Ms. Randall
Regents Chemistry
Lab Activity: Endothermic vs Exothermic Reactions

Background: A chemical reaction occurs when two or more compounds are rearranged together. This means that the atoms that were joined together in the original substances break apart and rearrange themselves to make something completely new; one or more compounds or elements may be transformed into one or more new compounds. This new substance is quite different from the original with its own unique properties.

A + B ----> C

Reactant + Reactant ----> Product

Many chemical reactions give off energy. Chemical reactions that release energy are called *exothermic* reactions. Some chemical reactions absorb energy and are called *endothermic* reactions. You will study one exothermic and one endothermic reaction in this experiment.

Objective:

- To study changes in temperature associated with chemical reactions, and to learn to identify processes as endothermic or exothermic based on the temperature change.
- To identify endothermic/exothermic reactions on reference Table I

Safety: Goggles, aprons

Sodium hydroxide is an extremely strong base that vaporizes at room temperature. Do not touch! Use a scoop at all times!

Pre-lab

1. Define endothermic and exothermic in your own words.

2. Classify each of the following as an exothermic or endothermic process.
    - Melting ice cubes _____
    - Burning a candle _____
    - Evaporation of water_____
    - Baking Bread _____
    - Splitting a gas molecule apart _____
    - Formation of snow in clouds _____

Materials:

- NaOH
- NH_4NO_3
- Graduated cylinder
- Room Temp H_2O
- Ziploc Baggie
- Balance/weigh boat/scoops

Procedure:

1. Put a weigh boat on the balance. Tare(re-zero) the balance.
2. Add about 3.00g of Ammonium nitrate. Record the mass.
3. Put the Ammonium nitrate into a zip-lock bag.
4. Add 50.0mL room temperature water to the baggie.
5. Close the bag and shake until the solid dissolves.
6. After a minute, feel the outside of the bag for temperature changes. Record your observations.
7. Dispose of the contents of the bag down the drain followed by large amounts of water. Dispose of baggie in the garbage.
8. Repeat the above procedure in a clean bag using sodium hydroxide.

Data:

Mass of Ammonium nitrate_____g

Mass of Sodium hydroxide_____g

Observations:

Substance	***Chemical Formula***	***Observations***

Analysis:

1. Each of the reactions you observed were decomposition reactions in which each of the ionic compounds were broken down in to their cation and anion in solution. For example the decomposition of KNO_3 in water would be as follows:

$$KNO_3 \xrightarrow{H_2O} K^+ + NO_3^-$$

Write the decomposition reaction for each of the compounds you observed.

2. Which reaction was Endothermic? Which reaction was exothermic? How could you tell?

3. For the endothermic reaction, what has more energy, the chemical reactants or the chemical products? For the exothermic reaction, what has more energy, the chemical reactants or the chemical products? How do you know?

4. Using Table I locate the two reactions you observed. Do you agree with the ΔH values that are listed?

5. Explain in terms of heat why the endothermic reaction made the bag feel cold.

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Lab Conclusion: Endothermic vs Exothermic Reactions

1. **Write a paragraph summarizing what you have learned about the scientific concept of the lab from doing the lab. Back up your statement with details from your lab experience.**

2. **When ammonium chloride crystals are dissolved in water, the temperature of the water decreases. What does this temperature change indicate about the dissolving of ammonium chloride in water?**

   A) It is an endothermic reaction because it absorbs heat.
   B) It is an endothermic reaction because it releases heat.
   C) It is an exothermic reaction because it absorbs heat.
   D) It is an exothermic reaction because it releases heat.

3. **In what type of reaction do the products of the reaction always possess more potential energy than the reactants?**

   A) Endothermic B) Exothermic
   C) Spontaneous D) Redox

4. **Which of the following best describes exothermic chemical reactions?**

   A) They never release heat.
   B) They always release heat.
   C) They never occur spontaneously.
   D) They always occur spontaneously.

5. **Which phase change is accompanied by the release of heat?**

   a. $H_2O(s) \rightarrow H_2O(g)$

   b. $H_2O(s) \rightarrow H_2O(l)$

   c. $H_2O(l) \rightarrow H_2O(g)$

   $H_2O(l) \rightarrow H_2O(s)$