MATTER, HEAT AND INSULATION

GRADE LEVEL

3rd-5th grade

OBJECTIVE

Students will use the engineering process to develop an insulated container to minimize the loss of heat energy.

PURPOSE OF ACTIVITY

Read or Listen
Identify Details
Apply Skills

21st CENTURY SKILLS

Critical Thinking
Collaboration

COGNITIVE LEVEL

Strategic Thinking
Extended Thinking
Skills and Concepts

CLASS TIME

2 hours

MATERIALS

A group of four needs:

- Hot water
- Plastic cup
- Thermometer
- Bubble-wrap, wool, cotton and other items to be used for insulation
- Timers
- Thermos
- Laptops or digital device for research
- Student Sheet

PROCEDURE

1. Show the thermos. Explain that heat energy can be gained or lost due to the cooling or heating effects of the environment. Ask students why they think this thermos can keep something hot on a cold day and have them write ideas down.
2. Students will conduct an investigation with hot water. The students will be trying to keep the hot water as warm as possible for the designated time. For the investigation, students will use the cup. They will use other insulating materials to help the container be as effective as possible.
3. Students then make modifications to the container for a second test.
4. Students will use the student sheet to record observed temperatures under the evidence portion and will also give reasoning. They will then formulate a claim on how these experiments work and also an explanation.

CRITICAL THINKING QUESTIONS

Which insulation worked best to insulate the water?

The wool.

What role did heat transfer play in the design of the insulation?

Heat transfer was being prevented.

Adapted from: https://energy.utah.gov/energy-education/curriculum/

ENERGY GAME CHANGERS

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Student Sheet Name _____

MATTER, HEAT AND INSULATION

List three structural designs that you think the hot beverage thermos has that enables it to keep hot chocolate warm for a long time.

1.

2.

3.

Materials: Using these ideas and materials you will design a container to keep your water hot. Each group will need one plastic cup, hot water, bubble wrap, cotton balls, wool or other insulating materials, roll of tape and a thermometer.

Initial Container Design: Draw the container below as you will be using it for your first experiment. The hot water, entire container and insulation materials must be included and labeled.

Data Table (your evidence from the experiment): Measure and record the temperature of water in the container every five minutes. While waiting, work through the scenarios that follow this data table.

Container #	Temp Start	Temp 5 min.	Temp 10 min.	Temp 15 min.	Temp 20 min.	Temp 25 min.
Trial #1						
Trial #2						

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Redesign your second container with its insulation and sketch it here. Please label all the changes that you are going to make. Write a statement describing how the **structure** of differing materials allows them to **function** as insulators.

Now run your experiment again and enter your data into the table on the first page.

Reasoning:

1. Which container maintained the original or starting temperature for the longest period of time? Why do you think this was the case?

2. Which container maintained the original or starting temperature for the shortest period of time?

3. Why do you think this was the case?

Explanation: Write a claim statement providing evidence (data) to support the claim. You must include reasoning and describe why the structure of your insulating materials functioned as an insulator. Include the words “heat transfer, heat energy, temperature or heat loss” in your explanation.