

# Meltdown: Heat Conduction in Different Materials

You probably have lots of firsthand experience with melting. If you hold a piece of chocolate in your hand too long, it melts into a sticky mess. If you leave ice cubes in your soda, eventually they melt away. But, what exactly does it mean for something to melt? **Melting** occurs when a solid is heated enough to undergo a phase change and becomes a liquid. In the melting chocolate example, your hand supplies the heat. In melting ice example, the soda is warmer than the ice. In each case, heat flows from one substance to another. But does heat flow the same way between all materials?

Heat transfer from one object to another by direct contact is called **conduction**. Heat energy flows from a warmer object to a cooler object until both objects are at the same temperature. Whenever there is a change in temperature, heat energy has been transferred. Some materials are better at transferring heat than others. Materials that allow heat to flow easily through them are called **conductors**. Materials that are more resistant to heat flow are called **insulators**. For example, a hot pot on the stove will burn your hand if you touch it directly because the heat flows easily from the metal to your hand. However, if you wear an oven mitt, heat does not flow as easily through the fibers, which protects your hand.



## Vocabulary

- **conduction:** heat transfer from one material to another by direct contact
- **conductor:** a material that allows heat to flow through it easily
- **insulator:** a material through which heat does not flow easily
- **melting:** when a solid turns into a liquid

## What You Need

- 2 ice cubes
- 2 black blocks
- 2 black rubber O-rings
- 2 Vernier Go!Temp temperature probes
- 1 computer
- 2 pieces of drinking straw, approximately 2 inches long
- tape
- 2 index cards (3" x 5")

## The Experiment

1. Fold each of the 3" x 5" index cards in half to make labels for the two black blocks. Label one block "Block A" and the other "Block B."
2. Look at the two blocks without touching them.

**Do the two blocks look the same or different? If different, how?**

3. Next, pick up each of the blocks. In the box below, describe how each block *feels*. What do you think each block is made of?

**Block A:**

**Block B:**

4. Predict what you think will happen to an ice cube placed on each block. Do you think the ice cube on Block A will melt faster, slower, or at the same rate as the ice cube on Block B? Give a reason for your prediction.

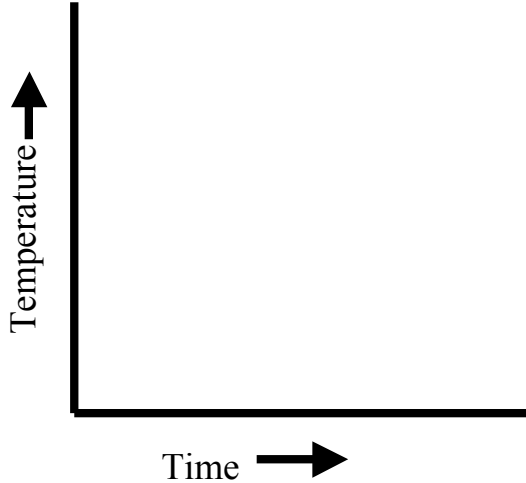
**I think the ice cube on Block A will melt \_\_\_\_\_ than the ice cube on Block B.**

**Reason:**

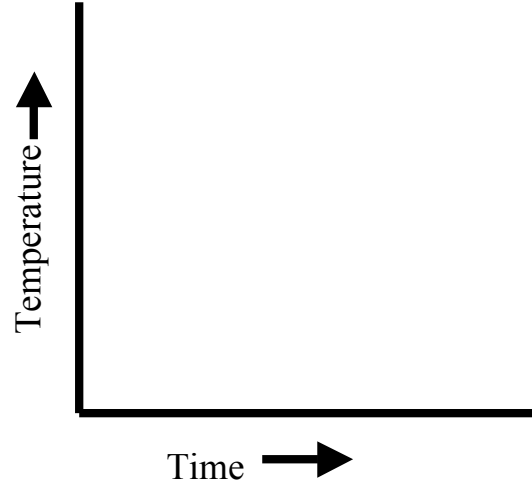
5. Take a piece of straw and tape it tightly to the outside edge of each of the black blocks. Try to put the straw in the same place on each block.
6. Put the blocks down on a flat surface next to their labels—make sure you don't mix them up! Place a black rubber O-ring in the middle of each block.
7. Place a temperature probe into each of the straws so that the straws hold the probes in place.
8. Set the temperature probes to collect data for 10 minutes with a temperature reading every second, and start recording the data.
9. Place an ice cube in the middle of each ring. Try to put them down at exactly the same time.
10. Use the observation sheet to take notes about what happens to the two ice cubes as time passes.

## Analysis

1. Describe what happened to each of the ice cubes during the 10 minutes. Was your prediction correct?
2. On the axes below, sketch how the temperature of each block changed over the 10 minute observation period.



**Block A**



**Block B**

3. Based on the graphs, which block is the better conductor of heat energy? Explain your choice.

## Real Life Connections

Think about the materials that were used to build your school. Use your observational skills and your senses to come up with a list of conductors and insulators in your classroom. Remember that insulators slow heat transfer and conductors allow heat transfer to easily occur.

**Conductors**

**Insulators**

## Connections to Capuano

The Capuano Early Childhood Center was designed to be extremely energy efficient. A building's insulation keeps the inside warm in the winter and cool in the summer. Insulation does more than keep the environment inside the building comfortable. It also helps reduce the need to use heating and cooling systems, which saves money and is better for the environment outside the building.

How does the building insulation at your school compare to the insulation at the Capuano Center? Design an experiment to take temperature readings and compare them to data from the Capuano Center.

## Observations

| <b>TIME</b>       | <b>BLOCK A</b> | <b>BLOCK B</b> |
|-------------------|----------------|----------------|
| <b>1 minute</b>   |                |                |
| <b>2 minutes</b>  |                |                |
| <b>3 minutes</b>  |                |                |
| <b>4 minutes</b>  |                |                |
| <b>5 minutes</b>  |                |                |
| <b>6 minutes</b>  |                |                |
| <b>7 minutes</b>  |                |                |
| <b>8 minutes</b>  |                |                |
| <b>9 minutes</b>  |                |                |
| <b>10 minutes</b> |                |                |