Green by Design

This lesson was created as a supplement to the *Green by Design* program at the National Building Museum. It is designed to be used in your classroom independently, or as an activity before or after a school program at the Museum. For more information about and to register for the National Building Museum's school programs, visit http://www.nbm.org/schools-educators/school-visit/.

The *Green by Design* program helps fourth through ninth grade students understand the issues associated with making environmentally friendly living decisions and the effects of these decisions on their surroundings. It encourages young people to explore how design decisions are made and how they impact the natural and built environment.

National Building Museum

Created by an act of Congress in 1980, the National Building Museum explores, celebrates, and illuminates achievements in architecture, design, engineering, construction, and planning. Since opening its doors in 1985, the Museum has become a vital forum for exchanging ideas and information about such topical issues as managing suburban growth, designing and building sustainable communities, and revitalizing urban centers. A private, nonprofit institution, the Museum creates and presents engaging exhibitions and education programs, including innovative curricula for school children.

Over the past two decades, the Museum has created and refined an extensive array of youth programming. Each year, approximately 50,000 young people and their families participate in hands-on learning experiences at the Museum: 2-hour-long school programs for grades K–9; major daylong festivals; drop-in family workshops; programs helping Cub and Girl Scouts earn activity badges; and three innovative outreach programs, lasting between 30 and 60 hours, for secondary school students. The Museum's youth programming has won the Washington, D.C., Mayor's Arts Award for Outstanding Contributions to Arts Education and garnered recognition from the National Endowment for the Arts.

NATIONAL BUILDING MUSEUM
401 F Street, NW Washington, DC 20001
202.272.2448/www.NBM.org
Red Line Metro, Judiciary Square

Milli's Insulation Investigation*

When it is cold, we have to heat our homes to keep them warm. When summer comes, we turn on fans or air conditioning to keep our homes cool. Adding insulation to the walls helps decrease the amount of energy used to heat or cool our homes. Insulation is one of the materials that impacts the environmental friendliness of our homes. This experiment allows students to see how insulation works, by having them compare different types of materials used as insulation.

*This activity was developed by the American Chemical Society (ACS) as part of their National Chemistry Week (NCW) publication, Celebrating Chemistry. It is reprinted with their permission. For more information about NCW and other ACS educational resources, visit www.acs.org.

OBJECTIVES

Students will:

- identify how citizens impact their environment – natural and built – through the choices they make in use of construction materials;
- evaluate different insulating materials; and
- recognize the role of insulation in a house being environmentally friendly.

NATIONAL STANDARDS OF LEARNING

Science . . . . . E
Math . . . . . Problem Solving
Technological Literacy 8, 9, 10
Visual Arts 3

DURATION

1- 2 class periods, or 1- 2 hours

MATERIALS

- Blunt-ended scissors
- Ruler
- Pencil or pen
- Aluminum foil
- Newspaper
- Plastic wrap
- Wax paper
- 5 identical ice cubes
- Rubber bands
- Paper towels
- Baking tray
- Watch or timer
- Wire rack (optional)

GREEN VOCABULARY

insulation, chemistry, energy-efficient,

TEACHER PREP

- Photocopy *What Did You Observe*? worksheets, p. 50 (1 for each group)
- Ask students to review safety guidelines for conducting experiments, p. 57
- Gather supplies

LESSON PLAN

1. Discuss what insulation is

Explain to the students what insulation is. It is important to keep the temperature at home comfortable for living, no matter what the weather is like outside. When it is cold, we have to heat our homes to keep them warm. When summer comes, we turn on fans or air conditioning to keep our homes cool. Heat moves from a place where it is warmer to one where it is colder. To help keep your home comfortable inside, insulation is placed in the walls, where it works like a jacket around your home. The most common types of insulation used in homes are made from fiberglass and cellulose. Fiberglass is extremely fine strands of glass. Cellulose insulation looks like a pulpy, puffy form of just what it is: recycled newspapers, boxes and waste paper. Adding insulation to homes is a good way to save energy. In this activity you will test several different materials to find out which one is the best insulator.

2. Test the insulators
Divide the students into smaller working groups. Work with the students to complete the following experiment:

1. Cut the aluminum foil, newspaper, plastic wrap, and wax paper to the same size for wrapping each ice cube.

2. Wrap one ice cube in each type of wrapper, being careful to wrap the cubes the same way each time.

3. Use a rubber band to hold each wrapper in place.

4. Cover the baking tray with a paper towel. Place the cubes on the baking tray. A wire rack may be placed on the tray to observe the cubes more easily.

5. Check the cubes every fifteen minutes and record your observations in the “What Did You Observe?” section.

6. After the unwrapped cube has completely melted, or one and a half hours have passed, unwrap the cubes and observe how much ice is left inside each wrapper. Record your results in the “What Did You Observe?” section.

7. Throw away the wet wrappers and paper towels. Thoroughly clean the work area and wash your hands.

3. Discuss findings
Discuss with students the results of their experiment. Which material was the best insulator? Why? Think about heating and cooling your home if you didn't have insulation in your walls; what would happen? Why is insulation energy efficient? How does it save energy?

Explain to the students that the wrapper that allowed more heat through to warm up the ice and melt it fastest is the worst insulator. The insulator that kept the heat away from the ice and melted the ice the slowest is the best insulator. Metal tends not to be a good insulator because it transfers, or conducts, heat instead—in this case, the heat from the warmer air in the room to the cold ice. Materials like wood, cork, and some plastics and fabrics, on the other hand, are good insulators because they are poor conductors. Whether a material conducts heat, and how quickly or slowly it does, is determined by its chemical make-up and arrangement. Chemists can study and tweak those designs to make new, high-tech materials that make everything from our houses more weather-resistant and energy-efficient to our parkas warmer and computers smaller!

What Did You Observe? Student Worksheet

NAME:

Describe how the cube looks (if you can see it), or measure how big the damp circle on the paper towel has become.

Time in Minutes	Unwrapped Cube	Aluminum Foil	Newspaper	Plastic Wrap	Wax Paper
15					
30					
45					
60					
75					
90					

Which cube melted the fastest? _____

Which cube took the longest time to melt? _____

List the wrappers in order from worst to best insulator: _____

_____

Why do you think this is so? _____

Try this…
Try using other "wrappers" like heavy-duty foil, pieces of fabric, or bubble wrap. Try putting a set of cubes in the shade and a set in the sun. Put a set of wrapped cubes in the refrigerator and observe how the melting times differ when the surrounding temperature is lower.

Milli's Safety Tips

Always:

- Work with an adult.
- Read and follow all directions for the activity.
- Read all warning labels on all materials being used.
- Wear eye protection.
- Follow safety warnings or precautions, such as wearing gloves or tying back long hair.
- Use all materials carefully, following the directions given.
- Be sure to clean up and dispose of materials properly when you are finished with an activity.
- Wash your hands well after every activity.

Never eat or drink while conducting an experiment, and be careful to keep all of the materials used away from your mouth, nose, and eyes!

Never experiment on your own!

For more detailed information on safety go to chemistry.org/ncw and click on “Safety Guidelines”.