ScienceCube

Gaining or Losing Heat

Learning Objectives	Measuring the Temperature of Two Objects with Different Temperatures and Distinguishing Between the Heat Gaining and Heat Losing Objects
Should I think about it?	What happens to the temperature of the water in the beaker and the warm water in the cylinder when a cylinder filled with warm water is placed in a beaker of cold water?

Learning Content

1. Heat and Temperature

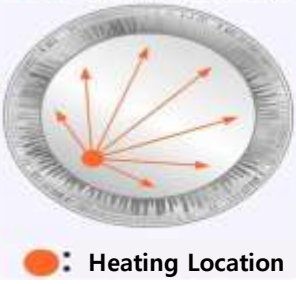
1) Heat: Energy that raises the temperature of an object or changes its state.

2) Temperature: A numerical representation of the hotness or coldness of an object.

2. Heat Transfer

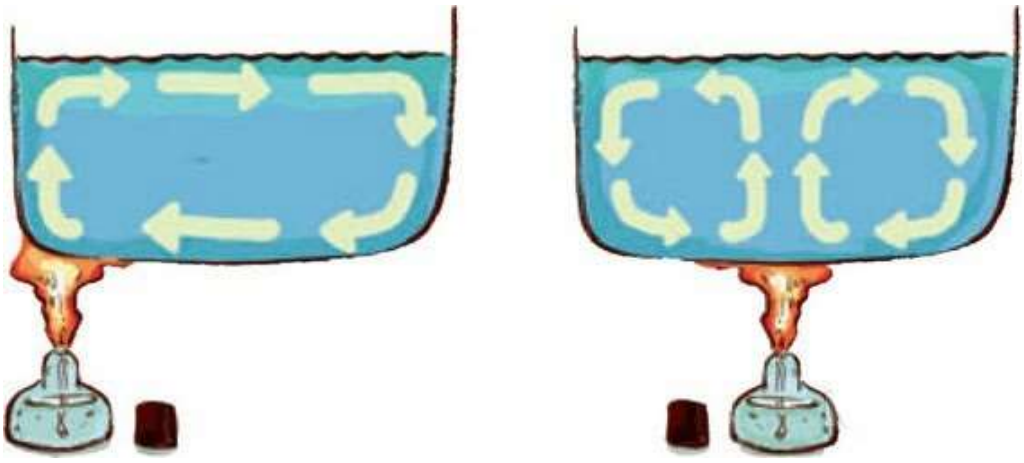
1) Heat Transfer in Solids

- Heat is transferred from a higher temperature area to a lower temperature area.
- Conduction: Heat is directly transferred through a solid material from a high-temperature area to a low-temperature area.

Category	Experimental Setup	Experimental Results	
When heating the center of the aluminum plate			The candle wax in the center starts melting first.
When heating the edges of the aluminum plate			The candle wax at the edges starts melting first.

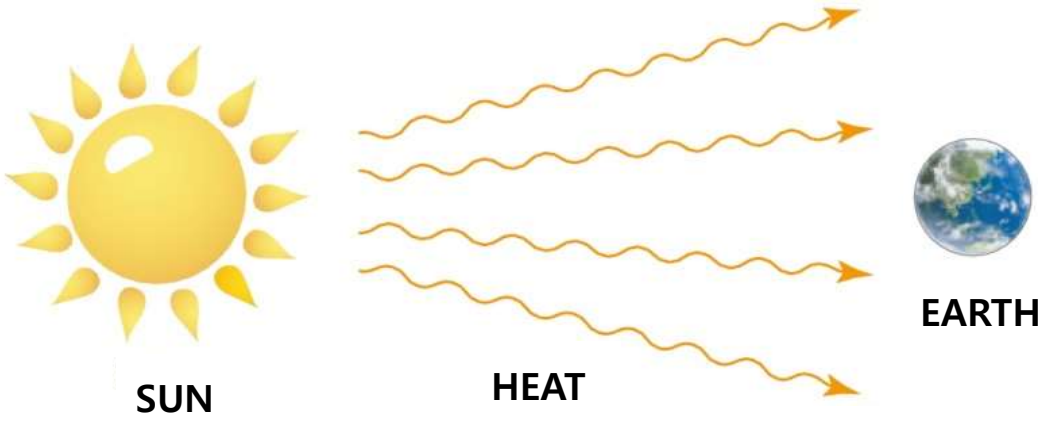
2) Heat Transfer in Liquids (Gases)

- When a liquid (gas) is heated, the warmed liquid (gas) becomes lighter than its surroundings and rises, transferring heat. Conversely, the cooler liquid (gas) from above descends. This circulation causes the liquid (gas) to whirl and transfer heat throughout.
- Convection: Heat transfer through the direct movement of the heated liquid (gas).



3) Heat Transfer by Radiation

- Heat from the sun is transferred to the Earth through empty space in the form of light.
    - Radiation: Heat transfer in the form of light



3. Temperature Sensor

- Can measure temperatures between -50℃ and 180℃.
- Contains a component at the end of the sensor whose resistance changes with temperature, displaying measurement values based on these resistance changes.
- Made of stainless steel.

