Keeping Warm?

Purpose

Students will investigate that some materials conduct heat much better than others and poor conductors reduce heat loss.

Materials

For the teacher: 4 similar sized/shape cups or mugs made of metal, clay (ceramic), paper, and polystyrene marker; hot plate; cooking pot; source of water; 4 thermometers; clock; metric measuring cup; transparency of Black Line Master (BLM) *Keeping Warm?*; overhead projector; overhead marker
For each student: copy of BLM *Keeping Warm?*, pencil

Activity

A. Advance Preparation

1. Label the cups A, B, C, and D.
2. Heat the water.

B. Activate Prior Knowledge

1. Ask students to share what they do to keep warm (e.g., wear a coat, put on thicker clothes, etc.)
2. Ask students to share what they do to keep food or drink warm (e.g., put it in a thermos, etc.)
3. Tell students that they will investigate how different types of containers help keep liquids warm. Tell students that conduction is the movement of heat through matter and that poor conductors reduce heat loss.
4. Show students examples of each container, talk about what they are made of, and discuss their ideas about each cup's ability to conduct heat.

C. Investigating Containers

1. Distribute the BLM *Keeping Warm?* to each student. Have students fill in their predictions, explain their reasoning, and record which material makes up each cup.
2. Set out the four cups and place a thermometer in each. Pour 200 ml hot water into each cup.
3. Put the transparency of the BLM *Keeping Warm?* on the overhead projector.
4. Record the start time on the transparency and direct students to write it on their BLMs.

(continued)

EXTENDING THE ACTIVITY

Have students create advertisements for each of the containers that communicate their findings about reduction of heat loss.

connecting across the curriculum

Mathematics
Have the students graph the data from their temperature chart. Challenge them to make different types of graphs and share them with the class.

Standards Links
5.1.7, 5.5.1

Activity (continued)

5. Call on four volunteers to read the temperatures on the different thermometers. Review using thermometers as you assist the volunteers.
6. Help the volunteers record the temperatures on the transparency. Instruct the class to write the data on their BLMs.
7. Break the class into four groups. Assign each group to a cup. Explain that each group is responsible for measuring the temperature of the water in its cup every two minutes for a total of 10 minutes.
8. Every two minutes direct students to read their thermometer and record the data, on their BLMs.
9. Have each group record its data on the transparency at the end of 10 minutes. Instruct the class to include all of the data on their BLMs.
10. Direct students' attention to the bottom row of the temperature table. Instruct them to use that information to complete their BLMs.

D. Discussing Conductors

1. Ask students: "Which cup is the poorest conductor? Is that what you predicted?"
2. Say to them: "Why do you think cup ___ (A, B, C, or D) is the poorest conductor?"
3. Have them look at the data again and determine which cup is the best conductor. Discuss whether each cup's ability to conduct heat was similar or if one was much better.

Questions for Review

Basic Concepts and Processes

During the investigation, ask students:

📖 Why was it important to pour the same amount of water into each cup?

📖 Is your prediction correct so far?

After the activity, discuss the following with students:

📖 Does metal or paper conduct heat better?

💡 How did the activity help you discover this?

📖 Of the cups tested, which should restaurants use for hot chocolate?

💡 How do you know that?

Name: _____

Which cup (A, B, C, D) do you think is the poorest conductor? (The poorest conductor will keep the water hot longest.) _____

Explain your reasons for your prediction: _____

_____

Record which material makes up each cup.

A: _____ B: _____

C: _____ D: _____

Time	Temperature Cup A	Temperature Cup B	Temperature Cup C	Temperature Cup D

Which cup is the poorest conductor? _____

What material makes up the cup? _____

Why do you think this cup kept the water hottest the longest?

_____

_____