

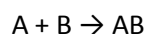
## TYPES OF CHEMICAL REACTIONS

Most reactions can be classified into one of five general categories:

1. Combination/Synthesis
2. Decomposition
3. Combustion
4. Single Replacement/Single Displacement
5. Double Replacement/Double Displacement

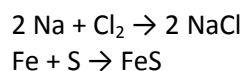
### 1. Combination/Synthesis Reactions

Any reaction in which two or more substances combine to form a single product is a *direct union* or *combination* reaction. The general form of a direct union reaction is:

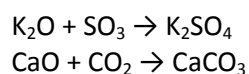


This type of reaction generally takes place between the following types of compounds:

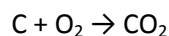
**A metal + non-metal**



**Metal oxide + non-metal oxide**

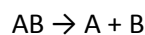


**Non-metal + non-metal**

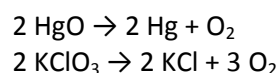


### 2. Decomposition Reactions

Decomposition is the reverse of combination. That is, a single reactant is broken down into two or more products either elements or compounds. A decomposition reaction will take place because the compound is unstable or as a result of heating or electrical decomposition (electrolysis). The general form for a decomposition reaction is:

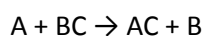


Some examples of decomposition reactions are:



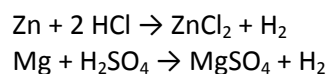
### 3. Single Replacement/Single Displacement Reactions

A displacement reaction involves an element reacting with a compound whereby the element displaces a second element from the compound. The general form of this type reaction is:

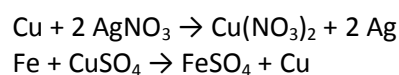


Displacement reactions usually occur between the following combinations:

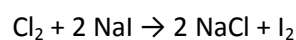
**An active metal + an acid**



**A metal + a salt**

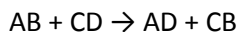


**A halogen + halide salt**



#### 4. Double Displacement/Double Replacement Reactions

A double displacement reaction that usually occurs in solution. The general form of a double displacement reaction is:

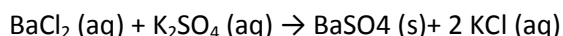
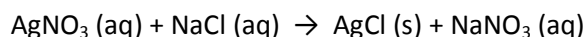


There are three types of double displacement/displacement reactions:

- A. Formation of a Precipitation—Precipitation Reaction
- B. Formation of a Gas
- C. Formation of Water—Acid/Base Reaction or Neutralization Reaction

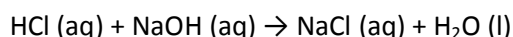
##### A. Precipitation Reactions

In this type of reaction, two compounds which are water soluble react to form two new compounds, one of which is a precipitate (i.e. insoluble in water). In order to determine which one of the products will be the precipitate requires the knowledge of the Solubility Rules. The rules governing the solubility of common salts are given on the last page of this document.



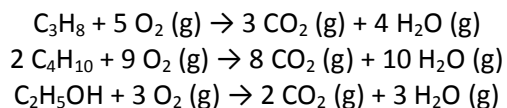
##### B. Acid/Base Reactions or Neutralization Reactions

A neutralization reaction occurs between an acidic compound and a basic compound to form an ionic compound and water.



#### 5. Combustion Reactions

Combustion reactions generally apply to organic compounds, such as hydrocarbons, which are used as fuels. In these cases, the compound is being burned in air (or oxygen) and producing carbon dioxide and water as products. A general form for a combustion reaction is:



#### THE SOLUBILITY RULES

1. All sodium, potassium, and ammonium salts are soluble.
2. The nitrates, chlorates, and acetates of all metals are soluble.
3. The chlorides, bromides, and iodides of all metals are soluble.  
Exceptions--lead, silver, and mercury(I)
4. The sulfates of all metals are soluble.  
Exceptions--lead, mercury(I), barium, calcium, and silver.
5. The carbonates, phosphates, borates, sulfites, chromates, and arsenates of all metals are insoluble.  
Exception--sodium, potassium, and ammonium
6. The sulfides of all metals are insoluble.  
Exception--barium, calcium, magnesium, sodium, potassium, and ammonium.
7. The hydroxides and oxides of all metals are insoluble.  
Exceptions--sodium, potassium, and ammonium are very soluble in water.