

# KEEP'S NATURAL RESOURCES 731

## FINAL ASSIGNMENT

Andrew Heren

### **Concept(s):**

Our sun is a constant source of energy. Each day, the sun bathes the Earth in unimaginable amounts of solar energy, most of which come in the form of visible light. All over planet Earth, sunlight is by far the most important source of energy for all living things. Without it, Earth would be lifeless.

Sunlight can be a practical source of energy for such everyday jobs as cooking, heating water, or warming up homes.

You are familiar with what happens to a dark-colored surface when sunlight strikes it: it will get warm. But without a little help, there is usually not enough heat produced to cook foods. To produce enough heat for cooking, it is necessary to shine additional sunlight from a wider area onto the black surface. This is easy to do with mirrors or other reflective surfaces, or with glass or plastic lenses.

The solar oven you will be building from this plan uses aluminum foil to gather sunlight. The foil-covered panels of the oven reflect sunlight into the cooking chamber, which is painted black. Heat is produced when the concentrated sunlight is absorbed by the black surface of the cooking chamber. The heat is contained inside the chamber with the help of insulation and a clear plastic oven bag. The result is a great solar cooker and yummy food!

### **WI Science Standards:**

#### **Inquiry Standards:**

C.8.1 Identify questions they can investigate using resources and equipment they have available

C.8.2 Identify data and locate sources of information including their own records to answer the questions being investigated

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

### Physical Science Standards:

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

### Classroom Management Goals/Skills:

Use the excitement of science and cooking to keep attention and to spur interest

Give students the option of working on their own or with a partner

Use video in the Elaboration section

<b>Objectives The student will be able to:</b>	<b>Evaluation Question for Each Objective</b>
Use scientific terms to explain how they think a solar cooker works.	Does the student use the correct terms? Does their explanation show their understanding of solar energy?
Complete a working solar oven	Does the student's oven work to cook the s'more?
Discuss different possible materials to make their oven more efficient.	Students will be able to evaluate and redesign their ovens if necessary.

### Vocabulary:

*Energy* – the ability to do work

*Solar energy* – Energy from light

*Renewable energy* – energy from natural resources that can be renewed at a constant rate.

ENGAGEMENT		
What the Teacher Will Do	Eliciting Questions/ Student Responses	What the Students Will Do
Ask students questions to let them explain what they know about solar energy.	Q: What type of energy does the sun give us?  Q: Can someone tell me why we want light?  Q: What are different ways we can cook food?	A: Light and heat  A: To be able to see things. Also- to heat things!  A: Stove, oven, microwave

<p>Ask students anticipatory questions.</p>	<p>Have you ever wondered how strong the sun's heat really is?</p> <p>Do you think that we could actually cook something just with the sun's heat?</p> <p>The sun's energy is a renewable energy source. That means that we can use its heat and light for energy.</p> <p>Today we will be making s'mores in our own solar ovens.</p>	<p>Solicit student responses</p>
<p>Explain that today we are each going to use the Sun's light energy to make an oven. The oven converts the sun's light energy into heat energy for cooking.</p>	<p>Ask students to give a hypothesis about how the oven works and will it really work?</p>	<p>Allow hypotheses</p>
<p>Show materials for building solar cookers and ask students what they think each material's purpose is.</p>	<p>Q: What do you think the aluminum foil is for?</p> <p>Q: What do you think the clear plastic is for?</p> <p>Q: What do you think the rolls of newspaper are for?</p> <p>Q: What do you think the black paper is for?</p>	<p>A: To gather more light. Light bounces off of the foil into the oven. A mirror could work as well.</p> <p>A: Insulation so heat can't escape. It has to be transparent so light can get through.</p> <p>A: Added insulation- like insulation in the walls of buildings.</p> <p>A: Absorbs the light. Compare this to wearing a white shirt or a black shirt on a summer day.</p>

## TRANSITION

Now that you've created a guess, or hypothesis, about whether the solar cookers will work and how they work, we will begin constructing our solar cookers.

## EXPLORATION

What the Teacher Will Do	Eliciting Questions/ Student Responses	What the Students Will Do
<p>Pass out materials for building solar cookers:</p> <p>1 Pizza box (get donations from local pizzeria)</p> <p>1 sheet of black construction paper</p> <p>2 sheets of aluminum foil -- be careful to leave this in good condition!</p> <p>1 piece of laminating film (get these from office store that laminates and has scraps that can be reused!)</p> <p>pencil or pen</p> <p>Black electrical, duct, scotch and masking tape</p> <p>Glue sticks or white glue</p> <p>Newspapers for insulation</p> <p>Knife for teacher/aide to cut boxes</p> <p>Direction sheet for students</p>	<p>Review again what each material's purpose is.</p>	<p>Students will use the direction sheets to build their solar cookers.</p> <p>Students will then cook their s'mores.</p>

## TRANSITION

Students will bring their cookers and s'mores to a meeting area to present their results.

