GRADE 9 SCIENCE
Keep It Warm: Investigating Insulation

Curriculum Expectations

SNC 1D Science Expectations	
Overall Expectations	
PHV.03	Evaluate the social, economic and environmental costs and benefits arising from the methods of electrical energy production used in Canada.
Developing Skills of Inquiry and Communication	
PH2.03	Through investigations and applications of basic concepts, demonstrate the skills required to plan and conduct an inquiry into electricity using instruments, tools and apparatus safely, accurately and effectively (e.g., use an ammeter and a voltmeter to measure current and potential difference in a circuit).
PH2.06	Through investigations and applications of basic concepts, communicate ideas, procedures, results and conclusions using appropriate SI units, language and formats, and evaluate the processes used in planning, problem solving, decision making, and completing the task.
SNC 1P Science Expectations	
Developing Skills of Inquiry and Communication	
PH2.02	Through investigation and the applications of basic concepts, identify an authentic practical challenge or problem related to the use of electricity (e.g., to design household wiring; to increase the efficiency of electrical usage in the school).
PH2.03	Through investigation and the applications of basic concepts, formulate questions about the problem or issue.
PH2.06	Through investigation and the applications of basic concepts, organize, record and analyse the information gathered (e.g., interpret patterns and trends; discuss relationships among variables; and predict consequences of action or inaction).

Introduction

Conservation of energy is very important today. Energy is expensive, the supply of fossil fuels is limited, and using fossil fuels produces a lot of pollution. Energy can be saved through the use of proper insulation. What materials are the most effective insulators? In this activity you will find out.

Purpose

To determine how well different materials insulate?

Materials

- 3 identical pop cans
- thermometer or temperature probe
- scissors
- boiling water
- clock, watch or timer
- various types of insulating material (newspaper, cardboard, wool, carpet, fiberglass insulation - handle with gloves, etc.)
- masking tape
- goggles
- metric ruler

Procedure

1. Select two materials to test. Place one material, about 1 cm thick, around the sides and the tops of the pop can. Tape the insulation for the sides to stay in place. Use the second can for the next material. The third can is the control.

2. Cut a small hole in the insulation on the top of each can to fit the thermometer (or temperature probe). See Figure #1. Do not put the insulation on top of the can until the water is added.

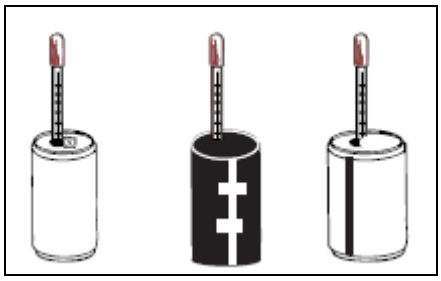


Figure #1 - Illustration of cans with insulating material.

3. Place 250 mL of boiling water into each can. Be careful not to spill the water. Wear goggles and a lab apron or coat.

4. Immediately place the insulation on the top of the can. Be certain the hole for the thermometer (or temperature probe) is over the opening in the can top. Insert the thermometer (or temperature probe) almost to the bottom. Make certain that the materials will not tip over.

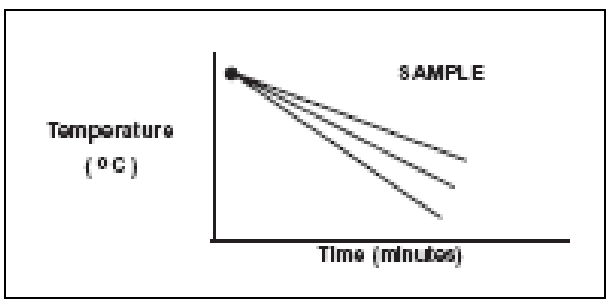
5. Allow the thermometer (or temperature probe) to stabilize. This is when it does not increase or decrease for a few seconds. Then take readings every 30 seconds for 6 minutes. Record you data on the data table.

6. Repeat procedures 3. to 5. for each of the other two cans.

Data Table #1

	Insulation Type	Insulation Type	Insulation Type
Time (min)	**Temperature (Celcius)**	**Temperature (Celcius)**	**Temperature (Celcius)**
0.0			
0.5			
1.0			
1.5			
2.0			
2.5			
3.0			
3.5			
4.0			
4.5			
5.0			
5.5			
6.0			

Graph your data as temperature vs. time.



Analysis

1. Explain why it is important to be sure that all insulating material be the same thickness around the pop can?
2. What was the relationship between temperature and time in this experiment?
3. Compare the insulating abilities of your materials.
4. Compare the abilities of your materials to insulate with materials tested by others in your class?
5. What makes a good insulator? What are some advantages and disadvantages of using each of the materials tested in your class?
6. Why is it necessary to include a control?
7. Identify any sources of error in this experiment. Suggest ways to improve the design.

Conclusion

What material proved to be the best insulator?

Suggestions for Further Study

1. What is an R-value? How does it help a person who is buying insulation?
   An *R-value is a measure of how well something insulates.*
2. Under your teacher's supervision, investigate different shapes to see if that affects the rate of heat loss. The results of this study can be related to living organisms and to designs for energy efficient buildings.
   The higher the volume to surface area ratio, the slower the loss of heat.
3. Conduct an energy efficiency survey of your home or school. Determine how insulation changes can conserve energy. Determine if they are cost effective.
4. Find out how long the world's supply of oil is expected to last. How will this affect the price of oil in a few years?
5. Report on alternative energy sources. Some topics are solar, wind, geothermal, tidal, biomass, fusion, ocean thermal and cogeneration energies.

Websites

Direct Energy:
http://directenergy.com/ontario/home/home_improvements/insulation.aspx?wt.srch=1&WT.mc_id=GOONI1
Department of Energy Insulation Fact Sheet:
http://www.ornl.gov/sci/roofs+walls/insulation/ins_01.html
Cellulose Insulation Manufacturers Association: http://www.cellulose.org/