the CEED

THE CENTER FOR ENERGY EFFICIENT DESIGN

Title			
Grade Level	5th	**Subject**	**Light Energy**
Objective(s): Describe how passive solar energy can be used in our everyday lives and homes. Predict the relative transmission, reflection, and absorption properties for various materials. Construct a solar heater for a home or garage.		**SOL Addressed:** 5.1 The student will demonstrate an understanding of scientific reasoning, logic, and the nature of science by planning and conducting investigations in which g) data are collected, recorded, analyzed, and communicated using proper graphical representations and metric measurements; h) predictions are made using patterns from data collected, and simple graphical data are generated; i) inferences are made and conclusions are drawn; j) models are constructed to clarify explanations, demonstrate relationships, and solve needs; and, 5.3 The student will investigate and understand basic characteristics of visible light and how it behaves. Key concepts include) opaque, transparent, and translucent; d) reflection of light from reflective surfaces 5.4 The student will investigate and understand that matter is anything that has mass and takes up space; and occurs as a solid, liquid, or gas. Key concepts include b) the effect of temperature on the phases of matter; 5.6 The student will investigate and understand how Earth's surface is constantly changing. Key concepts include g) human impact	
		Common Core Standards: 5-ESS3-1Develop a model using an example to describe ways the geosphere, biosphere, hydrosphere, and/or atmosphere interact. [4-ESS3-1 Obtain and combine information to describe that energy and fuels are derived from natural resources and their uses affect the environment. 4-ESS3-2 Generate and compare multiple solutions to reduce the impacts of natural Earth processes on humans 4-PS3-2 Make observations to provide evidence that energy can be transferred from place to place by sound, light, heat, and electric currents 4-PS3-4 Apply scientific ideas to design, test, and refine a device that converts energy from one form to another. ESS3.C	

<table>
<tr><td>Materials Needed Per Class of 30

and

Prior Knowledge</td><td colspan="2">Student computers with internet access
Student handouts, Discussion Questions
Thermometers
Mirrors
Aluminum foil
Clear plastic wrap, sheet protectors or transparencies
Black (and other colored) paper
Cardboard or cardboard boxes
Scissors
Tape (clear and masking tape)
Glue sticks
Sunny window(s) to attach projects to
Duct tape
Newspaper
Black paint (spray and/or tempera)
Washed, recycled aluminum cans
Recycled computer cooling fans and solar panels to run them (optional)
The student should have an introduction to basic, properties of light. The student should understand transmission, reflection, and absorption of light on an object. The following video may be played as an example of a solar home heater https://www.youtube.com/watch?v=FtfaZMahSUU .</td></tr>
<tr><td>Ways to differentiate this lesson plan</td><td colspan="2">• EXTENSION for Higher Level Learner
The student could design a blueprint of a garage or building applying solar principles by identifying the best location for the placement of solar heaters onto an existing building.
• MODIFICATIONS
The student can use the model solar heater in their own home and record observations to justify or discredit its home-heating potential.</td></tr>
<tr><td>Introduction/ Anticipatory Set</td><td>Anticipatory Set:
Think-Pair-Share
Imagine you live in the remote Alaskan wilderness and it is very cold all the time. How would you heat your home if there was no electricity available? (Allow discussions, they will probably say “fire”) What if using fire was not an option, how would you heat your home then?
Questions to ask students:
• Are there clever ways to use recycled materials?
• What are some common recycled materials that many people have available to them?</td><td>Introduction:
The teacher will ask the students what they know, understand, and want to know about radiant energy.</td></tr>
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Guided Practice	**Questions for the Activity:** Are there inexpensive ways to heat existing homes? What is the most efficient way to heat a home with limited supplies? What aspects should be considered when implementing a solar home heater? Day 1 1. Allow students to investigate and take notes on solar power at the CEED website http://dashboard.intellergy.us/ceed/index.php and on solar heaters on the web. 2. Have students draw a sketch of what some heaters look like and list materials that have been provided by the teacher. The student should consider materials at home that are safe to use and bring in for this project. 3. Students should discuss what they think will be the best transmitters, reflectors, and absorbers of radiant energy and how that relates to a solar heater.
Independent Practice	Days 2-3 (or more, as needed) The student will create a solar heater and test it. The teacher will decide if having partners is better for their classroom setting. The student will record data about the current weather conditions, data from the CEED dashboard solar equipment and their personally-made heater (temperature at exhaust port) and organize it into a graph/chart.
Closure (Summary of Lesson)	Final Day Students will present and share their projects with the class. They will explain challenges, successes, and failures they experienced. The class will compare their individual results to those of their peers and create a final sketch of what they would do if they could repeat this project and make improvements.
CEED Building Application/ Sensor Data	Students will visit the CEED website http://dashboard.intellergy.us/ceed/index.php to learn about types of solar power, uses of solar power, and solar power production capabilities.
Assessment	Student participation in activities and discussions. Have students answer the questions below on their own paper or classroom blog. 1. Did your solar heater perform as you expected? Why or why not? 2. What problems did you have while building your solar heater? Do you wish you had any other resources? What would they be? 3. How could you improve on your design and make it more efficient? 4. Using what you have learned, how might you apply your knowledge of solar radiation to your future or existing home?