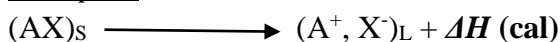


PW no.3 : Calorimetry
Measuring dissociation energy of a solid body

1- General :

- Chemical thermodynamics covers all energy exchanges that accompany changes of state and chemical reactions.
- Calorimetry is based on a fundamental principle: principle of equality of heat exchanges (what is lost by one medium is gained by another medium): this is the first principle of thermodynamics.
- The reactions release heat, they are exothermic reactions.
- Other reactions can absorb heat, they are endothermic.

Example :

$$\Delta H = Q_p = m C_p \Delta T = m C_p (T_f - T_i)$$

ΔH : variation of enthalpy (joule or cal), C_p : Heat capacity (cal/g.K)

2- Principle of manipulation :

- In an isolated medium (Calorimeter), [standard condition i.e.: $P=1\text{atm}=Cte$], we can determine the quantity of heat absorbed or released during the dissociation of solid bodies in water.
- Inside a calorimeter (we neglect its mass):

$$\sum \Delta H_p = 0$$

$$\Rightarrow \Delta H_{H_2O} + \Delta H_{diss} + \Delta H_c = 0 \Rightarrow \Delta H_{diss} = - \Delta H_{H_2O} = - (m C_p \Delta T)$$

If we have :

- ✓ $\Delta H > 0$: endothermic reaction
- ✓ $\Delta H < 0$: exothermic reaction
- ✓ $\Delta H = 0$: athermal reaction

3- But :

Measuring dissociation energy of a solid body.

4- Materials :

Test tubes, Calorimeter (Dewar), Thermometer, evaporating dish, Spatula, Graduated cylinder, Electric balance.

5- Products used:

Ammonium chloride (NH_4Cl), Sodium chloride ($NaCl$), Sodium hydroxide ($NaOH$), Distilled water.

6- Operating Mode:**a. Effect of temperature:**

Prepare 3 test tubes numbered 1 to 3 and fill them with 10ml of distilled water and then measure the temperature for each tube.

Weigh the same amount (1g) of the following body:

- 1) NH_4Cl and put it in **tube 1** and note the dissociation temperature T_1 (diss).
- 2) $NaCl$ and put it in **tube 2** and note the dissociation temperature T_2 (diss).
- 3) $NaOH$ and put it in **tube 3** and note the dissociation temperature T_3 (diss).

b. ΔH_{diss} determination of the dissociation of NH_4Cl and $NaOH$:

- Place 100 ml of distilled water in the calorimeter and note its temperature T_i .
- Add 1g of NH_4Cl to the calorimeter, close and stir, note the temperature T_f (diss).
- Repeat the same steps for $NaOH$.