ScienceCube

Convection Phenomenon

Observe convection through an experiment and explain its application in real life.

Fundamental Concept

1. Convection Phenomenon

When a liquid or gas is partially heated and its temperature rises, that part expands and its density decreases, causing a buoyant force that makes it rise. Meanwhile, the cooler and denser liquid or gas descends. This process repeats, and heat is transferred by the movement of the substance itself.

2. Boiling Water and Ice

If you place ice at the bottom of a test tube and fix it so it doesn't float, and then heat the top part of the test tube, convection does not occur, and heat transfer is inefficient. In this case, heat moves only by conduction. Since water is a poor conductor of heat, the water at the top boils while the ice at the bottom remains unchanged.

Experiment

Materials Needed

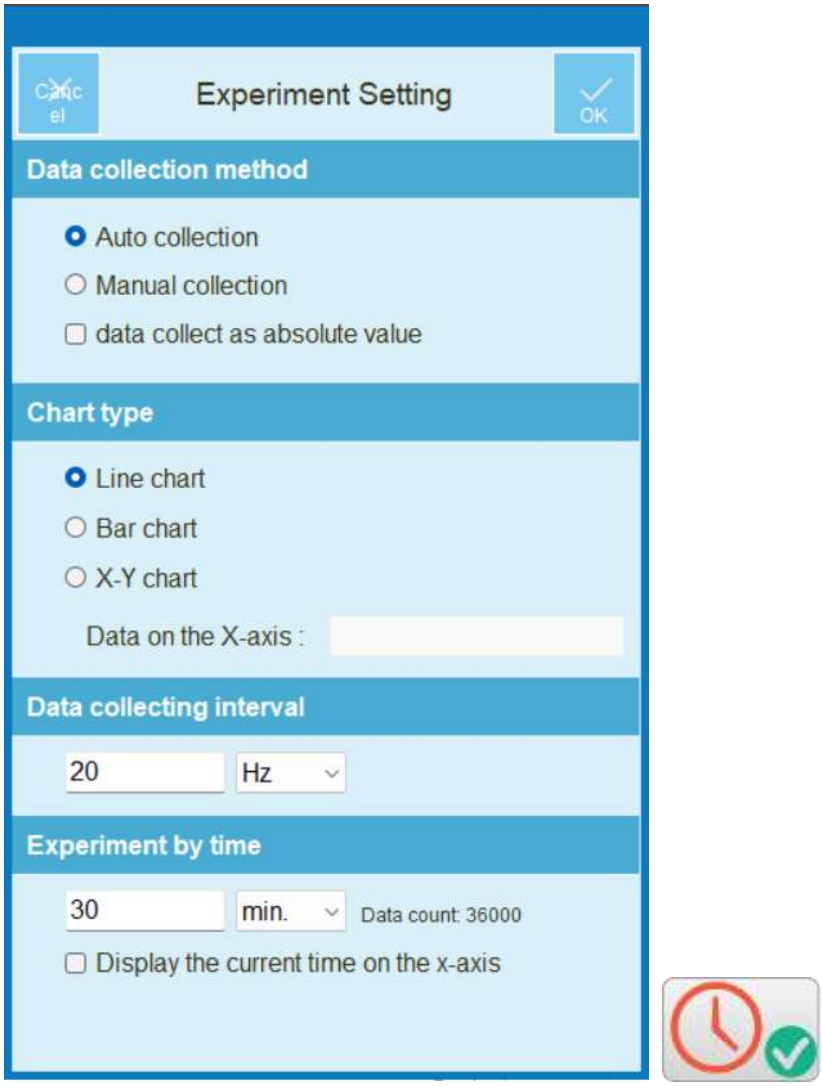
Interface, Science# Program, two temperature sensors, test tube (24Φ200mm), cork stopper (size 8, height 21top 24*bottom 20), stand, clamp, clamp holder, awl, water, lighter, alcohol lamp.

Preparation of Experimental Apparatus

1. Use an awl to make two holes in the cork stopper.
2. Fill the test tube up to 80% with water and add boiling chips to prevent overflow.
3. Insert the temperature sensors into the cork stopper and then seal the test tube.
4. Adjust the height of the temperature sensors to measure the temperatures of the water at the top and bottom of the test tube.
5. Tilt the test tube at a 45° angle and secure it with the stand.
6. Position the alcohol lamp so it is centered below the test tube and between the two temperature sensors. (Ensure the flame does not directly touch the test tube.)

Interface Setup

1. Run the Science# program.
2. Connect the temperature sensors to the interface.
3. Click to set up the experimental environment as shown below or click to automatically set up.



Data Collection

1. Light the alcohol lamp and observe the temperature changes of the water at the top and bottom of the test tube.
2. Once the temperature of the water at the top exceeds 80°C, extinguish the flame and end the experiment after 5 minutes.
3. Touch the bottom of the test tube with your hand.

Data Analysis

Recording Data

1. Plot the temperature changes of the water at the top and bottom of the test tube while heating the middle.

2. Record the temperature changes of the water at the top and bottom of the test tube over time in the table below.

Time (sec)		0	50	100	150	200	250
Temperature (°C)	Top						
	Bottom						

3. After the experiment, record the temperatures at the top and bottom of the test tube and explain.

Position	Top	Bottom
Temperature (°C)		

Data Application

1. Explain why the test tube is heated in the middle during the experiment with the alcohol lamp.

2. Predict what would happen to heat transfer if the bottom of the test tube were heated instead of the middle.

3. Find and explain examples of convection phenomena in daily life.

4. There is a proverb: "Birds hear words by day, and rats hear words by night." Identify and explain the scientific principle related to convection in this proverb.