

Chemistry Lecture #46: Types of Reactions

Chemical reactions fall into categories based on what you start with (reactants) and what you end up with (products). There are five types of reactions: synthesis, combustion, decomposition, single-replacement, and double-replacement.

Synthesis: Two or more substances react to form one substance.

Examples:



In the above example, two elements (iron and chlorine) combine to form the ionic compound iron (III) chloride.



In above example, two compounds (CaO and H₂O) combine to form the compound Ca(OH)₂.



In the above example a compound (SO₂) combines with an element (O₂) to form the compound SO₃.

The standard pattern in all the above examples is



Combustion: A substance combines with oxygen.

A combustion reaction occurs anytime an element or compound combines with oxygen. In the previous example of



we labeled it as a synthesis reaction because two substances combined to form one substance. But it is also a combustion reaction since the SO_2 is combining with the O_2 .

Here's another example:



This is another example of a combustion reaction that is also a synthesis reaction.

However, not all combustion reactions are synthesis reactions. For example,



In the above example, a substance (CH_4) reacts with oxygen to produce two substances that contain oxygen, CO_2 and H_2O .

The general pattern in combustion reactions is



Decomposition: One substance decomposes into two or more substances.

Synthesis means things are being put together. Decomposition is the opposite: things are falling apart.

Examples:



In the above example, one compound (NH_4NO_3) is breaking apart into two compounds (N_2O and H_2O).



In the above example, a compound (H_2O_2) is breaking apart into a compound (H_2O) and an element (O_2).



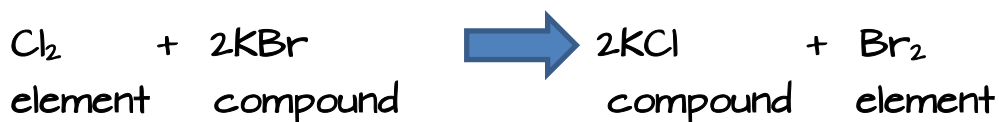
In the above example, a compound (NaN_3) is breaking apart into elements (Na and N_2).

The general pattern we see in decomposition is

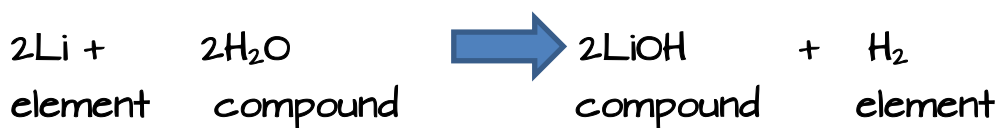


Single-replacement: One element replaces the atoms of another element in a compound.

Example:



In the above example, Cl is replacing the Br in KBr. KBr has been turned into KCl.



In the above example, Li is replacing one of the H's in H₂O. H₂O is now LiOH.

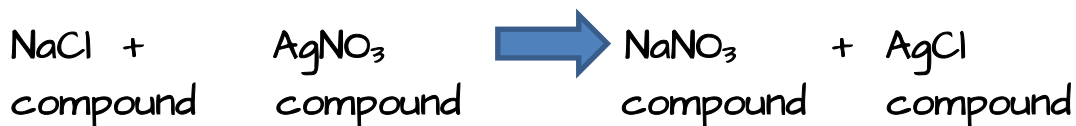
The pattern we see in all single-replacement reactions is



If there is an element and a compound on one side of the arrow, and an element and a compound on the other side, you have a single-replacement reaction.

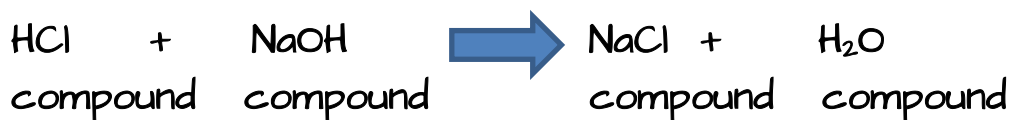
Double-replacement: Two compounds exchange ions

In a double-replacement reaction, the positive and negative ions of two compounds switch places.



In the above example, Na and Ag switch partners. NaCl becomes NaNO₃. AgNO₃ becomes AgCl. Two replacements have occurred.

H₂O is often a common product of a double replacement reaction. For example,



In the above example, H and Na switch partners. HCl becomes HOH or H₂O. NaOH becomes NaCl.

The basic pattern for double replacement reactions is



Summary of Reactions

Synthesis



Combustion



Decomposition



Single-replacement



Double-replacement

