

# Heat of Reaction Lab

**Purpose :** To determine the heat of reaction for two different reactions and identify which is the endothermic and which is the exothermic reaction.

## Procedure

- 1) Measure out about 1 gram of baking soda on a piece of filter paper (record exact mass).
- 2) Measure out about 30mL of 1M acetic acid solution (record exact volume).
- 3) Add vinegar to a Styrofoam cup and measure the initial temperature of the acetic acid solution.
- 4) Add the baking soda to the acetic acid in the cup and stir with the thermometer.
- 5) Record the temperature at the point when it stops changing (make sure it is at its highest/lowest point).
- 6) Pour solution in the sink and wash Styrofoam cup.
- 7) Cut a 2 in strip of magnesium and weigh. Record exact mass.
- 8) Measure out about 30 mL of 1.5M HCl and pour in the Styrofoam cup.
- 9) Measure the starting temperature of the acid solution, then add the magnesium and stir with the thermometer. Record the temperature when it stops changing.
- 10) Pour solution in sink and wash Styrofoam cup.

## Safety

- 1) Acetic acid and hydrochloric acid are very reactive so wash any exposed areas with extensive amounts of water.
- 2) Goggles and aprons at all times!

## Data Table

	Experiment 1	Experiment 2
Mass	Baking Soda	Magnesium
Volume	Vinegar	HCl
Starting Temp		
Final Temp		
Temperature Change		

## Calculations (complete on a separate sheet)

- 1) Calculate the amount of heat absorbed/released by the water in experiment 1.
- 2) How much heat was absorbed/released by the reaction?
- 3) Calculate the Heat of reaction for experiment 1
- 4) How much would the temperature of 100.g of water change if 5.35g of baking soda was completely reacted?
- 5) Calculate the amount of heat absorbed/released by the water in experiment 2.
- 6) How much heat was absorbed/released by the reaction?
- 7) Calculate the Heat of reaction for experiment 2 in Cal/g.
- 8) How much energy would be transferred if a 10.5 gram piece of magnesium was completely reacted?

## Questions

1. What sign did you come up with for the heat of the reaction in experiment #1( $\Delta H$ )? What does that tell you about whether the reaction was endothermic or exothermic?
2. What sign did you come up with for the heat of the reaction in experiment #2( $\Delta H$ )? What does that tell you about whether the reaction was endothermic or exothermic?
3. Why was it necessary to measure the temperature and volume of the water to determine the Heat of Reaction? (Why can we just measure the reactants?)
4. The amount of acid in both reactions is much more than is necessary. Why is that essential to your calculation? (What might happen if you used too little acid? What is your calculation based on?)

## Analysis

1. What are 3 sources of error that might effect your results?
  - a.
  - b.
  - c.
2. How might you improve each of those errors?
  - a.
  - b.
  - c.

Draw energy bar diagrams for the two reactions showing both the change in the water and the change in the reactants.