ScienceCube

Endothermic Reactions

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1. **Observe the temperature change due to heat exchange during a chemical reaction.**
2. **Explain the energy exchange process in the reaction between barium hydroxide and ammonium nitrate.**

Fundamental Concept

1. Endothermic Reaction

A reaction where the energy of the products is greater than the energy of the reactants, resulting in the absorption of heat from the surroundings.

2. Examples of Endothermic Reactions

1) Photosynthesis

$6CO_2 + 6H_2O + \text{heat} \rightarrow C_6H_{12}O6 + 6H_2O$

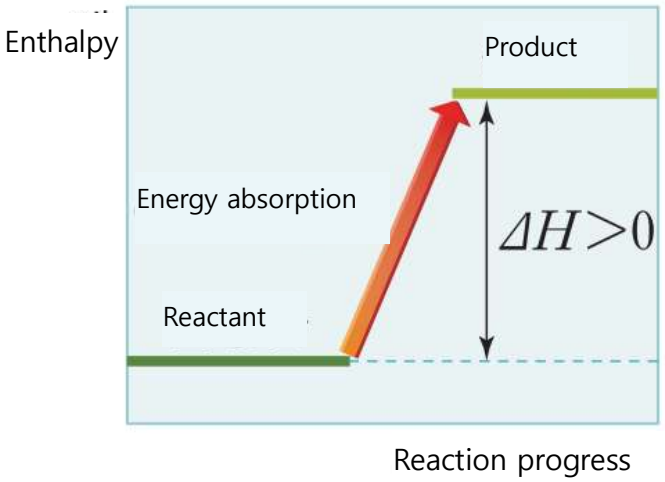
2) Thermal Decomposition of Calcium Carbonate

$CaCO_3 + \text{heat} \rightarrow CaO + CO_2$

3) Reaction between Barium Hydroxide and Ammonium Nitrate

$Ba(OH)\cdot 8H_2O(s) + 2NH_4NO_3(s) + \text{heat} \rightarrow Ba(NO_3)_2\ (s) + 2NH_3(aq) + 10H_2O$

3. Graph of Endothermic Reaction



4. Characteristics of Endothermic Reactions

1) Energy Magnitude: Reactants < Products

2) Absorbed Energy: Energy of Products−Energy of Reactants

3) Stability of Substances: Reactants are more stable than products.

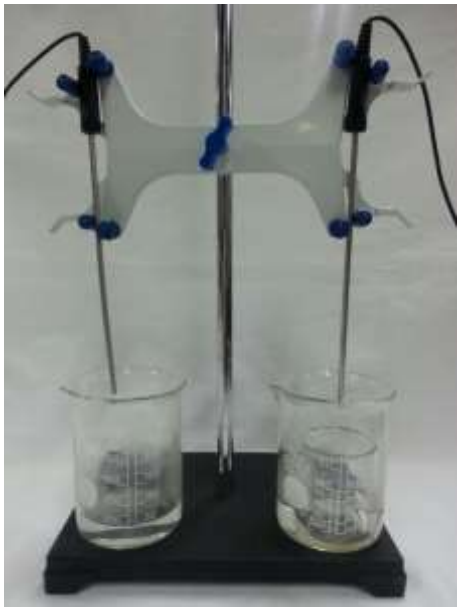
Experiment

Materials Needed

Interface, Science# program, Two Pt temperature sensors, Barium hydroxide, Ammonium nitrate, Two 100mL beakers, Two 250mL beakers, Warm water, Stand, Glass rod, Measuring spoon

