

Activity

Conduction in Gases and Liquids

Lab Preview

Directions: Answer these questions before you begin the Activity.

1. What does the safety symbol that shows an open flame tell you?

2. At what temperature should you keep the water in the beaker while you complete the data table?

Does smog occur where you live? If so, you may have experienced a temperature inversion. Usually the Sun warms the ground, and the air above it. When the air near the ground is warmer than the air above, convection occurs. This convection also carries smoke and other gases emitted by cars, chimneys, and smokestacks upward into the atmosphere. If the air near the ground is colder than the air above, convection does not occur. Then smoke and other pollutants can be trapped near the ground, sometimes forming smog. In this activity you will use a temperature inversion to investigate the conduction of heat in air and water.

What You'll Investigate

How is heat transferred by conduction in liquids and gases?

Materials

thermometers (3)	test tube (large)
2 foam cups	ring stand
400-mL beakers (2)	test-tube clamp
burner or hot plate	wire gauze
paring knife	scissors
thermal mitts (2)	ice

Goals

- **Measure** temperature changes in air near a heat source.
- **Observe** conduction of heat in air.
- **Observe** conduction of heat in water.

Safety Precautions

CAUTION: Use care when handling hot water. Pour hot water using two hands. Make sure the test tube does not point at anyone.

Procedure

1. Using the paring knife, carefully cut the bottom from one foam cup.
2. Use a pencil or pen to poke holes about 2 cm from the top and bottom of each foam cup.
3. Turn both cups upside down, and poke the ends of the thermometers through the upper holes and lower holes, so both thermometers are supported horizontally. The bulb end of both thermometers should extend into the middle of the bottomless cup.
4. Heat about 350 mL of water to about 80°C in one of the beakers.
5. Place an empty 400-mL beaker on top of the bottomless cup. Record the temperature of the two thermometers in the data table on the next page.
6. Add about 100 mL of hot water to the empty beaker. After one minute, record the temperatures of the thermometers in the data table.

Activity (continued)

7. Continue to record the temperatures every minute for 10 min. Add hot water as needed to keep the temperature of the water at about 80°C.
8. With scissors cut a piece of wire mesh slightly larger than the diameter of the test tube.
9. Place ice in the bottom of the test tube and push the mesh into the tube against the ice.
10. Attach a test-tube clamp to the ring stand and clamp the test tube so it is nearly vertical.
11. Fill the test tube with cold water to within 2 cm of the top, and carefully heat the water near the top of the test tube with the burner.

Data and Observations

Air Temperatures in Foam Cup		
Time (min)	Upper thermometer (°C)	Lower thermometer (°C)
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		

Conclude and Apply

1. **Explain** whether convection can occur in the foam cup if it's being heated from the top.

2. **Describe** how heat was transferred through the air in the foam cup.

3. On a separate sheet of paper, **graph** the temperatures measured by the upper and lower thermometers, with time on the horizontal axis.

4. **Explain** why the temperature of the two thermometers changed differently.

5. **Explain** why the ice in the test tube didn't melt.

6. **Predict** how the ice would behave if the water in the tube were replaced by an aluminum rod.
