

Where's The Heat?

Grade

7

Topic: Energy
Grade: 7
Duration: 2 x 45 minutes

Students will discover how buildings are heated. Students will find sources of heat loss within the school and how this can be prevented. They will work with the custodian on this investigation.

Curriculum Expectations

- 7s52: Demonstrate understanding that heat is a result of molecular motion
- 7s54: Explain how the characteristics and properties of heat can be used, and identify the effect of some of these applications on products, systems, and living things in the natural and human-made environments
- 7s57: Explain how heat is transmitted by conduction, convection, and radiation in solids, liquids, and gases
- 7s65: Formulate questions about and identify needs and problems related to heat
- 7s68: Compile qualitative and quantitative data gathered through investigation in order to record and present results, using diagrams, flow charts, frequency tables, bar graphs, line graphs, and stem-and-leaf plots produced by hand or with a computer
- 7s69: Communicate the procedures and results of investigations for specific purposes and to specific audiences, using media works, written notes and descriptions, charts, graphs, drawings, and oral presentations
- 7s78: Identify and describe steps that can be taken to conserve energy and the reasons for doing so
- 7s79: Identify the components of a system that are designed to transfer heat energy and describe methods for conserving energy within that system
- 7e6: Produce media texts using writing and materials from other media
- 7e53: Identify various types of media works and a variety of the techniques used in them
- 7e62: Identify some of the ways in which non-verbal communication techniques (e.g., tone of voice and body language) can affect audiences, and use these techniques in their own speech to arouse and maintain interest, and convince and persuade their listeners
- 7e63: Use eye contact, variations in pace, appropriate gestures, and such devices as the "pause for effect" in presentations
- 7e70: Create a variety of media works
- 7m81: Systematically collect, organize, and analyse data
- 7m83: Use computer applications to examine and interpret data in a variety of ways
- 7m87: Evaluate data and make conclusions from the analysis of data
- 7m93: Understand the difference between a spreadsheet and a database for recording and retrieving information

Background Information

Heat is a form of energy. Atoms and molecules are constantly moving and the amount of heat within any substance depends on how much and how fast its atoms move. When more heat energy is given to something its temperature rises, it expands and it may change from a solid to a

liquid or from a liquid to a gas. Heat can be transferred from one place to another in three ways. These are conduction, convection or radiation. Heat can only move from a hotter area to one that has a lower temperature.

Conduction – Heat moves through solid objects by conduction. If you put a metal spoon in a hot drink, the handle of the spoon gets hot. The heat around the spoon warms the metal and passes through it along the handle. Some materials such as metal are good heat conductors; others called insulators, are not.

Convection – Hot air rises. The air over a fire or over an area heated by the sun gets hotter and rises, letting colder air flow below it. Heated water flows in to form swirling currents. In a room, the hot air rises and as the air reaches the ceiling, it starts to cool. This movement is called convection current. The cool air falls and the cycle begins again. Cold air enters a building through a window or a vent for the furnace. Heaters should be placed under windows to heat the cold, incoming air.

Radiation – Nearly all our heat and light come from the sun. The sun is 150 million kilometres away but its heat and light radiation pass through space and reach us at the speed of light eight minutes later.

Accountability

Students will understand how heat energy is used at the school and how it can be conserved.

Teacher Notes

1. Use this scenario approach:

Recently, you saw a consumer report on the news. It talked about how much energy is lost in older buildings that are poorly insulated. The reporter put out a challenge to students to determine how energy efficient their school was. You decide to take this up as an activity at your school. You will work with the custodian and the EC team to create a report that can be used on the television show as an example of a school that is making a difference.

2. Review the different types of heat.
3. Students are trying to discover how to make the school more energy efficient. The students will be examining how the school is heated.
4. Talk to the custodian at the school and find out how the school is heated – forced air, hot water, electricity, solar energy.
5. Conduct a simple experiment to demonstrate convection currents.
 - Take a piece of coloured construction paper. Cut out a large circle. Draw a line on the paper in the shape of a spiral, leaving spaces about 1-2 cm. Make a small hole in the centre of the spiral.
 - Take a piece of thin string or fishing line and make a knot at one end. Push the unknotted end through the hole in the spiral until it rests on the knot. Carefully cut along the line with scissors.
 - Hang the spiral over the heaters in the classroom and watch what happens.
 - Hang the spiral in other places in the classroom and record what happens
 - Determine where the currents are located in the class.
 - Discuss the fact that the rising hot air currents catch the spiral making it twist and turn. In the room, the convection currents that form around the heat source carry the heat all around the room so that eventually every corner of the room is warmed.
6. Create a survey that indicates the name of the different rooms in the school, the number and location of the windows and the number and location of all heat vents. Record this information in a database
7. Answer the following questions:

- Are the windows close to the heating ducts?
 - If the school is heated with hot water radiators, are they near or under the windows?
 - In what direction do most of the windows face?
 - Are the sources of heat in each room placed so that they create good convection currents?
 - How do you rate the overall efficiency of the school?
8. Take temperature readings at different spots in the room to discover how efficient the heating system is in keeping all areas of the room at the same temperature. Record this information in a spreadsheet.
 9. Heat loss occurs for several reasons – the main one being from poor insulation around doors and windows.
 10. Create a method of determining where drafts are located. Record the draughty locations. Talk to the custodian about ways to help close these drafts that are causing energy loss in the school. Add this information to the database.
 11. Create a media report from your investigations that can be sent to the television show that outlines all the ways that your school has addressed this issue of heat loss and heat conservation. Your report should contain real data, charts, diagrams and a plan for the future.
 12. Work with the EC Team for additional ideas.

Home Extension

1. Complete a similar survey at home to see how the heat is distributed.
2. Look for ways that the home can be weatherproofed to make it more efficient. Look at ideas such as weather stripping and insulation.
3. Examine the basement and attic for drafts.

Lesson Comments

Teachers, feel free to add in your own comments for this lesson.