## EXPLANATION

What the Teacher Will Do	Eliciting Questions/ Student Responses	What the Students Will Do
Ask each student to present their cooker to the class and explain their design.	How did your solar cooker work? Did it cook the s'more?	Students will present their cooker to the class. They must explain why their cooker did or didn't successfully cook the s'more.
Ask review questions to reinforce concepts.	1) What is the aluminum foil for? 2) What is the newspaper for? 3) Why do we need plastic? 4) Why do we use black construction paper? 5) Where does the heat come from to cook the s'mores? 6) Can you tell if the oven is getting hotter by looking at the s'more?	To gather light  To insulate the box and hold in heat. This lets the sun into the cooker and insulates it. To absorb heat  From the sun  Yes, you can see if it is melting

## TRANSITION

Now that we have seen how our solar cookers worked, or did not work, some of you may have doubts that such a thing really works.

## ELABORATION

What the Teacher Will Do	Eliciting Questions/ Student Responses	What the Students Will Do
<p>Ask if any students have used solar cookers before.</p> <p>Ask what purpose solar cookers may have besides a cool science project.</p>		<p>Give their responses.</p> <p>Give their guesses.</p>
<p>Show the YouTube video on solar cooking in Africa.  <a href="http://www.youtube.com/watch?v=xZWlpKRuur0">http://www.youtube.com/watch?v=xZWlpKRuur0</a></p> <p>(There are many videos on YouTube on using solar cookers)</p>	<p>Ask: What differences do you see between the commercial solar cookers and ours?</p>	<p>Students will give answers.</p>

## TRANSITION

Now that we know solar cookers are very useful inventions that can be used in many situations, let's see if we can evaluate or analyze each of ours and see if we can make improvements on it.

## EVALUATION

What the Teacher Will Do	Eliciting Questions/ Student Responses	What the Students Will Do
<p>Are there any students who want to redesign their solar cookers?</p>	<p>Give students opportunity to correct problems or improve their cookers.</p>	<p>Improve cookers as desired</p>
<p>Give short quiz on the materials and use of a solar cooker.</p>		<p>Students will take the quiz.</p>

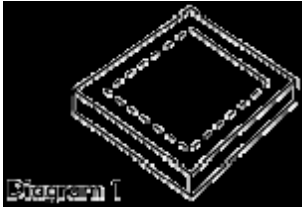
Sources:

<http://www.energyforeducators.org/lessonplans5/5th%20Solar%20lesson.pdf> by Kai-Mei Fu and Michael Preiner

<http://www.stevespanglerscience.com/experiment/solar-oven>

## Student Direction Sheet for Solar Cooker

**Step 1** Have the student place the construction paper on top of the box and trace the outline. The teacher or aide should then cut three slits, leaving the edge closest to the box opening.



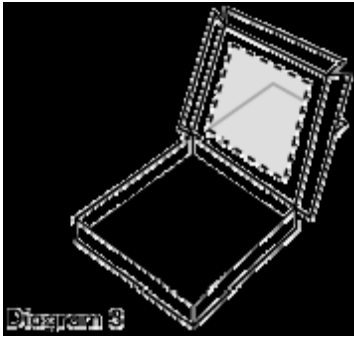
**Step 2** Form a flap by gently folding back along the uncut line to form a crease. (Diagram 2) Cut a piece of aluminum foil to fit on the inside of the flap. Smooth out any wrinkles.



### Step 3

Measure a piece of plastic to fit over the opening you created by forming the flap in your pizza box. The plastic should be cut larger than the opening so that it can be taped to the underside of the flap. It is important to get these seals tight!

**Step 4** Cut another piece of aluminum foil to line the bottom of the pizza box and carefully glue into place. Cover the aluminum foil with a piece of black construction paper and tape into place. (Diagram 3) Note: the layer of aluminum foil underneath the black is optional.



### Step 5

Line the sides of the pizza box with rolled newspaper for added insulation.

### Step 6

Close the pizza box top (window), and prop open the flap of the box with a wooden dowel, straw, or other device and face towards the sun. (Diagram 4). Adjust until the aluminum reflects the maximum sunlight through the window into the oven interior.



### Step 7

Cook some s'mores! Let the s'mores cook for at least 10 minutes -- preferably more if there is time.



## Review Quiz

1. What is solar energy?
2. Briefly explain how a solar cooker works.
3. Would it work as well to use another color of paper besides black?
4. What else would you like to try cooking in your solar cooker?