

Energy Efficient Buildings

Grade

7

Topic: Energy
Grade: 7
Duration: 4 x 45 minutes

Students will create plans for an energy efficient addition to the school. They will work in small groups with each group having responsibility for examining one aspect of the problem. Students will create working diagrams and a model of their building addition to present at an EC Team meeting.

Curriculum Expectations

- 7s53: Identify, through experimentation, ways in which heat changes substances, and describe how heat is transferred
- 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
- 7s64: Design and build a device that minimizes energy transfer
- 7s65: Formulate questions about and identify needs and problems related to heat
- 7s66: Plan investigations for some of these answers and solutions, identifying variables that need to be held constant to ensure a fair test and identifying criteria for assessing solutions
- 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
- 7s79: Identify the components of a system that are designed to transfer heat energy and describe methods for conserving energy within that system
- 7s82: Demonstrate an understanding of the factors that must be considered in the designing and making of products that meet a specific need
- 7s89: Use appropriate techniques and materials
- 7s99: Identify energy as a significant cost in the manufacturing and use of products or systems
- 7e5: Produce pieces of writing using a variety of forms (e.g., descriptive, narrative, and expository compositions), techniques and resources appropriate to the form and purpose, and materials from other media (e.g., diagrams, illustrations)
- 7e24: Use spreadsheets appropriately to convey specific types of information
- 7e37: Plan a research project and carry out the research
- 7e47: Use instructions and explanations to plan and organize work
- 7e48: Ask questions and discuss different aspects of ideas in order to clarify their thinking
- 7m53: Recognize the front, side, and back views of three-dimensional figures
- 7m54: Sketch front, top, and side views of three-dimensional figures with or without the use of a computer application
- 7m83: Use computer applications to examine and interpret data in a variety of ways
- 7m93: Understand the difference between a spreadsheet and a database for recording and retrieving information

Background Information

Designing buildings that are more energy efficient is very important now. A building can be looked at as a closed system. Things outside it such as climate, winds and seasonal temperatures affect the building. Once

the building has been heated, it is important to make sure that the heat stays inside. Heat moves in any direction – up, down or sideways, as long as it is moving from a warm spot to a colder one. To keep heat inside, you need to make sure that cold air doesn't get in.

One of the most effective ways for homeowners and builders to minimize the amount of heat loss from a house and thereby reduce energy consumption is by insulation. Insulating materials are put in floors, walls and attics to minimize heat loss. They work by being made of material that traps and holds thousands of tiny air pockets. Since air is a poor conductor of heat, this helps reduce the heat loss in a house.

Another way to keep the cold out is with weather-stripping or caulking to prevent drafts. It is important not to seal the building completely since some fresh air must come in to allow the currents to flow and for a fresh supply of oxygen.

Accountability

Students will understand how insulation can be used to create a more energy-efficient building.

Teacher Notes

1. Use this scenario approach:

Many schools in your area are quite old and do not have sufficient space or may be lacking special program areas (e.g., science labs). Additions are being added to existing schools. Your school board wants to design and construct new sections that are the most energy efficient as possible. They have hired your design company to develop a proposal for these new additions. You will need to make it as energy efficient as possible for the Canadian climate.

2. In this activity, students will put their knowledge of structural strength together with their understanding of how heat is used in buildings.
3. Discuss how insulation material is used. Bring in samples of objects that use insulation material. This can be both for hot and cold objects. Look at how a Thermos container is used. The flask is made up of several layers that keep either the heat or cold inside the flask. Inside the flask is a double-walled container of glass or steel. The walls are silvered on the inside to reflect heat rays that behave like light rays so that rays cannot leave or enter the flask. Between the container walls is a vacuum that prevents heat conduction through the walls. The container support and stopper are made of insulating material such as cork that reduces conduction.
4. Discuss why you pour hot water into the Thermos jug first to make it more efficient.
5. Look at lunch containers that student use. How are they constructed? What materials are used to keep food either hot or cold? How long are they effective?
6. Talk about how you dress on cold days especially if you are going to be active. You dress in several layers and there is a layer of air in between that acts as an insulator.
7. Look at how insulation is used to keep buildings warm in winter and cool in summer.
8. Invite a homebuilder to the class to talk about home insulation. Ask this person to bring insulation samples for the students to examine. Discuss how new buildings have a standard of insulation that is rated for its efficiency. The better insulated the building, the more energy efficient it will be.
9. Research how insulation materials are used and find out which one are the most environmentally friendly. Record the results in a database.
10. Talk to the custodian at the school and find out how the school is insulated – what material was used?
11. In small groups, have students discuss how to build a structure that will be energy efficient. Have them draw preliminary plans of their structure. Include detailed sketches of the design. On the design plans, indicate what strategies will be used to make it energy efficient (insulation, windows and doors in the correct place, energy efficient windows, building materials, etc.)
12. Decide what materials would be needed to make it energy efficient and create a list of these materials. Find out the cost of these materials. Use a spreadsheet to calculate the costs.
13. Construct the model and use the insulation materials. Create a database to record the different types of material used.

14. Include a report to go along with your model that clearly demonstrates why it is structurally sound and energy efficient.
15. Devise an experiment to test how energy efficient the structure is.

Home Extension

1. Find out about the insulation properties at home. Talk to parents about ways to increase the insulation value of the home to decrease energy costs.

Lesson Comments

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