

5 E Lesson

Solar Collector Project

Grade Level : 8

Concept(s): In Tech. Ed. and Science class we have been talking about energy. We learned about renewable and nonrenewable energy. We also learned about the need to use more renewable energy. In both classes you have learned about solar radiation and the 'free' energy we get from it. We have also learned that we can use energy to do work for us. The students' job is to build a passive solar collector that will capture the sun's energy and use it to do work. The goal is to put as much of the sun's energy to work as possible to perform two tasks: heat water and cook a s'more. Students will design a solar collector, build the solar collector, and then test the solar collector.

Standards Addressed:

WI Science Standards

- A.8.6 Use models and explanations to predict actions and events in the natural world
- A.8.7 Design real or thought investigations to test the usefulness and limitations of a model
- C.8.2 Identify* data and locate sources of information including their own records to answer the questions being investigated
- C.8.3 Design and safely conduct investigations* that provide reliable quantitative or qualitative data, as appropriate, to answer their questions
- C.8.4 Use inferences* to help decide possible results of their investigations, use observations to check their inferences
- C.8.5 Use accepted scientific knowledge, models*, and theories* to explain* their results and to raise further questions about their investigations*
- C.8.6 State what they have learned from investigations*, relating their inferences* to scientific knowledge and to data they have collected
- C.8.8 Use computer software and other technologies to organize, process, and present their data
- C.8.9 Evaluate*, explain*, and defend the validity of questions, hypotheses, and conclusions to their investigations*
- C.8.10 Discuss the importance of their results and implications of their work with peers, teachers, and other adults
- D.8.8 Describe and investigate the properties of light, heat, gravity, radio waves, magnetic fields, electrical fields, and sound waves as they interact with material objects in common situations
- D.8.9 Explain the behaviors of various forms of energy by using the models of energy transmission, both in the laboratory and in real-life situations in the outside world

WI Technology Education Standards

- B.8.4 Discover that resources are essential; they must be used effectively to produce a desired outcome, and outputs from one system may be inputs to another system

- C.8.2 Explain and demonstrate several solutions to a problem or opportunity using technological design, tools, careful planning, experimentation, and testing
- C.8.3 Brainstorm and illustrate ways to integrate efficiency into design through the reuse of materials, resources, and waste in technological systems

Objectives:

Upon completion of the activity/lesson students will be able to:

- Define solar energy, where it comes from and how it is used.
- Explain and demonstrate how to capture passive solar energy
- Graph heat gain and loss

Material List:

- 1 transparency sheet per group
- Colored paper
- Whatever supplies students want to bring
- Computer access
- Thermometers
- S'mores: graham crackers, marshmallows, chocolate

Engagement		
What will the teacher do	Eliciting questions/student response	What the students will do
Ask questions of the students to get them thinking about project.	<p>What kinds of energy do we get from the sun?</p> <p>How can we best collect the sun's energy?</p> <p>What you have experienced when out in the sun or a car that is sitting out in the sun vs. the shade.</p> <p>What side of your house gets the most solar energy and how does it get into your house?</p> <p>How do you stay warm?</p> <p>In the winter, how does your house stay warm?</p> <p>How do you keep something warm from getting cold?</p>	Students will answer questions posed by the teacher

Exploration		
What will the teacher do	Eliciting questions/student response	What the students will do
<p>Assign the students into groups of two.</p> <p>Pass out the Solar Collector Project Sheet out to the student groups.</p> <p>Instruct students about the activity.</p>	Solar Collector Project Sheet	<p>Plan, design, build and test a solar collector that meets the requirements and harnesses as much of the suns energy as possible.</p> <p>Create a chart to note temperature changes and observations.</p>

Explanation		
What will the teacher do	Eliciting questions/student response	What the students will do
Have the students present their solar collector and their test results.	Tell the class how your solar collector works and how well it did out in the sun.	Students will present their models to the class. Students will also explain how it works and how well it worked.

Elaboration		
What will the teacher do	Eliciting questions/student response	What the students will do
<p>Have students come up to the board and graph their results from their solar collectors.</p> <p>Have students leave the collectors up front on a table.</p>	<p>What do we notice from the results?</p> <p>Did you harness any of the suns energy? How do you know? How well was it captured?</p> <p>What to you notice about the shape of the graph overall?</p> <p>What might account for any ups and downs in the graph?</p> <p>What might account for any differences between students solar collector results?</p>	Students will come up to the board and graph the results of their solar collector.

