Heat of Solution Lab

Objectives

1. Quantify the relationship between temperature, energy and heat
2. Understand that an endothermic reaction causes a decrease in temperature and exothermic reactions cause an increase in temperature

Materials:

- Styrofoam cup
- Thermometer
- 2 weigh boats
- 2 scoopulas
- Electronic balance
- NH_4NO_3
- NaOH

Procedure

1. Use a graduated cylinder and measure 75.0 ml of water into a styrofoam cup
2. Record the temperature of the water in the data table
3. Making certain to weigh accurately, obtain between three and four (3-4) grams of NH_4NO_3.
4. Add the NH_4NO_3 to the water, continually swishing the cup gently, and with constant observation of the temperature until it remains constant for about 15-20 seconds.
5. Record the final temperature in the data table.
6. Rinse out your cup for the next experiment.
7. Repeat steps #1 – #6 using 1-2 grams of NaOH instead. **(CAUTION – NaOH is CAUSTIC)**

Data Table		
Salt Used→	NH_4NO_3	NaOH
Mass of 75.0 mL of water,		
Mass of salt used (grams)		
T_i, Initial Temperature of Water (˚C)		
T_f, Final Temperature of solution (˚C)		
ΔT, Temperature Change (˚C)		

Analysis (Show your work, where applicable)

1. Is the dissolution of the NH_4NO_3 in water an exothermic or endothermic process?

2. Is the dissolution of the NaOH in water an exothermic or endothermic process?

3. Assuming 1 mL of water has a mass of 1 gram and the specific heat of the dilute solution is the same as water (4.18 J/g˚C), calculate the number of joules involved in the dissolution of the NH_4NO_3. (use actual mass of H_2O)

   # of joules = 75 g x 4.185 J/g°C x temperature change (if the temperature goes down, then the temperature change is negative)

4. Record your answer: _____ J (from dissolution of NH_4NO_3)

5. How many **moles** of NH_4NO_3 was dissolved (Use your ACTUAL number of grams dissolved)

   NH_4NO_3 _____ moles dissolved

6. Calculate the number of joules that would be involved if one mole of the substance were dissolved in water. This is called the molar "Heat of Solution". (Show your work)

   Joules/mole of NH_4NO_3 = (Joules From Experiment)/(Moles used in experiment)

   Heat of dissolution of NH_4NO_3 = _____ joules/mole

7. Making the same assumption as #3, calculate the number of joules involved in the dissolution of the NaOH. (use actual mass of H_2O)

   # of joules = 75 g x 4.185 J/g^{o}C x temperature change

8. Record your answer: _____ J (from dissolution of NaOH)

9. How many **moles** of NaOH was dissolved (Use your ACTUAL number of grams dissolved)

   NaOH _____ moles dissolved

10. Calculate the number of joules that would be involved if one mole of the substance were dissolved in water. This is called the molar "Heat of Solution". (Show your work)

    Joules/mole of NaOH = (Joules From Experiment)/(Moles used in experiment)

    Heat of dissolution of NaOH = _____ joules/mole

11. Compare and contrast the heat of dissolution of NH_4NO_3 to that of NaOH