

# Insulators

## Summary

The insulating properties of four types of spoons are explored. Students then apply their knowledge by designing the perfect hot chocolate cup.

## Time Frame

1 class periods of 60 minutes each

## Group Size

Small Groups

## Materials

- hotplate
- pan of water
- wooden spoon
- metal spoon
- plastic spoon
- metal spoon with insulated handle (such as plastic or wood)
- 4 thermometers
- tape

## Background for Teachers

You pick up a paper cup that's full of hot chocolate and quickly put it down. It's too hot to hold. Heat conduction through the molecules of the cup are responsible for this heat transfer. Heat energy in the hot chocolate makes these molecules move very quickly. As this heat is transferred to the cup, motion is passed along from one molecule to the next. When all the molecules of the cup gain enough energy, they all begin to move faster, and you can feel the heat.

Metals are the best conductors of heat because their molecules are very close together. Because of this, metal molecules bump into one another very easily, a great set up to pass along heat energy. Wood and ceramic materials are called insulators because they do not pass along heat well.

## Intended Learning Outcomes

- Observe simple objects, patterns, and events, and report their observations.
- Predict results of investigations based on prior data.

## Instructional Procedures

### Part 1:

Place a hot plate with a pan of heated water at a central location in the room.

Tape a thermometer to the end of each spoon handle so that you're taking the temperature of the spoon's handle and not the water.

Place each spoon/thermometer set up in the water.

Explain the experimental set up to the students.

In small groups, have them predict the order of the spoons' handles from the hottest to the coldest as the water in the pan comes to a boil.

Have a group recorder write down their predictions and their reasoning.

Have each group explain their prediction and the reasoning to the class. Note sources of agreement and disagreement.

Record information from the four spoons at three minute intervals on class graphs--one for each spoon (time across the horizontal axis and temperature on the vertical axis).

After sufficient time has passed and enough data collected (about 30 minutes), draw a conclusion as a class.

Identify the metal spoon as a conductor and the wooden spoon as an insulator.

Have each group decide if their predictions were correct or incorrect.

Discuss the predictions, the experiments, and the results as a whole class.

#### Part 2:

Pick up a paper cup, shriek that it is too hot, and quickly put it back down. Explain to students that this cup of "hot chocolate" is too hot to hold. Ask if they have ever had this experience.

Explain that they will now use what they have learned about conductors and insulators to design a hot chocolate cup that will keep the hot chocolate warm but not burn their hands.

Have each group design the ideal cup. What materials will they use? Why?

Have small groups of students illustrate their ideal cup and write an explanation of why it is ideal.

Present group ideas to the entire class.

#### Assessment Plan

Evaluate group plans for the ideal hot chocolate cup created in Part 2 of the lesson. Check for understanding and use of their knowledge concerning insulators.

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