Types of Chemical Reactions

There are four major types of chemical reactions that we will examine this year:

- Synthesis (or Addition)
- Decomposition
- Single Displacement
- Double Displacement.

We will also discuss Combustion reactions (which don't fit nicely into any of the above categories)

Synthesis
- Two or more reactants combine to form a single product.
- The general form is: \( A + B \rightarrow AB \)

Ex. \( 2 \text{Mg}(s) + \text{O}_2(g) \xrightarrow{\Delta} 2 \text{MgO}(s) \)

Types of Synthesis Reactions
1. metal + non-metal forms an ionic compound:
   \( \text{Ca}(s) + \text{F}_2(g) \rightarrow \text{CaF}_2(s) \)
2. metal/non-metal + oxygen produces an oxide:
   \( \text{Mg}(s) + \text{O}_2(g) \rightarrow \text{MgO}(s) \)
3. non-metal oxide + water to make an acid:
   \( \text{SO}_3(g) + \text{H}_2\text{O}(l) \rightarrow \text{H}_2\text{SO}_4(aq) \)
   \( \text{SO}_2(g) + \text{H}_2\text{O}(l) \rightarrow \text{H}_2\text{SO}_3(aq) \)
4. metal oxide + water to make base:
   \( \text{MgO}(s) + \text{H}_2\text{O}(l) \rightarrow \text{Mg(OH)}_2(aq) \)
**Decomposition**

- A single compound is broken down into multiple products.
- This is the reverse of a synthesis reaction.
- The general form is: \( AB \rightarrow A + B \)

\[ \text{Ex. } 2 \text{H}_2\text{O(l)} \xrightarrow{12 \text{ volts}} 2 \text{H}_2(\text{g}) + \text{O}_2(\text{g}) \]

**Single Displacement**

- One element replaces another similar element in a compound.
- The general form is: \( A + BC \rightarrow AC + B \)

\[ \begin{array}{c}
\text{Blue} + \text{Red} \\
\text{Blue} + \text{Green}
\end{array} \rightarrow \begin{array}{c}
\text{Blue} + \text{Red} \\
\text{Blue} + \text{Green}
\end{array} \]

\[ \text{Ex. } \text{Mg(s)} + 2 \text{HCl(aq)} \rightarrow \text{MgCl}_2(\text{aq}) + \text{H}_2(\text{g}) \]

\[ \text{Ex. } 2 \text{NaI(aq)} + \text{F}_2(\text{g}) \rightarrow 2\text{NaF(aq)} + \text{I}_2(\text{s}) \]
**Double Displacement**
- Two reactants recombine to form two new compounds.
- The general form is: \( AB + CD \rightarrow AD + CB \)

\[ 2 \text{KI}_{(aq)} + \text{Pb(NO}_3)_2_{(aq)} \rightarrow \text{PbI}_2_{(s)} + 2 \text{KNO}_3_{(aq)} \]