Experimental Activities

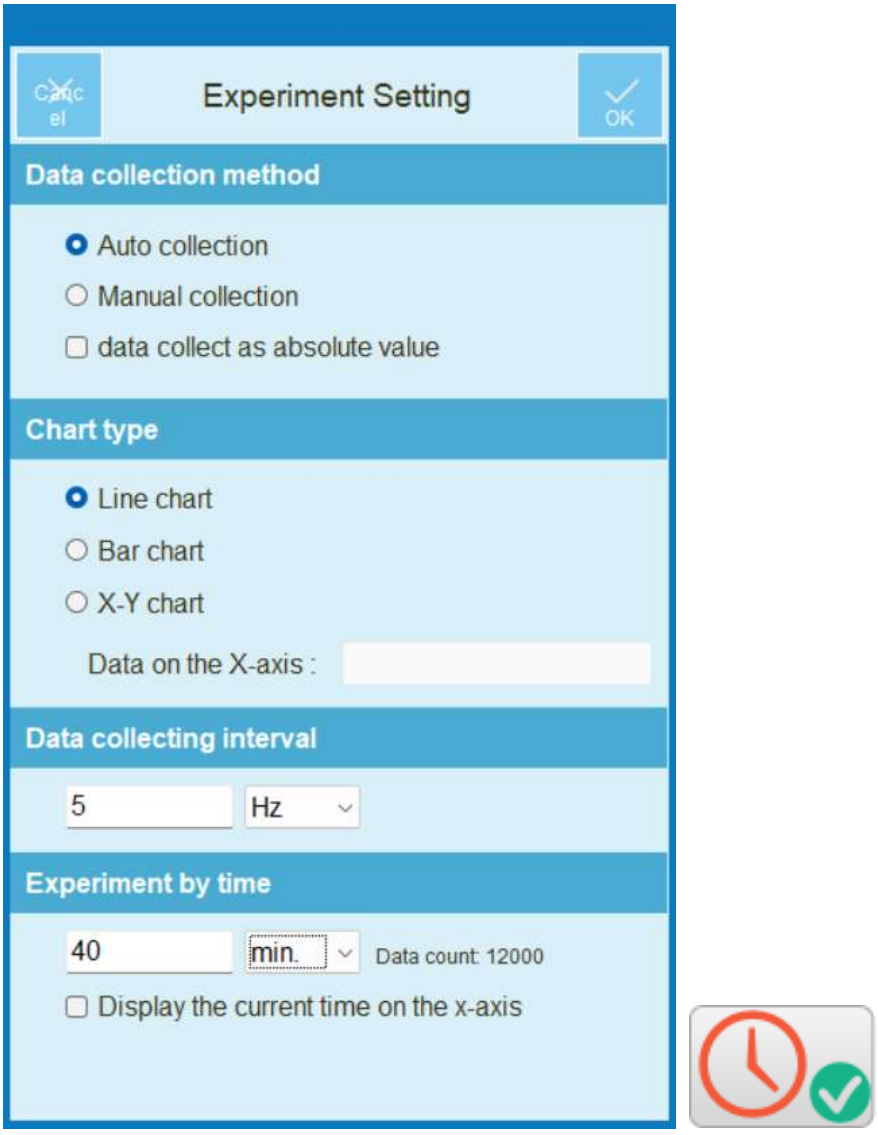
Materials Needed

Interface, Science# program (smart device), 2 temperature sensors, Cylindrical styrofoam container, 100 mL graduated cylinder, Warm water, Cold water, Stand (with clamp holder), Rubber stopper

Experimental Procedure

Setting Up the Equipment

1. Run the Science# program on the smart device and connect it to the powered interface via Bluetooth or cable.
2. Connect the two temperature sensors to the interface.
3. Press the button in Science# to set up the experimental environment as shown below. (Press the button  for automatic setup.)



Experiment

1. Pour 100 mL of cold water (approximately 15℃) into the styrofoam container.
2. Pour 100 mL of warm water (approximately 45℃) into the graduated cylinder.
3. Insert a temperature sensor into the rubber stopper and seal the opening of the graduated cylinder with it.
4. Insert the other temperature sensor into the water in the styrofoam container and secure it with a clamp holder on the stand. (Ensure the sensor does not touch the walls or bottom of the styrofoam container.)
5. Press the button  to start data collection.

6. Quickly place the graduated cylinder filled with warm water into the styrofoam container.

7. The experiment will automatically end after the set time.

Experimental contents

1. Display the temperature changes of the cold water in the styrofoam container and the warm water in the graduated cylinder in a graph.

2. Calculate the temperature difference between the cold water in the styrofoam container and the warm water in the graduated cylinder using the table below.

Category	Initial Temperature(℃)	Final Temperature(℃)	Temperature Difference(℃)
Cold Water			
Warm Water			

Experimental results

1. Explain how the temperatures of the cold water and warm water change over time.

2. Based on the experiment results, identify which substance lost heat and which substance gained heat between the cold water and warm water.

Heat Losing Substance	Heat Gaining Substance

3. Explain the relationship between heat transfer and temperature.


Report
(For Teachers)
Report
(For Students)