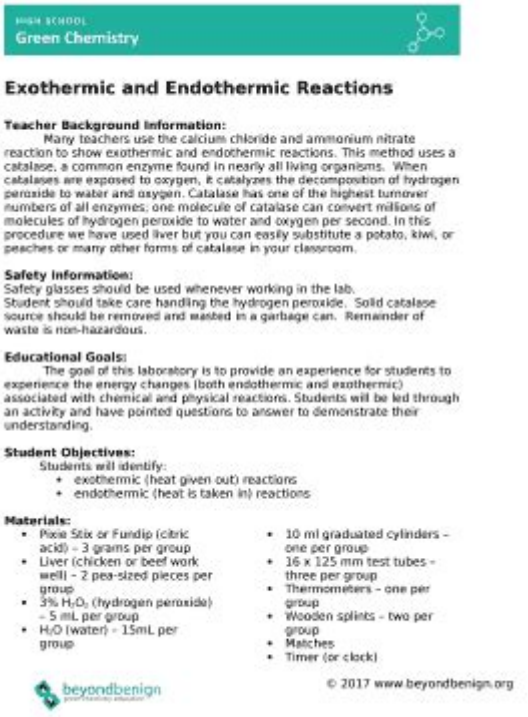
Endothermic And Exothermic Reactions Lab Answer Key



HIGH SCHOOL
Green Chemistry

Exothermic and Endothermic Reactions

Teacher Background Information:
Many teachers use the calcium chloride and ammonium nitrate reaction to show exothermic and endothermic reactions. This method uses a catalase, a common enzyme found in nearly all living organisms. When catalases are exposed to oxygen, it catalyzes the decomposition of hydrogen peroxide to water and oxygen. Catalase has one of the highest turnover numbers of all enzymes; one molecule of catalase can convert millions of molecules of hydrogen peroxide to water and oxygen per second. In this procedure we have used liver but you can easily substitute a potato, kiwi, or peaches or many other forms of catalase in your classroom.

Safety Information:
Safety glasses should be used whenever working in the lab.
Student should take care handling the hydrogen peroxide. Solid catalase source should be removed and wasted in a garbage can. Remainder of waste is non-hazardous.

Educational Goals:
The goal of this laboratory is to provide an experience for students to experience the energy changes (both endothermic and exothermic) associated with chemical and physical reactions. Students will be led through an activity and have pointed questions to answer to demonstrate their understanding.

Student Objectives:
Students will identify:
- exothermic (heat given out) reactions
- endothermic (heat is taken in) reactions

Materials:
- Pixie Stix or Fundip (citric acid) – 3 grams per group
- Liver (chicken or beef work welll – 2 pea-sized pieces per group
- 3% H_2O_2 (hydrogen peroxide) – 5 mL per group
- H_2O (water) – 15mL per group
- 10 ml graduated cylinders – one per group
- 16 x 125 mm test tubes – three per group
- Thermometers – one per group
- Wooden splints – two per group
- Matches
- Timer (or clock)

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Endothermic and exothermic reactions lab answer key is an essential aspect of understanding chemical reactions and their energy transformations. In chemistry, reactions can be classified into two primary categories based on their heat exchange with the surroundings: endothermic and exothermic reactions. This article will delve into the definitions, characteristics, and examples of these reactions, and we will provide a comprehensive answer key for a typical lab experiment designed to demonstrate these concepts.

Understanding Endothermic Reactions

Definition

Endothermic reactions are chemical reactions that absorb energy from their surroundings, usually in the form of heat. This absorption of energy results in a decrease in the temperature of the immediate environment, causing the reaction mixture to feel cold to the touch.

Characteristics of Endothermic Reactions

- Energy Absorption: Endothermic reactions require energy input for the reaction to occur.
- Temperature Decrease: The temperature of the surroundings drops as energy is absorbed.
- Positive Enthalpy Change: The change in enthalpy (ΔH) for an endothermic reaction is positive, indicating that energy is absorbed.
- Examples: Common examples include photosynthesis, the melting of ice, and the dissolution of ammonium nitrate in water.

Understanding Exothermic Reactions

Definition

Exothermic reactions are chemical reactions that release energy to their surroundings, usually in the form of heat. As a result, the temperature of the surroundings increases, and the reaction mixture feels warm or hot.

Characteristics of Exothermic Reactions

- Energy Release: Exothermic reactions release energy, making them self-sustaining in some cases.
- Temperature Increase: The temperature of the surroundings rises as energy is released.
- Negative Enthalpy Change: The change in enthalpy (ΔH) for an exothermic reaction is negative, indicating that energy is released.
- Examples: Common examples include combustion reactions, respiration, and the reaction of sodium hydroxide with water.

Experimental Overview

In a typical lab experiment designed to demonstrate endothermic and exothermic reactions, students will conduct two separate trials: one focusing on an endothermic process and the other on an exothermic process.

