the CEED

THE CENTER FOR ENERGY EFFICIENT DESIGN

Insulation Investigation

Grade Level	Sixth	**Subject**	Science

Objective(s):

- To determine how various insulation materials affect the energy efficiency of a home.
- To investigate heat loss using different insulation materials.

SOL Addressed:

- 6.1
- 6.3b
- PS.7c,d

Common Core Standards:

- MS-PS3-3
- MS-PS3-4
- MS-PS3-5

Materials Needed Per Class of 30

and

Prior Knowledge

Materials

Each lab group of three to four students will need the following items:

- One large plastic bowl (4 cup or 32 oz disposable plasticware)
- One 8oz plastic cup (It must fit inside the larger bowl and leave a gap between the two to allow for insulation to be added.)
- warm tap water
- cold tap water
- Celsius Thermometer
- rice
- newspaper
- cotton balls
- fabric
- stopwatch (or Activboard running clock)
- paper towels

This is an introductory activity that is best used before completing the CEED Home Activity.

Prior Knowledge

Students need to be able to accurately read a Celsius thermometer.

Ways to differentiate this lesson plan

- **EXTENSION for Higher Level Learner**
  - Students will chose alternate materials or combination of materials to create the most effective insulation.
  - Students can use technology to investigate the R-Value of different building insulation materials that are used in homes today. They can create a PowerPoint or Photostory of their information.
  - Students will investigate the benefits of triple paned Krypton insulated windows verses double paned Argon insulated windows.

<table>
<tr><td></td><td colspan="2">

- **MODIFICATIONS**
  - Technology Modification – Probeware can be used instead of a standard Celsius thermometer.

</td></tr>
<tr><td>Introduction/ Anticipatory Set</td><td>Anticipatory Set:
Show the students a thermos. Ask them why the thermos can keep items warm or cold regardless of the surrounding temperature.

Class Discussion – Spend some time discussing the importance of insulation by asking the students the following questions.

Questions to ask students:
What is insulation?
Where can you find insulation?
What is the purpose of insulation?
What is the function of insulation in the home in the winter verses in the summer?
Does insulation conserve energy?
Why is it important to conserve energy?</td><td>Introduction:
Students will investigate the ability of different materials to reduce the rate of heat transfer. Students will be asked to create a hypothesis and conduct an experiment that tests the various insulating materials. They can chose to use hot or cold water to investigate heat transfer.

This activity is designed to give the student maximum flexibility in creating and testing their student created hypothesis. Some may even chose to test both types of water with the same insulation material.</td></tr>
<tr><td>Guided Practice</td><td colspan="2">Divide the students into groups of 2 or 3 and have the students answer the following pre-lab questions as a group.

1. What is the purpose of insulation?
2. What do you think this lab will demonstrate about insulation?
3. Using the lab data sheet:
a. Create a hypothesis based upon the materials you have available.
b. Identify the variables on your lab data sheet.
c. Create a data table to record your results.</td></tr>
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Independent Practice	**Instructions** 1. Using the supply list, pick up the necessary supplies. 2. You are free to test multiple insulation types in any order. 3. Water will be added to the inner cup. You are free to use hot water or cold water. Be sure to record whether you are using warm or cold water. 4. Record the initial water temperature at the beginning of each trial. 5. The insulation material will be packed between the bowl and the inner cup. 6. Record the temperature of the water as it changes. During this activity, you decide the frequency of temperature reading. **Remember that you need to test multiple materials and that your procedures should remain constant. Do not exceed a two minute time period between temperature readings.** 7. Use your data table to record your results. 8. Following lab cleanup, complete the post-lab questions. a. Record your step by step procedures. b. Analyze your data and draw a conclusion. Was your hypothesis supported? c. Create a graph that accurately displays your results.
Closure (Summary of Lesson)	• Students will share their results in the form of a class discussion and graph display. • Lesson Extension: The teacher will discuss the energy efficient insulation choices used in the CEED building. For example, the building uses triple paned Krypton insulated windows instead of double paned Argon insulated windows.
CEED Building Application/ Sensor Data	**CEED Dashboard Lesson Extension** **CEED Dashboard Link** Using the CEED Dashboard, students will access the data available concerning electrical usage. Compare the net energy usage of the CEED building per month to an average 2000 square foot building. Be sure to compare the same months and to break down the energy usage per square foot. The CEED building is 3600 square feet. The teacher can bring in a few sample electrical bills to establish a fact sheet which shows the price per kilowatt hour of electricity.

Assessment	• Lab Report • Classroom Presentation of Graph Results

Lab Report Below

Lab Report

Title: _____

Statement of the Problem:

_____

_____

Information:

_____

_____

Hypothesis: (Remember that it is an "If_____then_____" statement.)

_____

_____

_____

Experimental Setup

Variables:

Independent Variable: (variable that changes) _____

_____

Dependent Variable: (variable that responds to the change of the independent variable)_____

_____

Control: _____

Constants: _____

_____

Procedure:

_____

_____

_____

_____

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_____

Procedure Continued:

_____
_____
_____
_____
_____
_____

Materials used:

_____ _____
_____ _____
_____ _____
_____ _____

Results: (Establish your headings according to your procedure and data collection.)

Conclusions: (paragraph form, complete sentences)

Graphing : Graph your results on a separate piece of paper.

Lab Procedure Reflection: Given the opportunity to repeat this activity, what would you change or do differently?