TYPES OF REACTIONS

Most chemical reactions can be grouped into five categories:

- synthesis
- decomposition
- combustion
- single displacement
- double displacement

SYNTHESIS

- ⇒ Involves the combination of smaller atoms and /or molecules into larger molecules
- ⇒ Two or more reactants combine to make one product
- \Rightarrow The general equation for a synthesis reaction is: A + B \rightarrow AB
- ⇒ Examples:

$$H_2 + I_2 \rightarrow 2 HI$$

2 Na +
$$Cl_2 \rightarrow 2$$
 NaCl

DECOMPOSITION

- ⇒ Opposite to synthesis
- ⇒ Involves the splitting of a large molecule into elements or smaller molecules
- ⇒ One reactant breaks apart into two or more products
- \Rightarrow The general equation for a decomposition reaction is: AB \rightarrow A + B
- ⇒ Examples:

$$2 H_2O \rightarrow 2 H_2 + O_2$$

$$NH_4NO_3 \ \rightarrow \ N_2O \ + \ NH_3$$

$$2\;HCI \rightarrow \;H_2\; +\; CI_2$$

COMBUSTION

- ⇒ Involves a compound that is made up of carbon and hydrogen called a hydrocarbon.
- \Rightarrow The hydrocarbon reacts with oxygen (O₂)
- ⇒ ALWAYS produces carbon dioxide and water
- ⇒ The general equation for a double displacement reaction is:

$$C_x H_y \ + \ O_2 \ \rightarrow \ CO_2 \ + \ H_2 O$$

Examples

$$CH_4 + O_2 ---> CO_2 + H_2O$$

$$C_2H_6 + O_2 ---> CO_2 + H_2O$$

SINGLE DISPLACEMENT

- ⇒ Involves one element replacing or displacing a second element in a compound
- ⇒ A metal element will only displace a metal in a compound.
- ⇒ A non-metal will only displace a non-metal in a compound.
- ⇒ The general equation for a single displacement reaction is:

A + XY
$$\rightarrow$$
 AY + X (where A is a metal)
e.g. 2 Na + ZnCl₂ \rightarrow 2 NaCl + Zn
B + XY \rightarrow XB + Y (where B is a non-metal)
e.g. 2 NaCl + F₂ \rightarrow 2NaF + Cl₂

⇒ Examples:

$$3 \text{ CuCl}_2 + 2 \text{ Al} \rightarrow 2 \text{ AlCl}_3 + 3 \text{ Cu}$$

 $\text{Br}_2 + \text{Cal}_2 \rightarrow \text{I}_2 + \text{CaBr}_2$

DOUBLE DISPLACEMENT

- ⇒ Involves both elements in different compounds displacing each other or exchanging places.
- ⇒ The metals switch places and the non-metals switch places
- ⇒ Analogy two couples dancing and they switch partners
- ⇒ The general equation for a double displacement reaction is:

$$AB + XY \rightarrow AY + XB$$

⇒ Examples:

$$2 \; \text{FeCl}_3 \; + \; 3 \; \text{Na}_2 \text{S} \; \rightarrow \; \; 6 \; \text{NaCl} \; + \; \text{Fe}_2 \text{S}_3$$

$$AgNO_3 + NaCl \rightarrow NaNO_3 + AgCl$$

$$Pb(NO_3)_2 \ + \ 2 \ KI \ \rightarrow \ 2 \ KNO_3 \ + \ PbI_2$$