Types of Reactions

Synthesis Reactions

- Formation of new product
- $A + B \rightarrow AB$

Decomposition Reactions

- Break down of a molecule into simpler components
- $AB \rightarrow A + B$

Complete Combustion

- Burning of a hydrocarbon to form only water and carbon dioxide
- $CH_{4\,(g)} + O_{2\,(g)} \rightarrow CO_{2\,(g)} + 2H_2O_{\,(g)}$
- Other substances undergo complete combustion to form stable oxides.
- $Mg_{\,(s)} + O_{2\,(g)} \rightarrow MgO_{(s)}$

Incomplete Combustion

- Burning of a hydrocarbon to form carbon dioxide, water along with carbon monoxide and carbon (caused by insufficient oxygen).
- $4CH_{4\,(g)} + 6O_{2\,(g)} \rightarrow C_{\,(s)} + 2CO_{\,(g)} + CO_{2\,\mathbf{(g)}} + 8H_2O_{\,(g)}$

Single Displacement

- Most involve a metal (A) replacing another metal (B) in a compound
- $A + BX \rightarrow B + AX$

Reactivity of Metals

- A reaction will only occur if the metal (A) is above metal B in the reactivity series.

Reactivity of Halogens

- Halogens can take part in single displacement reactions as well.
- $Cl_{2\,(g)} + NaI_{\,(aq)} \rightarrow NaCl_{\,(aq)} + I_{2\,(g)}$

Double Displacement

- $AX + BY \rightarrow BX + AY$
- In a double displacement reaction new products must be formed in order for a reaction to have taken place.

Formation of a Precipitate

- When two solutions are mixed a solid is formed.
- $BaCl_{2\,(aq)} + K_2SO_{4\,(aq)} \rightarrow BaSO_{4\,(s)} + 2KCl_{\,(aq)}$

Production of Gas

- In many cases a double displacement forming a gas will take place in two steps, a double displacement followed by decomposition.

- This is called a reaction mechanism

1. $Na_2CO_{3\,(aq)} + 2HCl_{\,(aq)} \rightarrow 2NaCl_{\,(aq)} + H_2CO_{3\,(aq)}$

2. $H_2CO_{3\,(aq)} \rightarrow H_2O_{\,(l)} + CO_{2\,(g)}$

Overall reaction

3. $Na_2CO_{3(aq)} + 2HCl_{(aq)} \rightarrow 2NaCl_{(aq)} + H_2O_{(l)} + CO_{2(g)}$

Formation of Water in Neutralization

- Acids and bases are double displacement reactions forming water.
- HA + BOH → AB + HOH