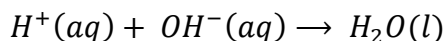


**Aim :** To determine of heat capacity of a calorimeter and enthalpy of neutralisation of hydrochloric acid solution with sodium hydroxide solution.

**Principle :**

The enthalpy of neutralization ( $\Delta H_{neut}$ ) of an acid can be defined as the enthalpy change associated with the complete neutralisation of its dilute aqueous solution containing one mole of  $H^+$  ions by a dilute aqueous solution of a base containing one mole of  $OH^-$  ions. The neutralisation of a strong acid with a strong base can be considered as the combination  $H^+(aq)$  ions with  $OH^-(aq)$  ions and can be represented as-



To determine the enthalpy changes associated with reactions, the following heat exchange principle of calorimetry is used.

**Heat lost by one part of the system = Heat gained by the other part of the system**

Using this principle, a thermochemical experiment can be performed using an isolated system such as a calorimeter. The experimental determination of the integral enthalpy of neutralisation involves the measurement of rise or fall in temperature during the reaction using a calorimeter container. The heat capacity of the calorimeter can be determined by using cold, hot and warm (cold + hot) water using the relation-

$$C_p(\text{calorimeter}) = 4.185V d_w \left[ \frac{T_h - T_m}{T_m - T_c} - 1 \right] \text{ J K}^{-1}$$

The enthalpy of neutralization can be calculated as follows-

$$\Delta H = -[C_p(c)(T_m - T_a) + V_{\text{base}} s(T_m - T_b) + V_{\text{acid}} s(T_m - T_a)]$$

where,  $C_p(c)$  is the heat capacity of the calorimeter

$T_a$ ,  $T_b$  and  $T_m$  are the temperatures of acid, base and equimolar mixture of the two respectively.

$s$  is the specific heat of the calorimeter.

$V_{\text{acid}}$  is the mass of acid taken (for water, mass  $\approx$  volume as density  $\approx 1 \text{ kg L}^{-1}$ )

$V_{\text{base}}$  is the mass of base taken.

$\therefore$  Enthalpy of neutralization

$$\Delta H_{neut} = \frac{\Delta H}{\text{Mole amount of acid or base}}$$

