# Lab #8: Molar Heat of Solvation and Molar Heat of Fusion

## Objectives:
1. Using the First Law of Thermodynamics, Conservation of Energy, determine the Heat of Solvation of NaOH and the Molar Heat of Fusion of Water.
2. Evaluate the design of a simple calorimeter.

## Hypothesis:
Comment on the level of accuracy of the Styrofoam Calorimeter.

## Materials:
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| Graduated Cylinder | Ice | Electronic Balance | $NaOH_{(s)}$ |
| 2 Styrofoam Cups and 2 Plastic Lids | Distilled Water | Thermometer | |

## Pre-Lab Exercise:
1. Read the procedure thoroughly and using the law of conservation of energy, determine what measurements are needed. Set up two observation tables to record all necessary measurements for both parts of the experiments.
2. Rewrite the procedure in a detail manner that reflects your actual measuring methods. (Remember that the wrong measuring techniques or devices used can affect your % errors.)

## Procedure:

### A. Molar Heat of Solvation of NaOH:
1. Get approximately 100 mL of distilled water and determine its temperature.
2. Obtain about 6.00 g of $NaOH_{(s)}$.
3. Dissolve the $NaOH_{(s)}$ in distilled water using the thermometer as a stirring rod and the Styrofoam Cup and plastic lid. The thermometer should be in the solution before the NaOH is completely dissolved. Read the temperature continuously and record the lowest or highest final temperature.

### B. Molar Heat of Fusion of Water:
1. Get approximately 50 mL of distilled water in another Styrofoam Cup and determine its temperature.
2. Obtain about 10 g of ice and place it in the water.
3. Measure the temperature continuously until the lowest final temperature is reached.

## Observations:

### Part A: Molar Heat of Solvation of NaOH

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### Part B: Molar Heat of Fusion of Water

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**Analysis:**

**Part A: Molar Heat of Solvation of NaOH**
1. Using the Law of Conservation of Energy, determine the molar enthalpy of solvation of NaOH. Show all the steps involved and list all values used.
2. Given the lattice energy of NaOH is 900 kJ/mol, determine the molar enthalpy of hydration of NaOH.
3. Draw a detail potential energy diagram for the dissociation of $NaOH_{(s)}$ in water (including lattice and hydration energies). Label all pertinent information and discuss the solvation of NaOH in terms of an endothermic or exothermic process.

**Part B: Molar Heat of Fusion of Water**
1. Using the Law of Conservation of Energy and presume that the temperature of ice is 0°C, determine the water's molar enthalpy of fusion. Show all the steps involved and list all values used.

**Evaluation:**
1. What is the % error of the experiment if the theoretical value of the molar enthalpy of solvation of NaOH is –44.51 kJ/mol?
2. Given the theoretical molar enthalpy of fusion for water is 6.01 kJ/mol, calculate the % error of this experiment.
3. Evaluate the effectiveness of the Styrofoam Calorimeter.
4. What is another source of error for both parts of the experiment besides the Styrofoam Calorimeter? Explain.

**Conclusion:**
1. Revisit your hypothesis and comment on your prediction.
2. Summarize what you have learned from this lab.