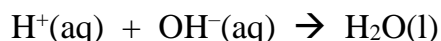


HESS'S Law Makeup**Background:**

In this experiment, you will determine the quantity of heat energy released in two exothermic reactions in order to use Hess's Law to determine the heat of reaction for the synthesis of water.

Use the following procedures, data tables and analysis questions to determine the thermochemical equations that can then be combined to find the heat of the reaction for the synthesis of water according to the following reaction:

**Reaction 1****Procedure**

1. Measure 100 mL of water into a calorimeter.
2. Record the temperature of the water in the calorimeter.
3. Obtain about 2.00 grams of sodium hydroxide. Record the mass used. Since sodium hydroxide picks up moisture from the air (called hygroscopic), it is necessary to weigh it quickly and proceed to the next step without delay.
4. Add the NaOH pellets to the water in the calorimeter. Place the lid on the calorimeter and stir the solution gently until the entire sample has dissolved.
5. Record the highest temperature reached during the reaction.
6. Discard the solution into the sink. Rinse the thermometer and the calorimeter.

Data

Mass of water used in the calorimeter	100.0 g
Initial temperature of the water	20.0 °C
Mass of the NaOH used in the reaction	2.18 g
Final temperature of the solution	25.0 °C

Analysis

Calculate ΔT for the reaction	_____ °C
Calculate the heat energy of the reaction	_____ J
Calculate the moles of NaOH used	_____ mol
Calculate the energy released <i>per</i> mole NaOH	_____ J/mol = _____ kJ/mol

Thermochemical Equation for Reaction 1

Reaction 2

Procedure

1. Measure 100 mL of 0.5M HCl solution into a calorimeter.
2. Record the temperature of the HCl solution in the calorimeter.
3. Obtain about 2.00 grams of sodium hydroxide. Record the mass used. Since sodium hydroxide picks up moisture from the air (called hygroscopic), it is necessary to weigh it quickly and proceed to the next step without delay.
4. Add the NaOH pellets to the HCl solution in the calorimeter. Place the lid on the calorimeter and stir the solution gently until the entire sample has dissolved.
5. Record the highest temperature reached during the reaction.
6. Discard the solution into the sink. Rinse the thermometer, the calorimeter and the graduated cylinder.

Note: For calculations we will make the assumption that the HCl solution has the same mass and heat properties identical to pure water.

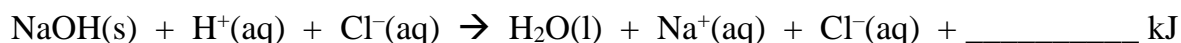
Data

Mass of HCl used in the calorimeter	100.0 g
Initial temperature of the HCl	18.0 °C
Mass of the NaOH used in the reaction	2.16 g
Final temperature of the solution	29.0 °C

Analysis

Calculate ΔT for the reaction	_____ °C
Calculate the heat energy of the reaction	_____ J
Calculate the moles of NaOH used	_____ mol
Calculate the energy released <i>per</i> mole NaOH	_____ J/mol = _____ kJ/mol

Thermochemical Equation for Reaction 2



Final Analysis

Use Hess's Law, the thermochemical equation for reaction 1, and the thermochemical equation for reaction 2 to determine the molar heat of the reaction for the synthesis of water.