Preparation of the Apparatus

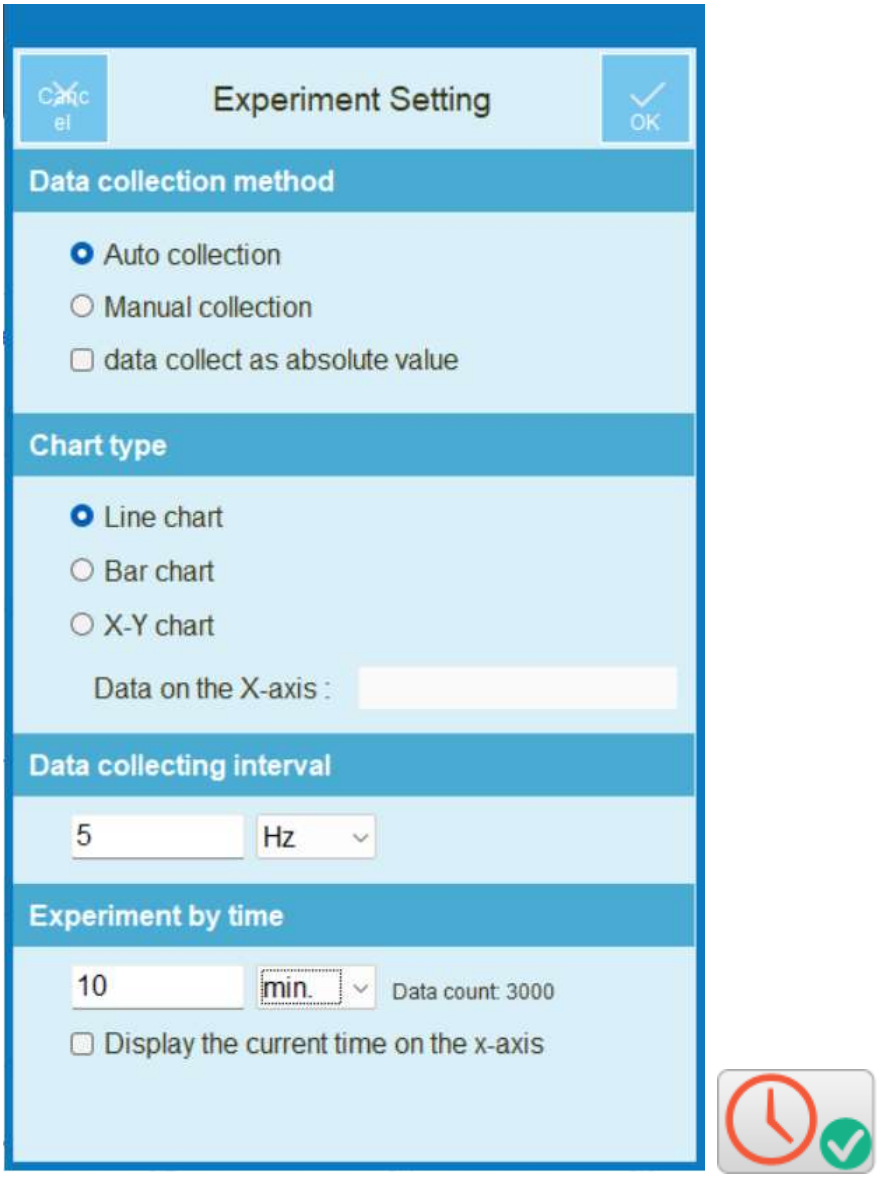
1. Connect the clamp to the stand and fix two Pt temperature sensors.
2. Pour 50mL of warm water into each of the 250mL beakers.
3. Place a 100mL beaker inside one of the 250mL beakers so that they overlap.



4. Adjust the height of the two temperature sensors so that they are submerged in the water in each beaker (be careful not to let the sensors touch the walls or bottom of the beakers).
5. Add 3 spoons of barium hydroxide to the 100mL beaker using a measuring spoon.

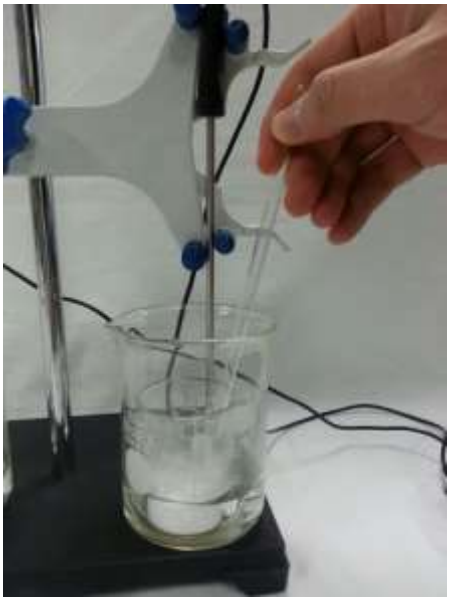
Interface Settings

1.  Run Science#.
2. Connect the two Pt temperature sensors to the interface.
3.  Click the button to set up the experiment environment as shown below, or  click the button for auto setup.



Data Collection

1. Add 3 spoons of ammonium chloride to the 100mL beaker containing barium hydroxide using the measuring spoon.
2.  Click the button to start collecting data.
3. Stir the barium hydroxide and ammonium chloride well with a glass rod, holding the 100mL beaker steady to prevent it from shaking.



4. After the reactants are well mixed, observe the temperature change in the water in both beakers for 10 minutes.

Data Analysis

Recording Data

1. Draw a graph comparing the temperature changes in the water in both beakers over time.

Application of Data

1. Explain the reason for the observed experimental results.

2. Name the type of reaction where this energy exchange occurs.

3. Predict and write down how the temperature change would differ if the mass of the reactants were increased.

4. Distinguish between endothermic and exothermic reactions among the following everyday phenomena (Endothermic: Endo, Exothermic: Exo)

Refrigerator		Combustion	
Hand warmer		Sprinkling water on a hot day	
Ice pack		Photosynthesis