Thermochemistry—
Experiment Summaries and Concepts

Exploring Energy Changes—Exothermic and Endothermic Reactions

Technology

Energy in the form of heat is exchanged in almost every chemical reaction or physical change in state. Some reactions absorb heat as they proceed, while others release heat as they take place. In this technology-based activity, students examine the heat changes in physical and chemical reactions and classify them as exothermic or endothermic. Students further investigate the amount of heat transfer in one of these reactions by measuring the resulting temperature change electronically as a function of time.

Concepts

- Thermochemistry
- Heat
- Temperature
- Exothermic vs. endothermic
- System vs. surroundings

Measuring Energy Changes—Heat of Fusion

Our everyday experience tells us that energy in the form of heat is needed to melt ice or boil water. What happens to the heat energy that is absorbed in these endothermic processes? Can the amount of heat energy be determined? The purpose of this experiment is to study the temperature and heat changes that occur when ice melts. Students first measure a heating curve for ice, water, and steam, and then use the heat equation to determine the amount of heat needed to melt ice.

- Heat vs. temperature
- Exothermic vs. endothermic
- Heat of fusion
- Enthalpy change

Discovering Instant Cold Packs—Heat of Solution

Inquiry

Instant cold packs are familiar first aid devices used to treat injuries. Most commercial cold packs consist of a plastic package containing a solid and an inner pouch filled with water. When the pack is activated, the solid dissolves in the water and produces a large temperature change. The purpose of this inquiry-based activity is to design a calorimetry experiment to determine the enthalpy change that occurs when a "cold pack solid" dissolves in water.

- Enthalpy change
- Heat of solution
- Calorimetry
- Dependent and independent variables

Measuring Calories—Energy Content of Food

All human activity requires "burning" food for energy. How much energy is released when food burns in the body? In this applied chemistry activity, students investigate the calorie content of different snack foods. Students use calorimetry to calculate the amount of heat energy released when different snack foods burn and identify patterns in the calorie content of foods.

- Combustion reaction
- Calorimetry
- Nutritional Calorie
- Calorie content of food

Heats of Reaction and Hess's Law—Small-Scale Calorimetry

Microscale

Burning magnesium in a Bunsen burner flame provides a dazzling demonstration of a combustion reaction. The intense flame produces blinding light and searing heat. The amount of heat produced in this reaction cannot be measured directly. In this microscale experiment, students use Hess's Law to determine the heat of reaction for the combustion of magnesium by an indirect method. The heats of reaction for magnesium and magnesium oxide reacting with hydrochloric acid are measured using special small-scale calorimeters and then combined algebraically with the known heat of formation of water to calculate the heat of combustion of magnesium.

- Heat of reaction
- Heat of formation
- Hess's Law
- Calorimetry

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