Materials Required

- For Endothermic Reaction:
- Ammonium nitrate (NH_4NO_3)
- Water
- Calorimeter or Styrofoam cup
- Thermometer
- For Exothermic Reaction:
- Calcium chloride ($CaCl_2$)
- Water
- Calorimeter or Styrofoam cup

- Thermometer

Procedure

1. Endothermic Reaction:
- Measure a specific amount of water (e.g., 100 mL) and pour it into the calorimeter.
- Weigh a specific amount of ammonium nitrate (e.g., 10 g).
- Add the ammonium nitrate to the water and stir until it dissolves completely.
- Record the initial temperature of the water before adding ammonium nitrate.
- Measure and record the final temperature of the solution after the ammonium nitrate has dissolved.

2. Exothermic Reaction:
- Measure a specific amount of water (e.g., 100 mL) and pour it into a second calorimeter.
- Weigh a specific amount of calcium chloride (e.g., 10 g).
- Add the calcium chloride to the water and stir until it dissolves completely.
- Record the initial temperature of the water before adding calcium chloride.
- Measure and record the final temperature of the solution after the calcium chloride has dissolved.

Data Analysis

- Calculate the temperature change (ΔT) for both reactions using the formula:
$$
ΔT = T_{\text{final}} - T_{\text{initial}}
$$

- For the endothermic reaction, a negative ΔT indicates a temperature decrease, while for the exothermic reaction, a positive ΔT indicates a temperature increase.

Answer Key for Lab Experiment

Endothermic Reaction Data Analysis

1. Initial Temperature: Measure the temperature before adding ammonium nitrate (e.g., 25°C).
2. Final Temperature: Measure the temperature after the reaction (e.g., 20°C).
3. Temperature Change (ΔT):
$$
ΔT = 20°C - 25°C = -5°C
$$
- This negative value confirms that the reaction is endothermic, as energy was absorbed from the surroundings.

Exothermic Reaction Data Analysis

1. Initial Temperature: Measure the temperature before adding calcium chloride (e.g., 25°C).
2. Final Temperature: Measure the temperature after the reaction (e.g., 34°C).
3. Temperature Change (ΔT):
\[
ΔT = 34°C - 25°C = +9°C
\]
- This positive value confirms that the reaction is exothermic, as energy was released into the surroundings.

Conclusion and Implications

Understanding endothermic and exothermic reactions lab answer key is crucial for students and educators alike. Through hands-on experiments, students can observe the direct effects of energy changes during chemical reactions.

The implications of these reactions extend beyond the classroom:
- Real-World Applications: Knowledge of these reactions is applicable in fields such as thermodynamics, environmental science, and engineering.
- Safety and Precautions: Understanding the energy changes associated with reactions helps in predicting the behavior of substances in various conditions, which is essential for laboratory safety and industrial processes.
- Further Study: Students interested in chemistry can explore more complex reactions and energy transformations, gaining insight into topics like reaction kinetics and equilibrium.

In summary, the classification of reactions into endothermic and exothermic categories not only enhances our understanding of chemistry but also provides practical knowledge applicable to various scientific and industrial domains. The hands-on lab experience solidifies theoretical concepts, making it an integral part of the learning process.

Frequently Asked Questions

What defines an endothermic reaction?

An endothermic reaction is characterized by the absorption of heat from the surroundings, leading to a decrease in the temperature of the environment.

What is an example of an exothermic reaction?

A common example of an exothermic reaction is the combustion of fuels, such as burning wood or gasoline, which releases heat and light.

How can you experimentally identify an endothermic

reaction in the lab?

You can identify an endothermic reaction by measuring the temperature of the reaction mixture; a significant drop in temperature indicates that heat is being absorbed.

What are some common substances used to demonstrate exothermic reactions in a lab setting?

Common substances include magnesium ribbon reacting with oxygen and hydrochloric acid reacting with sodium hydroxide, both of which release heat.

What safety precautions should be taken when conducting endothermic and exothermic reaction experiments?

Safety precautions include wearing gloves, goggles, and lab coats, working in a well-ventilated area, and being aware of the potential hazards of the chemicals used.

In a lab experiment, how can you measure the heat change during a reaction?

You can use a calorimeter to measure the heat change during the reaction by monitoring the temperature change of the reaction mixture.

What role do catalysts play in endothermic and exothermic reactions?

Catalysts speed up the rate of both endothermic and exothermic reactions without being consumed in the process, but they do not change the overall energy change of the reaction.

How does the concept of enthalpy relate to endothermic and exothermic reactions?

Enthalpy is a measure of the total energy of a thermodynamic system; in exothermic reactions, enthalpy decreases as energy is released, while in endothermic reactions, enthalpy increases due to energy absorption.

Endothermic And Exothermic Reactions Lab Answer

Key

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TextMeshPro - Unity マニュアル
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Unlock the secrets of endothermic and exothermic reactions with our comprehensive lab answer key. Discover how these processes work—learn more now!

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