

### Experiment 3: Determination of the enthalpy heat of the dissolution $\Delta H_{diss}$

#### Enthalpy :

The enthalpy of dissolution (heat of dissolution) is the heat accompanying the complete dissolution of 1 mol substance. This enthalpy of solution ( $\Delta H_{solution}$ ) can either be positive if energy (heat) is absorbed (endothermic) or negative if energy (heat) is released (exothermic).

$$\Delta H_{diss} = \frac{Q}{n}$$

#### Where:

- $\Delta H_{diss}$  : The enthalpy of dissolution
- $Q$  : The heat energy
- $n$  : Number of moles

#### The objective of the experiment

In this practice, the objet is to determine the enthalpy of dissolution in water of sodium hydroxide, potassium hydroxide and ammonium chloride by calorimetry.

#### How to calculate

Since the system is isolated then

$$\sum Q_i = 0$$

$$Q_{gained} + Q_{lost} = 0$$

$$Q_{cold\ water} + Q_{product} + Q_{calorimeter} = 0$$

#### Materials and Chemicals

Materials	Chemicals
<ul style="list-style-type: none"><li>• Calorimeter with mixer</li><li>• Thermometer</li><li>• Heating device</li><li>• Becher</li><li>• Analytical balance</li></ul>	<ul style="list-style-type: none"><li>• Distilled water</li><li>• Sodium hydroxide (NaOH)</li><li>• Potassium hydroxide (KOH)</li><li>• Ammonium chloride (NH<sub>4</sub>Cl)</li></ul>

#### Procedure

1. We take a becher and ignore its weight before filling it with  $m_1=100$  g of cool water.
2. Put the cold water into the calorimeter.
3. We close the calorimeter and wait for thermal equilibrium to be achieved, and take a temperature reading of the system (cold water + calorimeter), let it be  $T_1$ .
4. We take 5,61 g of the product we put it into the calorimeter .
5. We close the calorimeter and wait for thermal equilibrium to be achieved, and take a temperature reading of the system (cold water + product + calorimeter), let it be  $T_f$ .
6. Record the obtained results in the table.

Product	Mass of Cold Water $m_1$ (g)	Mass of Product $m_2$ (g)	Temperature of Cold Water $T_1$ (K)	Equilibrium Temperature $T_f$ (K)
KOH				
NH <sub>4</sub> Cl				

**Answer the questions**

1. Calculate the number of moles of KOH, and NH<sub>4</sub>Cl that were put in the calorimeter
2. Calculate  $Q_{\text{product}}$  produced by both reactions.
3. Calculate the enthalpy  $\Delta H_{\text{KOH}}$  and  $\Delta H_{\text{NH}_4\text{Cl}}$
4. Predict the dissolution reaction type for KOH and NH<sub>4</sub>Cl
5. Justify your answer.