

Calorimeter Lab

Enthalpy of Solutions

Purpose: Calculate the enthalpy of dissolving for two ionic solutions.

Materials:

Reagent grade ammonium chloride (NH_4Cl)

Reagent grade calcium chloride (CaCl_2)

Calorimeter

Graduated cylinder

Water

Thermometer

Procedure:

1. Measure out 100 milliliters of distilled water in a graduated cylinder.
2. Add the water to the calorimeter.
3. Record the temperature of the water. This will be known as the **initial temperature**.
4. Measure approximately 10.00 g of ammonium chloride. Record the exact amount to the nearest .01g.
5. Add the ammonium chloride to the water in the calorimeter.
6. Place the lid on top, and place the thermometer in the calorimeter so that the thermometer bulb is immersed in the liquid but the temperature can still be read.
7. Carefully stir the solid by moving the stirrer in an up and down motion. **Be careful to not break the thermometer.**
8. Carefully watch for a change in temperature. When the solid is completely dissolved record the temperature. This will be your **final temperature**.
9. Once completed, empty, rinse, and dry the calorimeter with a paper towel then repeat the procedure using **10.00 g of calcium chloride**.
10. Calculate the heat for the dissolving of the two solids. The formula is given below.

Data:

	Ammonium Chloride NH₄Cl	Calcium Chloride CaCl₂
Mass of water in Calorimeter (1ml=1g)		
Mass of solid used Estimate to 0.01g		
Temperature (initial) Estimate to 0.1 °C		
Temperature (final) Estimate to 0.1°C		
Temperature Change Temp _{final} - Temp _{initial}		
Q _{reaction} (heat of the reaction)		

Calculations: Calculate the heat for the dissolving of the two solids.

The heat absorbed or released to the water using the equation for heat.

$$q_{\text{surroundings}} = m \times C \times (T_{\text{final}} - T_{\text{initial}})$$

q_{surroundings} = Quantity of heat absorbed by the water

m = mass of the water

C = Specific heat capacity of water (4.184J/g °C)

ΔT = Temperature change (T_{final} - T_{initial})

$$q_{\text{reaction}} = - q_{\text{surroundings}}$$

Formula mass of ammonium chloride is 53.5g/mol

Formula mass of calcium chloride is 111.0 g/mol

$$\Delta H = \frac{q_{\text{reaction}}}{\text{Mass of solid/Formula mass}}$$

Enthalpy sign Conversion

Exothermic reaction	Δ H is negative (Δ H < 0)
Endothermic reaction	Δ H is positive (Δ H > 0)