8.3 – Strong and Weak Acids and Bases

8.3.1 - Distinguish between strong and weak acids and bases in terms of the extent of dissociation, reaction with water and electrical conductivity

Strong Acid/ Base

- Almost completely dissociate
- React rapidly with water
- Higher electrical conductivity

Weak Acid/ Base

- Only Partially dissociate
- React slowly with water
- Lower electrical conductivity

8.3.2 - State whether a given acid or base is strong or weak

Examples of **strong acids** include:

- Hydrochloric acid - HCl
- Nitric acid - HNO_3
- Sulfuric acid - H_2SO_4

Examples of **strong bases** include:

- Sodium hydroxide - NaOH
- Potassium hydroxide - KOH
- Barium hydroxide - $Ba(OH)_2$

Examples of **weak acids** include:

- Ethanoic acid - CH_3COOH
- Carbonic acid - H_2CO_3

Examples of weak bases include:

- Ammonia - NH_3
- Aminoethane - $C_2H_5NH_2$

In a reaction with water, strong acids and bases will completely dissociate, so the reaction is shown to go to completion:

$$HCl + H_2O \rightarrow H_3O^+ + Cl^-$$

$$KOH + H_2O \rightarrow K^+ + OH^-$$

On the other hand, weak acids and bases reacting with water are shown to be at equilibrium, with only partial dissociation.

$$CH_3COOH + H_2O \leftrightarrow CH_3COO^- + H_3O^+$$

$$NH_3 + H_2O \leftrightarrow NH_4^+ + OH^-$$

One mole of a **monoprotic acid**, such as HCl, produces one mole of H^+ ions. One mole of a **diprotic acid**, such as H_2SO_4, produced two moles of H^+ ions.

8.3.3 - Distinguish between strong and weak acids and bases, and determine the relative strengths of acids and bases, using experimental data

pH measurement

The pH of a strong acid will be lower than the pH of a weak acid. Likewise, the pH of a strong base will be higher than the pH of a weak base. This can be found using a pH meter or an indicator substance.

Conductivity measurement

A strong acid or base will have a higher reading on a conductivity meter than a weak acid or base, provided they are at equal concentrations, or **equimolar**, since they have more ions in the solution.

Sidenote:

Some exams might ask you about the cause of **acid rain**. You should be aware that the atmosphere contains non-metal oxides (i.e. CO_2), which form acids when they are dissolved in water. An example of this is carbonic acid, which is formed from CO_2 and water. However, rain is only defined as acidic if the pH is below 5. This is most common around polluted areas, where there is increased output of CO_2 and other such gases. These may also come from volcanoes.

Acid rain is harmful to aquatic species because the pH of their environment may change, plants because the pH of the soil changes, and buildings because the acid erodes metal and stone.