Ministry of Higher Education and Scientific Research
University of Mohamed Khider Biskra

1st year LMD SNV /

Subject: Chemistry 2

Practical work no. 04

Determination of the molar heat of a reaction of neutralization of a strong acid (HCl) by a strong base (NaOH)

The molar heat of an acid/base dosage is the quantity of heat released for one mole of acid reacted with one mole of a base. It is the quantity of heat released to form one mole of water molecule.

In general :

$$(H^+,A^-)_{(aq)} + (B^+,OH^-)_{(aq)} \rightarrow (B^+,A^-)_{(aq)} + H_2O + Q_p$$

$$H^+ + OH^- \rightarrow H_2O + Q_p$$

Examples: the heat of the dosage (acid/base) under standard conditions:

$$(H^+,Cl^-)_{(aq)} + (Na^+,OH^-)_{(aq)} \rightarrow (Na^+,Cl^-)_{(aq)} + H_2O + Q_p \qquad Q_p = -13,71 (Kcal/mole)$$

$$(H^+,NO_3^-)_{(aq)} + (Na^+,OH^-)_{(aq)} \rightarrow (Na^+,NO_3^-)_{(aq)} + H_2O + Q_p \qquad Q_p = -13,71 (Kcal/mole)$$

The reaction gives a salt and water. The fact, that the acid and the base are strong, therefore totally dissociated; we can assume that the salt obtained remains in solution in the state of solvated ions and that the balance of the neutralization reaction is equivalent to the formation of a mole of water from a proton H^+ and a hydroxyl ion OH^-

1- Objectives :

Determination of the molar heat of a neutralization reaction of a strong acid (HCl) by a strong base (NaOH).

2- Materials :

Calorimeter (Vase Dewar), thermometer, beaker, 50ml graduated cylinder.

3- Products used:

Sodium hydroxide solution (NaOH) with a concentration of 1mol/L, hydrochloric acid solution (HCl) with an unknown concentration, distilled water.

4- Operating mode :

• Using a graduated cylinder, measure 50 ml of an HCl_{aq} acid solution of unknown concentration.

• This quantity of acid is poured into the calorimeter and the initial temperature T_o is recorded after closing the calorimeter.

• Add 50ml of NaOH soda solution. Stir after addition to homogenize, wait a few moments then note the temperature T_f obtained after a few seconds.