THERMOCHEMISTRY

Introduction

Thermochemistry deals with the heat changes accompanying a chemical process. The difference between the heat content of products and reactants measured at constant pressure condition is called enthalpy change. It is expressed as $\Delta H = H_P - H_R$.

During an exothermic process in which heat is given out $H_R > H_p$ and so ΔH is negative. On the other hand, during an endothermic process, which is accompanied by absorption of heat; $H_R < H_P$, so ΔH is positive.

Enthalpy of dissolution

The enthalpy of solution of a solid in water may be defined as the amount of heat evolved or absorbed during the dissolution of 1 mole of the solid in excess of water so that further dilution produces no more heat change in the system, e.g.

$$NH_4NO_3 + H_2O \longrightarrow NH_4^+(aq) + NO_3^-(aq)$$
$$\Delta H = +26\ kJ$$

Enthalpy of solution depends on the temperature of solvent and amount of solvent (if not taken in large excess).

Enthalpy of Neutralization

Neutralization reaction is a reaction between an acid and a base to give salt and water.

Example:

$$HCl + NaOH \longrightarrow NaCl + H_2O$$

It is a neutralization reaction.

Enthalpy of neutralization of an acid by base is defined as the heat change when one gram equivalent of an acid is completely neutralized by one gram equivalent of a base in dilute solution at given temperature.

The heat of neutralization of a strong acid by a strong base or vice-versa is -57.1 kJ. This can be explained as follows:

According to the ionic theory, acids produce $H^+$and bases produce OH ions. One gram equivalent of acid in dilute solution (fully ionised) produces 1 mole of $H^+$and similarly 1 mole of OH^-will be produced from one gram equivalent of a base which react as follows to form water (1 mole).

$$H^+ + OH \longrightarrow H_2O$$
$$\Delta H = -57.1\ kJ$$

Measurement of enthalpy of solution or neutralization of reaction

The apparatus used for the measurement of enthalpy change is calorimeter.

Calorimeter constant of Calorimeter

Measurement of heat changes are carried out in calorimeters.