

Slowing Heat Transfer

WHAT YOU NEED



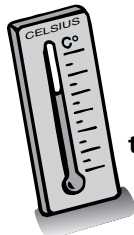
newspaper pieces
(30 cm × 30 cm)



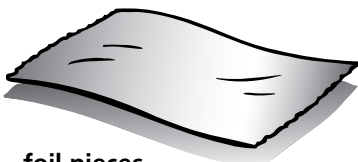
ice cubes



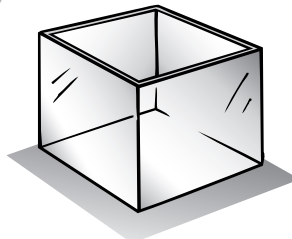
plastic wrap
(30 cm × 30 cm)



one
thermometer



foil pieces
(30 cm × 30 cm)



small, plastic container
(10 cm × 10 cm)



waxed paper pieces
(30 cm × 30 cm)



bag of vermiculite

Find Out

Do this activity to see what materials serve as heat insulators.

Process Skills

Predicting
Communicating
Observing
Controlling Variables
Interpreting Data
Classifying
Designing
Investigations
Experimenting

Time

- 30 minutes at the beginning of the first day
- 5 minutes every two hours throughout the day and 10 minutes the following day if necessary
- The same amount of time on various days over the next two weeks

WHAT TO DO

1. **Record** the temperature in the room with a thermometer and compare its reading to the room thermostat, if available.
2. **Record** 0 °C for the temperature of the ice cube.
3. Wrap the ice cube in one piece of waxed paper and place it in the plastic container.



4. **Record** the time the experiment begins and **predict** how long it will take for the ice cube to melt completely. **Record** your prediction.

5. **Observe** the ice cube at two-hour intervals throughout the day and at the start of the next day, if necessary. Observations should take no longer than one minute before you rewrap the ice cube. **Observe** the ice cube until it has completely melted, and **record** the time it takes to melt. **Compare** your time with the time recorded by the other groups.



6. Repeat Steps 1–5, twice a week for two weeks. Each time, wrap a new ice cube in a different insulating material.
7. **Evaluate** the materials as heat insulators by listing them from the best to the worst heat insulator.

Have each student group compare their results and draw conclusions about testing the same material multiple times.

Testing Materials as Heat Insulators

Insulation Used	Room Temperature	Ice Cube Temperature	Difference in Temperature Readings	Prediction: How Long Will It Take for the Ice Cube to Melt?	Results: How Long Did It Take for the Ice Cube to Melt?
Foil		Student answers will vary.			
Newspaper					
Waxed Paper					
Plastic Wrap					
Vermiculite					

Conclusions

1. Compare your predictions with your observations.
Answers will vary depending on predictions.
2. Which material provided the best heat insulation?
Answers will vary depending on student data.
3. List the materials in order of effectiveness as heat insulators.
vermiculite, newspaper, waxed paper, plastic wrap, foil

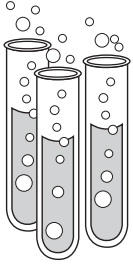
New Questions

1. What materials are used for insulation in our homes and schools? Why?
Accept any reasonable answers such as fiberglass, foam polystyrene, carpeting, or air trapped between windowpanes. These materials reduce heat loss, saving money and conserving resources.
2. What other materials might insulate an ice cube for more than one day?
Answers may include insulation that is made of cork, molded plastic, felt, fiberglass, and other materials that have pockets of air trapped within them.



Activity Journal

Lesson 1 • Heat Production



Name _____

ACTIVITY

Producing Heat

Record your observations in the chart below.

Lightbulb Strength	Temperature After 3 Minutes
Light Turned Off	
Light Turned On (25-watt bulb)	
Light Turned On (40-watt bulb)	
Light Turned On (60-watt bulb)	

What do you **predict** will happen when you replace the 40-watt bulb with the 60-watt bulb?

Answers will vary.

Name _____

Conclusions

1 Was heat produced by electric current? How do you know?

Yes. When the lightbulb was on, the temperature went up. When the lightbulb was off, the temperature began to go down.

2 Did the brightness of the bulb affect how much heat was produced? How? What evidence do you have for your answer?

Yes. The bulb with the higher wattage converted more electrical energy to heat. The temperature of the thermometer under the 60-watt bulb was higher than that under the 40-watt bulb.

3 Why was it useful to record the temperature before you turned on the 25-watt bulb?

It set a base temperature to compare the other temperatures to. When the lightbulb was on, the temperature rose from that base temperature.

Asking New Questions

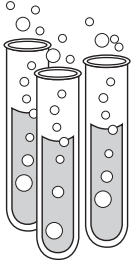
1 What do you think will happen if you repeat the activity using a 100-watt bulb? Why?

The temperature would rise even more because the 100-watt bulb converts more electrical energy to heat.

2 Will turning the lights off in a room help to keep the room cooler? Why?

Yes. It will help because lights give off heat, which then warms the air in the room. If the lights are turned off, the air will not be heated.

Name _____



ACTIVITY

Observing Heat Transfer by Conduction

Which butter pat do you **predict** will melt faster when the sticks are placed in hot water?

Answers will vary.

What did you **observe**?

Answers will vary.

Which stick feels warmer?

The aluminum foil stick should feel warmer than the wooden stick.

Name _____

Conclusions

- ① Compare your prediction with your observation.
Answers will depend on the prediction.

- ② What form of heat transfer melted the butter?
conduction

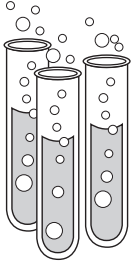
- ③ Why did the sticks need to hold the butter outside of the pie pan?
If the butter were over the hot water or in it, heat would have been transferred by convection and by radiation. You wouldn't be able to say which form of heat transfer melted the butter.

Asking New Questions

- ① **Predict** what will happen if you put the butter pat on the end of a plastic spoon.
Answers will vary. The butter will probably not melt or take longer to melt because plastic is not a good conductor of heat.

- ② How would the towels feel after you remove the pie pans holding hot water? Why?
Answers will vary. They would probably feel warm because the heat from the water was conducted through the pie pan to the towel. The table underneath the towel might also feel warm to the touch because of conduction.

Name _____



ACTIVITY

Using Heat to Do Work

What did you **observe** about the fork when the jar with the balloon was put in cold water?

Answers will vary.

What do you **predict** will happen to the fork when the jar with the balloon is put in hot water?

Answers will vary.

What did you **observe** when the jar was put in hot water?

Answers will vary.

Name _____

Conclusions

1 What happened to the air in the jar when you chilled it?
The air in the jar cooled down and molecules in the air moved closer together.

2 What happened to the air in the jar when it warmed?
The air expanded and pushed up on the balloon.

3 Describe what happened to the handle of the fork.
Answers will vary. Possibilities include that the handle moved down when the air was warmed, or the handle moved up when the air was cooled.

Asking New Questions

1 How could you use your jar to lift objects?
Answers will vary. One possibility is to attach something small to the end of the fork so it would be lifted when the air in the jar contracted.

2 Think about what you know about water heating on the stove. Would the jar and fork work as well if the jar were completely full of water instead of air?
No. If the jar were full of water, it would not work as well because water does not contract as much as air.

3 What would happen if you actually boiled water inside the jar?
If water inside the jar actually boiled, it would create steam, causing great pressure, and the balloon would explode off of the jar.