

Thermochemistry— Demonstration Summaries and Concepts



Colorful Heat—Temperature versus Heat Demonstration

Students often use the terms heat and temperature interchangeably in their daily lives. Scientifically, however, these terms represent different quantities. The difference between heat and temperature is a key concept in thermochemistry. This demonstration provides a colorful illustration of the relationship between heat and temperature.

Specific Heat Chemical Demonstration

Three different metals of equal mass are heated to the temperature of boiling water. The metals are then added to three insulated foam cups, each containing the same amount of cold water. The resulting temperature changes are very different. This demonstration may be used on a qualitative level to illustrate the concept of specific heat, or it may be used to introduce quantitative heat and specific heat calculations.

The Cool Reaction—An Endothermic Demonstration

Ask students to think about chemical reactions, and they usually visualize exothermic reactions that produce heat, light, and often sound as well. What does an endothermic reaction look and feel like? In this classic demonstration, two solids are mixed, and the solid turns to a liquid—a freezing cold liquid. In less than two minutes, the temperature drops to $-30\text{ }^{\circ}\text{C}$, cold enough to freeze water in contact with the reaction flask. “The Cool Reaction” is just that, cool and unusual!

Whoosh Bottle Chemical Demonstration

Combustion reactions represent the most important application of thermochemistry in our daily lives. The energy produced by the combustion of fossil fuels is used to heat our homes and power our vehicles. How much energy is released when fuels burn? In this classic “whoosh bottle” demonstration, students observe the dramatic “whoosh” of light, heat, and sound in the combustion of isopropyl alcohol and discover the products formed when organic compounds burn. A great way to introduce heat of combustion calculations!

Flameless Ration Heaters—An Applied Chemistry Demonstration

Developed by the United States Army for use by soldiers in the field, flameless ration heaters (FRH's) contain a composite magnesium/iron alloy material that reacts exothermically upon activation with water. The amount of heat released is sufficient to increase the temperature of food from room temperature to about $75\text{ }^{\circ}\text{C}$. In this interesting real-world demonstration of the applications of thermochemistry, students observe the heat of reaction for activation of an FRH with water and deduce the composition of the metallic heating pad based on qualitative chemical tests.



Concepts

- Temperature
- Heat

- Heat
- Specific heat
- Calorimetry

- Endothermic reaction
- Heat of reaction
- Enthalpy
- Entropy

- Exothermic reaction
- Combustion reaction
- Heat of combustion

- Exothermic reaction
- Heat of reaction