halogen will replace another halogen in a compound.

(Order of Reactivity of the Halogen group: $\text{F}_2 > \text{Cl}_2 > \text{Br}_2 > \text{I}_2$)

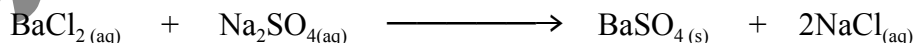


IV. Double Displacement reactions are like the single displacement reactions except that compounds exchange (trade) atoms.

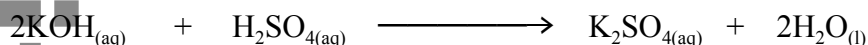
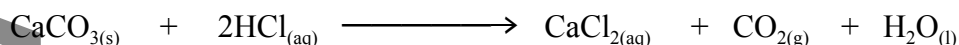
Their general format is: $AB + CD \longrightarrow AD + CB$

A double displacement reaction generally produces a precipitate, a gas or a water liquid.

1. **Solubility Rules** can be used to predict whether a product of a double displacement reaction will be a precipitate.

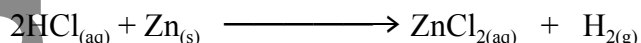


2. Neutralization reaction occurs when there is a double displacement reaction between an acid and a metal carbonate or when an acid reacts with a base.

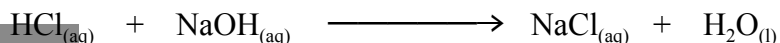


Acid - Base Reactions

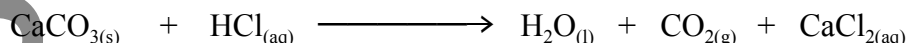
1. Acid + Metal \longrightarrow Salt + Hydrogen Gas



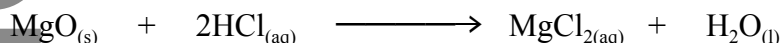
2. Acid + Base \longrightarrow Salt + Water



3. Acid + Metal Carbonate \longrightarrow CO_2 + H_2O + Salt



4. Metal Oxide + Acid \longrightarrow Salt + Water



Definition: **Salt**:

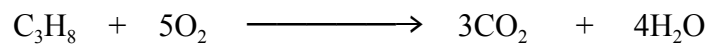
A chemical compound formed from the reaction of an acid with a base, where all or part of the hydrogen in the acid formula has been replaced by a metal (or other cation).

Salt of a binary acid is an --- ide.

Salt of an oxy acid could be an --- ate, --- ite, --- hypo --- ite, or a --- per --- ate.

Combustion Reactions: there are two types:

1. **Complete combustion:** occurs in the presence of excess oxygen gas, the products are carbon dioxide gas and water



2. **Incomplete combustion:** occurs in the presence on insufficient oxygen gas, products are carbon, carbon monoxide, carbon dioxide and water.