Practical Work N°3. Determination of the enthalpy heat of the dissolution $\mathbf{\Delta H_{diss}}$

Enthalpy

The enthalpy of dissolution, often known as the heat of dissolution, refers to the amount of heat released or absorbed when 1 mole of a substance completely dissolves. The enthalpy of solution (ΔHsolution) can be positive when heat energy is absorbed (endothermic) or negative when heat energy is released (exothermic).

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

Where

- ΔH_{diss} **:** The enthalpy of dissolution
- **Q :** The heat energy
- **n :** The number of moles

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

$\sum Q_i = 0$

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

$Q_{\text{cold water}} + Q_{\text{substance}} + Q_{\text{calorimeter}} = 0$

Materials and Chemicals

Materials	**Chemicals**
• Calorimeter with mixer • Thermometer • Becher • Analytical balance	• Distilled water • Potassium hydroxide (KOH) • Ammonium chloride (NH_4Cl)

Procedure

Experiment 1

1. Take a becher and ignore its weight before filling it with $\mathbf{m_1}$**=100 g** of cool water.

2. Put the cold water into the calorimeter.

3. 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 $\mathbf{T_1}$.

4. Weigh **5,61g** of **KOH**, and then put it into the calorimeter.

5. 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 $\mathbf{T_{eq}}$.
6. Record the obtained results in a table.

Experiment 2

1. Take a becher and ignore its weight before filling it with $\mathbf{m_1=100\ g}$ of cool water.
2. Put the cold water into the calorimeter.
3. 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 $\mathbf{T_1}$.
4. Weigh **5,34 g** of $\mathbf{NH_4Cl}$, and then put it into the calorimeter.
5. 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 $\mathbf{T_{eq}}$.

Questions

1. Record the obtained results in a table.

Product	Mass of Cold Water m_1(g)	Mass of substance m_2(g)	Temperature of Cold Water T_1 (K)	Equilibrium Temperature T_{eq} (K)
KOH				
NH_4Cl				

2. Calculate the number of moles of **KOH**, and $\mathbf{NH_4Cl}$ put in the calorimeter.
3. Calculate $\boldsymbol{Q}_{\text{substance}}$ for both **KOH**, and $\mathbf{NH_4Cl}$.
4. Calculate the enthalpy $\Delta \boldsymbol{H}_{\boldsymbol{KOH}}$ and $\Delta \boldsymbol{H}_{\boldsymbol{NH4Cl}}$.
5. Predict the dissolution reaction type for **KOH** and $\mathbf{NH_4Cl}$ and justify your answer.

Given:

K_{cal} = 61.50 J / K ; C_{H2O} = 4.184 J /g. K; M_{KOH} =56.11 g/mol); M_{NH4Cl} =53.49 g/mol);