**Types of Chemical Reactions**

1. **Synthesis**

2 or more elements or compounds combine to form a new substance

A + B → AB

Ex.1 element + element → compound

2Na + Cl2 → 2NaCl

Ex. 2 metal oxide + water → base

MgO + H2O → Mg(OH)2

Ex. 3 non-metal oxide + water → acid

CO2 + H2O → H2CO3

1. **Decomposition**

A compound breaks down into elements or simpler compounds

Ex.1 compound → element + element

2H2O → 2H2 + O2 (by the process of electrolysis)

Ex.2 carbonate → oxide + carbon dioxide

CaCO3 → CaO + CO2

Ex. 3 chlorate → chloride + oxygen

2KClO3→2 KCl + 3O2

1. **Combustion**

The reaction of a substance with oxygen, producing oxides and energy (light/heat)

Often occurs with hydrocarbons (compounds that contain only hydrogen and carbon such as methane, propane, etc.)

1. **Complete Combustion**

Occurs when sufficient oxygen is present

Most common oxides are produced

Ex. CH4 + 2O2 → CO2 + 2H2O

1. **Incomplete Combustion**

Occurs when insufficient oxygen is present

Less common oxides are produced

Ex. CH4 + O2 → CO + C + H2O

1. **Single Displacement**

A single element in a compound is replaced by another element.

1. **With a Metal**

Will only occur if the metal is more active than the metal ion in the compound (see activity series p. 126)

Ex.1. Cu + 2AgNO3 → 2Ag + Cu(NO3)2 \*copper is more active (higher in the series) than silver

Ex.2. Au + CuNO3 → no reaction \*gold is less active than copper

1. **With a Halogen**

Will only occur if the halogen is more active than the halogen in the compound (see activity series p. 127)

Ex.1. F2 + 2NaCl → 2NaF

Ex.2. I2 + CuF2 → no reaction \*iodine is less reactive than fluorine

Hint: The less active element wants to be alone

1. **Double Displacement**

This type of reaction involves the exchange of cations between 2 ionic compounds

Reactants are usually aqueous (dissolved in water, called a solution)

Products can be a precipitate (a solid), a gas, or become neutral.

Look up solubilities on the solubility table p. 137

Ex. 1. **Formation of a precipitate**

K2CO3 (aq) + CuSO4 (aq) → K2SO4(aq) + CuCO3(s)

Ex.2. **Formation of a gas**

Na2CO3 + HCl → NaCl + H2CO3

Carbonic acid is very unstable and breaks down.

H2CO3 → H2O + CO2

Overall : Na2CO3 + HCl → NaCl + H2O + CO2

Ex. 3. **Neutralization**

Acid + Base → Salt (any ionic compound) + water

HNO3 + NaOH → NaNO3 + H2O