Evaluation

What will the teacher do	Eliciting questions/student response	What the students will do
Grade the students Solar Collectors Have students complete the summary questions.		Build the Solar Collector Test the Solar Collector Students will complete and turn in the summary questions.

Solar Collector Project



Names: _____

In Tech. Ed. and Science class we have been talking about energy. We learned about renewable and nonrenewable energy. We also learned about the need to use more renewable energy. In both classes you have learned about solar radiation and the ‘free’ energy we get from it. Your job is to build a passive solar collector that will capture the sun’s energy and use it to do work. Your goal is to put as much of the sun’s energy to work as possible to perform two tasks: heat water and cook a s’more. You and a partner will need to design a solar collector, build the solar collector, then test the solar collector.

Before you begin you will need to think about how best to use and collect the sun’s energy. Think about things we have talked about in class, what you have experienced when out in the sun or a car that is sitting out in the sun vs. the shade. What side of your house gets the most solar energy and how does it get into your house? Use these thoughts and questions to help guide you in your design.

Size:

1. Maximum size 1 ft x 1 ft x 1 ft
2. Must be able to be opened (a door or flap) on one side to put in water and s’mores.

Materials:

1. 1 transparency sheet
2. Construction paper
3. Any other materials you can bring in

Procedure:

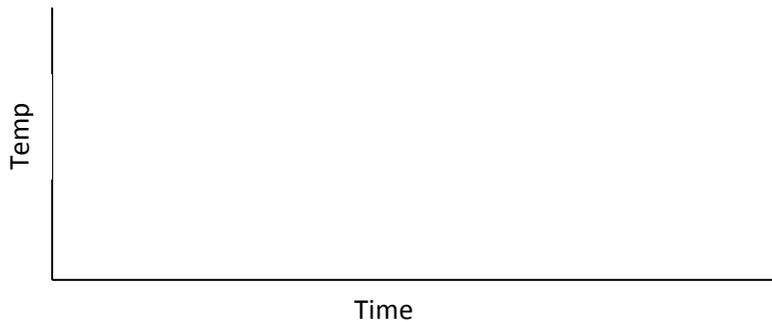
1. Planning
 - a. On plain paper
 - i. Draw top view
 - ii. Draw side view
 - b. Typed or neatly on lined paper
 - i. List of materials needed detailing how you are obtaining each material
 - ii. List of steps to build it
 - iii. 3 sentences on why you designed the collector the way you did
 - c. Turn in plans
2. Building
 - a. Bring in needed materials
 - b. Create data recording sheets on computer and graphs for each test
 - c. Build solar collector in class (3 class periods combined with science)
3. Testing
 - a. Testing in science class – heating water and recording data
 - b. Testing in Tech. Ed. – heating s’mores and recording data
 - c. Graphing results and answer summary questions



Data needed to record for Tech. Ed.

- Create a chart to record data and a graph to record data when done
 - Starting temperature
 - Temperature every 5 minutes while in the sun for 30 minutes and 10 minutes after out of sun
 - Control temperature in sun
 - Control temperature in shade
 - Observations of s'more recorded every 5 minutes

Graph example



Names: _____

Grading Rubric:

Criteria	Points Possible	Points Earned
Planning -Top view: on plain paper, neat, labeled -Side view: on plain paper, neat, labeled -List of materials and who is bringing what -Steps to build -3 reasons on why you are building it this way	2 2 3 2 3	____ ____ ____ ____ ____
Building -Used time wisely, had needed materials -Quality construction -Solar collector is proper size: max 1' x 1' x 1' -Able to access inside collector	6 6 6 2	____ ____ ____ ____
Data collection and analysis -Temperature and observation record sheet: created and complete -Graph of data complete: shade temp, sun temp, collector temp -Analysis questions: answered thoroughly	6 6 6	____ ____ ____
Total Points	50	_____

Summary Questions

1. How did you orientate your solar collector to the sun?

2. Was your solar collector successful? How could you tell?

3. If you had 4 quarter-size holes in in your solar collect would it help it gain heat energy or hurt it? ____
Why? _____

4. Is your solar collector a passive or active collector? _____

5. What is one thing you would change/add to your solar collector if you were to build it again?

6. If you were designing a new home what could you take from this activity that would help your home use solar energy?

7. In the space below draw a small floor plan of a house with: 1 bedroom, 1 bathroom, 1 kitchen, and 1 living room that does a great job of capturing the sun's energy for winter heating. Use the sun's location on the paper as the sun's location in the winter.

