Insulation, It's a Wrap!

Objective
Students will understand how natural gas or other fuels used to heat a home can be saved through use of insulation and other practices.

Curriculum Focus
Science
Math

Materials
- Copies of "Student Sheet: Insulation, It's a Wrap"
- Beverages in plastic containers, recently removed from the refrigerator
- Thermometers
- Tape and rubber bands
- Materials to use for insulation such as paper, cloth, bubble wrap, cardboard or cotton balls
- Stopwatch or clock with second hand

Key Vocabulary
Energy
Temperature
Insulation

Next Generation Science Correlations
4-PS3 – 2
4-PS3.D
4-ESS3.A
MS-PS3 – 3

Introduction

The largest use of energy in your home is for heating. Many homes are heated with natural gas. Other heating fuels include electricity, fuel oil, kerosene, and propane. To control energy use, it is important to make sure that your home is well insulated. The purpose of insulation is to stop heat from flowing to areas where it is not wanted. Heat moves in predictable ways, flowing from warmer objects to cooler ones, until both reach the same temperature.

Procedure

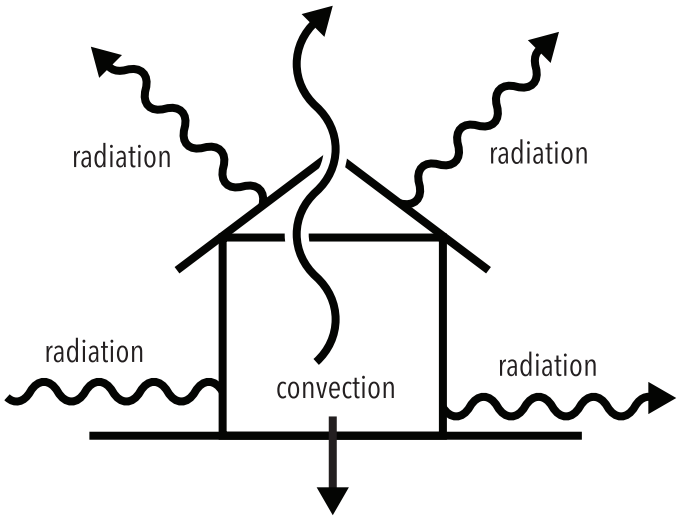
1. Have a volunteer hold a thermometer in a closed fist. Record the temperature of their hand when the thermometer stops rising. Place the thermometer in the center of a chilled beverage and record the temperature when it stops falling. Ask students to hypothesize about what will happen to the temperature of the volunteer's hand when they grasp the drink for 30 seconds.
2. Have the volunteer hold the beverage for 30 seconds. Record the temperature of the volunteer's hand as before. Compare the temperature of the volunteer's hand before and after holding the can. Which way did the heat flow, from the hand to the can or from the can to the hand?
3. Divide students into groups. Review the types of insulation material available to design and engineer a drink insulator, often called a koozie. Give each group a few minutes to discuss the design of their koozie and gather their insulating materials.
4. Pass out the copies of "Student Sheet: Insulation, It's a Wrap." As students read the introduction, pass out cold water bottles and have students take their first temperature reading.
5. Begin timing for 15 minutes while groups build their koozies around their bottles. Make sure the tops of the bottles will be open to insert the thermometer into the beverage. Then have students take their first temperature reading.

6. Set the timer for 10 minutes while the koozies sit in a warm place and students complete questions 4 and 5 on the handout.
7. Have students take the second temperature reading when time is up.
8. If time allows, have more than two temperature tests. Have students calculate the temperature difference from the first temperature to the last.
9. Discuss results and have groups complete the answers to question 8 on the handout. Distribute awards, if desired.

Student Award Extension: Insulation, It's a Wrap!

Have students create award ribbons individually or in groups. Ribbons should be labeled with an award category such as Best Insulating Koozie, Most Interesting Koozie or Best Understanding of Insulation. Have students present ribbons to other students or groups.

Student Sheet: Insulation, It's a Wrap!



Home Heat Loss

Many homes are heated with natural gas. The heat in your home can be lost in one of three ways. The first is conduction or heat transfer between objects that are physically touching. The second is convection, which is the transfer of heat by the motion of a fluid, which may be a liquid or a gas. Lastly, radiation is the transfer of heat through space as electromagnetic radiation.

What keeps hot air outside in the summer and inside in the winter? Insulation! Homes with insulation in their walls, ceilings and floors use less energy, stay more comfortable, and can reduce the cost of heating and cooling. One type of home insulation is a layer of fiberglass installed behind the surfaces of walls, above ceilings, and under floors. Other types are loose fill, which is blown in, and rigid foam. Caulking, weather-stripping or use of surfaces that block the sun's heat and light also keep the temperature comfortable in your home.

In this activity, you will construct the perfect koozie, a sleeve that is designed to thermally insulate a beverage container. It will keep your drink cold by slowing heat flow from your hand and the air to your beverage.

Materials

Bottled water recently removed from the refrigerator, thermometers, various insulation materials such as paper, cloth, bubble wrap or cotton balls, and a stopwatch or clock with a second hand.

Procedure

1. Use your insulation materials to design your koozie. Attach it with tape or rubber bands to your beverage. The top of the drink must be clear of insulation material so that a person could drink from the container.
2. When your teacher says it is time, remove the bottle lid and place the thermometer in the center of your water. When the temperature stops changing on the thermometer, record your temperature reading under Test 1, then remove the thermometer and replace the lid.

Record your temperature reading in this table.

Temperature Test 1	Temperature Test 2	Temperature Test 3	Temperature Test 4

3. Place your koozie in a warm location as directed by your teacher. When your teacher announces that time is up, take your temperature again and record it in the table. While you wait, work together to answer questions 4 and 5 below.

4. Sketch or describe your container and the materials used here.

5. Why did you choose these materials?

6. When time is up again, take the temperature of your water a second time and record it in the table. Your teacher may choose to repeat the test additional times. If so, record your additional temperature measurements in the data table.

7. Calculate the difference in temperature from the first test to the last so that you can compare your results with others

Test 1	
	–
Last Test	
	=
Temperature Difference	

8. Write down answers to the following questions:
   - How did your koozie perform compared to others?
   - What are some common factors in those insulators that performed well?
   - How could you improve your koozie?
   - From what you have learned about insulation and heat transfer, how could your family reduce heat transfer in your home?