Focus question

• How can we design a more efficient way to decrease energy transfer between a model home and the environment?
Identify criteria and constraints

Teacher master BB, *Insulation Criteria and Constraints*
Plan first design

Notebook sheet 29, *Home-Insulation Design*

Brainstorm materials with your group. Describe and illustrate a design on your notebook sheet.
Insulation testing

Teacher master CC, Insulation Testing Procedures
Prepare for testing

Notebook sheet 27, *Insulating Materials*

When we go outdoors, you will record your data on Part 2. Take your model, notebook sheet, and a writing utensil.
Sense-making discussion

Teacher master DD, Design-Challenge Results

Record your results. Which designs were most successful?
Plan next steps

1. What you might want to try on your next design?
2. Can you improve your group’s performance?
Plan next steps

In addition, you will be able to add a roof to your design.

1. What materials might you want to use?
2. What shape might the roof have?
Introduce roof designs

Teacher master EE, *Examples of Roof Designs*
Plan second design

Notebook sheet 29, *Home-Insulation Design*

Mark this as design 2 in the upper right corner.
Begin construction

Teacher master CC, **Insulation Testing Procedures**
Discuss class results

Teacher master DD, Design-Challenge Results

Record results. Which designs were most successful?
Homework

Notebook sheet 30, Final Project Reflection
Discuss your last design in terms of a system with a partner. Think about these questions.

1. What do the containers in the system represent?

2. Why is it important to add insulation to a home?
Discuss energy use

Discuss in your group.

• What are some problems with poor insulation that lets energy transfer to the environment?
Discuss energy use

Energy cannot be created or destroyed, only transferred. Heaters and air conditioners require energy to run.

If people use more energy to keep their homes warm or cool, that energy must come from somewhere and has costs.
Engineering design process

• What have you learned about how engineers work?
Engineering design process

1. What was the first thing you did to solve the problem?
2. What did you do next?
3. Did your design work exactly the way you hoped it would?
Engineering design process

Teacher master FF, *Engineering Design Process*
Engineering design process

• If I were to give you time now to design a new insulating container made from recycled materials, what would you do next?
Read “Home Insulation” on page 64.

Home Insulation

Brrr! On a chilly winter evening, you might curl up with a blanket, and turn up the heater. Snuggled warm in your home, the cold air outside can’t bother you. Houses are designed to help protect the people who live inside.

Heat = Energy Transfer

In layman's terms, this means that a number of different heat transfer mechanisms occur in homes. A house does an job by transferring thermal energy to the space around it. You don't actually have to touch the heater for it to work. This is because a lot of the heater's thermal energy is transferred by radiation. Radiation can heat you across the room.

The heater also transfers energy to the air parcels that come into contact with it. This is convection. Then as air warms up, the air begins to move spread. This leads to energy transfer by convection. The house uses induction, conduction, and convection to keep the inside of your home warm.

Now the warm air hits a wall. What happens? Where air particles collide with particles in the wall, energy transfer through conduction. Materials inside the wall, window, floor, and ceiling of a home can reduce energy transfer to the outside wall. These materials are called insulators.

Weather and Water Course, 5.3: Home Design

Step 27
Review vocabulary

Spend a few minutes reviewing the vocabulary for this part. Update the vocabulary index and table of contents in your notebook.

- constraint
- criterion (pl: criteria)
How can we design a more efficient way to decrease energy transfer between a model home and the environment?
Answer the focus question

1. How did changing the design affect the overall effectiveness of your home insulation design?

2. What other questions do you have?
Homework


**Science Practices**
- Asking questions. Scientists ask questions to guide their investigations. This helps them learn more about how the world works.
- Developing and using models. Scientists develop models to represent how things work and to test their explanations.
- Planning and carrying out investigations. Scientists plan and conduct investigations to test the models they developed in their investigations.
- Analyzing and interpreting data. Scientists use tables and graphs. They use numbers to help them think about patterns. Scientists make inferences based on observations and data. An explanation becomes an accepted theory when there are many pieces of evidence to support it.
- Engaging in argument from evidence. Scientists present evidence to listeners, and evaluate other people’s evidence. They must choose which best explains natural phenomena.
- Obtaining, evaluating, and communicating information. Scientists must be able to communicate clearly. They must evaluate others’ ideas. They must convince others of the merits of their ideas.

**Engineering Practices**
- Defining problems. Engineers ask questions to make sure they understand the problems they are trying to solve. They need to understand the constraints that are placed on their designs.
- Developing and using models. Engineers develop and use models to represent concepts they are designing. They test their models before building the actual objects or systems.
- Planning and carrying out investigations. Engineers plan and conduct investigations. They need to make sure that their designed systems are effective, efficient, and robust.
- Analyzing and interpreting data. Engineers collect and analyze data when they test their designs. They compare different solutions. They use the data to make sure they match the given criteria and constraints.
- Using mathematics and computational thinking. Engineers use mathematical and computational thinking to analyze data. They use mathematics to construct simulations, solve equations, and express different variables.
- Describing solutions. Engineers find solutions. They propose solutions based on a logical sequence of steps, and evaluate them using criteria and constraints.
- Engaging in argument from evidence. Engineers must be able to communicate clearly. They must evaluate other people’s ideas. They must convince others of the merits of their designs.
Homework

Design an icon for each practice to use when the practices are represented throughout the rest of the course.
Wrap-Up

Turn to your energy-transfer graphic organizer and complete radiation, convection, and conduction.
Answer the guiding question

• How does insulation reduce energy transfer?