



SOLAR OVENS

JUSTIN TAYLOR

SOLAR LESSON

Time Frame:	Standards:
2 -- 60 minute sessions 5 th Grade	<p>5.S.1.2.1 Use observation and data as evidence on which to base scientific explanations and predictions.</p> <p>5.S.1.2.3 Use models to explain or demonstrate a concept.</p> <p>5.S.1.5.1 Explain how the shape or form of an object or system is frequently related to its use or function.</p> <p>5.S.1.6.3 Select and use appropriate tools and techniques to gather and display data.</p> <p>5.S.5.1.1 Identify issues for environmental studies.</p> <p>5.S.5.2.1 Describe how science and technology are part of a student's life.</p> <p>5.S.5.3.1 Identify the difference between renewable and nonrenewable resources.</p>
Objectives:	
<p>SWBAT complete a working solar oven.</p> <p>SWBAT to discuss different possible materials to make their oven more efficient.</p>	
Background Information:	
<p>Our sun is a constant source of energy. Each day, the sun bathes the Earth in unimaginable amounts of solar energy, most of which comes 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.</p> <p>Sunlight can be a practical source of energy for such everyday jobs as cooking, heating water, or warming up homes. The challenge is to find ways to transform sunlight into usable heat. The most efficient way to transform sunlight into heat is to shine lots of sunlight onto a dark surface. Dark surfaces absorb most of the visible light that falls upon them, and reflect very little. Visible light that is absorbed this way usually causes the dark-colored surface to warm up. Of all colors, black is able to absorb the most light, and produce the most heat.</p> <p>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</p>	



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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!

http://www.re-energy.ca/t-i_solarheatbuild-1.shtml

Materials:

What you will need:

- Recycled pizza box
- Black construction paper
- Aluminum foil
- Clear plastic (heavy plastic laminate works best)
- Exacto or scissors.
- Pen/Pencil/Marker
- Tape
- Newspaper

Procedure:

Lesson:

At the beginning of the lesson one tutor should take the s'mores and start cooking them in a sunny spot since there may not be enough cooking time for the students' ovens.

Introduction/Lecture:

Have a demo of a solar oven on a table in front of the class.

Have the students gather around.

Q: Can anyone tell me what we have been studying this quarter in Science?

A: Energy

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Q: Can someone name a type of energy for me?

A: Heat, Light, Electricity, Mechanical (Moving), Potential, Gravity, Chemical, Solar

Explain to the students that today we are going to study the sun's energy.

Q: What type of energy does the sun give us?

A: Light (you can tell them this)

Q: Can someone tell me why we want light?

A: To be able to see things. Also- to heat things!

Q: What are different ways we can cook food?

A: Stove, oven, microwave

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.

Examine the solar oven with the students briefly. Ask

Q: What do you think the aluminum foil is for?

A: To gather more light. Light bounces off of the foil into the oven. A mirror could work as well.

Q: What do you think the saran wrap is for?

A: Insulation so heat can't escape. It has to be transparent so light can get through.

Q: What do you think the rolls of newspaper are for?

A: Added insulation- like insulation in the walls of buildings.

Q: What do you think the black paper is for?

A: Absorbs the light. Compare this to wearing a white shirt or a black shirt on a summer day.

Activity:

Have the students go outside to a sunny location and spread out. The students should be in groups of 2's or 3's depending on the number of tutors.

Tutors need to hand out the following materials to EACH student

- 1 Pizza box

- 1 sheet of black construction paper

- 2 sheet of tin foil- be careful to leave this in good condition!

- 1 pencil or pen

Each group needs

- 1 exacto knife (for the tutor)

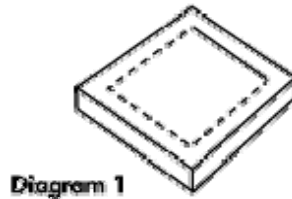
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1 roll of scotch tape
Saran wrap should be easily accessible to all!

Step 1

Have the student place the construction paper on top of the box and trace the outline. The tutor should then cut three slits, leaving the edge closest to the box opening.



Step 2

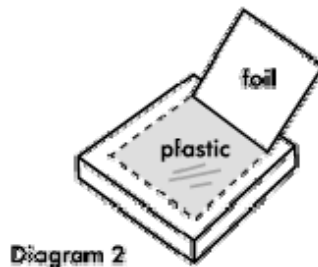
Form a flap by gently folding back along the uncut line to form a crease. (Diagram 2) Cut a piece of aluminum foil to fit on the inside of the flap. Smooth out any wrinkles.

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.

Step 4

Measure a 2nd piece of saran wrap. Tape this piece to the top side of the box. (This will make a total of two layers of saran wrap with a small layer of air in between). It is important to get these seals tight!



Step 5

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 Al foil underneath the black is optional.

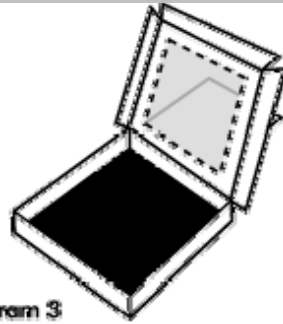


Diagram 3

Step 6

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

Step 7

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). (Mike and I found that the prop is not necessary with these boxes). Adjust until the aluminum reflects the maximum sunlight through the window into the oven interior.

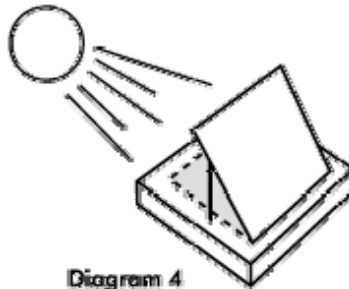


Diagram 4

Step 8

Cook some s'mores!!!!

Let the s'mores cook for at least 10 minutes- preferably more if there is time. While the food is cooking you can let the students look at other ovens, also you can ask them questions about the ovens. Possible questions include

- 1) What is the aluminum foil for?
- 2) What is the newspaper for?
- 3) Why do we need saran wrap?
- 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?

Activity while s'mores are cooking.

We have some magnifying glasses. It may not be possible to burn things in the late



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afternoon 4:30-5:30 but we can try! At least students can explore how a lens collects and focuses light.

Assessment:

This would be an Observational Assessment. Are the students able to complete this project? Also Are the students able to verbally explain the parts of the oven and why they were used?

References:

Tutors: Kai-Mei Fu and Michael Preiner

Materials: See below

Resources:

This lesson was adapted from <http://www.icpsolar.com/html/kdactivi.asp>. We were able to get Pizza My Heart to donate 25 large pizza boxes so each student can make one. A more quantitative lesson can be found at

<http://www.re-energy.ca/pdf/Solar%20Heat%20LP%20formatted.pdf>

which may be more appropriate for higher grades. More information on solar cooking (more than you could ever imagine) can be found at

<http://www.solarcooking.org/>

Note: Commercial/nice solar ovens can reach 350. Basic ones like ours should be able to reach 250.

www.stanford.edu/group/sciencebus/Lessons/2005%20Summer%20Energy/Solar%20Oven.doc