Cooking With The Sun

RENEWABLE ENERGY
THE INFINITE POWER
OF TEXAS

For Grades 6, 7 and 8

OVERVIEW

In this unit, students will construct and test three kinds of solar cookers to observe the differences in their efficiency. By the end of the unit, students should have an appreciation of the availability, simplicity, and cost effectiveness of using the sun as an energy source. Students will compute Fahrenheit/Centigrade conversions.

OBJECTIVES

See Middle School Teacher Resource Guide for TEKS objectives and additional information regarding this and other middle school units.

SUGGESTED TIMEFRAME

Teacher will need to determine how many class periods to devote to each activity, based on the suggested timeframe and length of classes.

Time	Activity	Content Area
10 minutes *15 minutes* *45 minutes*	**Activity 1** – Teacher Introduction **Activity 2** – Assessment of Current Student Knowledge **Activity 3** – Reading Passage and Vocabulary **Homework Assignment** – Sentences with Vocabulary	 Science Reading Vocabulary Language Arts
30 minutes	**Activity 4** – Understanding Fahrenheit and Celsius Temperatures	Science
45 minutes *45 minutes* *15 minutes*	**Activity 5** – Pre-Lab **Activity 6** – Lab **Activity 7** – Post-Lab	Science
30 minutes	**Activity 8** – Assessment	Science

REQUIRED MATERIALS

- copy of the Reading Passage and Student Data Sheets (includes reading comprehension questions, vocabulary and Lab Activity) for each student
- copy of the Assessment Questions for each student
- an equipment kit for each cooker that students will build, to be distributed by teacher
  - 1 - 250 ml beaker per cooker
  - 1 small thermometer
  - water to fill each beaker
- an equipment kit for each group containing the following:
  - 1 timer
  - sunglasses per student
  - Materials for Solar Cooker #1 (box panel cooker)
    - 1 cardboard box approximately 30 cm per side
    - appropriate cutting tool (scissors, razor knife, Xacto knife)
    - rubber cement
    - aluminum foil

  - 8” dowel @ c. ¼” diameter or chop stick
- Materials for Solar Cooker #2 (simple cone cooker)
  - 1 90 x 90 cm poster board
  - aluminum foil
  - rubber cement
  - 3 brass brads
  - appropriate tool for punching holes for brads
  - 1 box 30 cm x 30 cm x 30 cm (i.e. copier paper box without lid)
- Materials for Solar Cooker #3 (modified box panel cooker)
  - 1 cardboard box approximately 30 cm per side
  - cutting tool
  - black paint
  - paint brush

BACKGROUND INFORMATION

The general principle of a solar cooker is to heat food using the sun, which shines directly and can also be reflected. Dark cooking utensils absorb heat energy. A glass top traps the heat inside.
In this activity, students will be measuring the temperature of cooking surfaces for three different types of solar cookers, a reflective box cooker, a cone shaped cooker, and a black box cooker. This activity concentrates on measuring and comparing the temperatures produced by these cookers.

In commercially available solar ovens, cooking times are comparable to a conventional oven as the temperature can reach 450°F. In these student-made cookers, cooking times will be much longer, as they will typically reach a maximum 250°F in direct sunlight. Some quick-cooking foods include hot dogs, sliced frozen cookie dough, s’mores, and nachos. Foods that will cook in 1-2 hours include grains like rice, fruits, and above ground vegetables. Foods taking 3-4 hours include root vegetables, beans and legumes, and bread. A dark, lightweight, shallow pot, not oversized, cooks best.

The Texas Solar Cookers is a network of interested persons throughout the State. You might be able to find a local resource through this contact:: Monica Salyer, PO Box 690810, San Antonio, TX 78267-0810, phone 210-219-6448, or email omei@stic.net.

SUMMARY OF ACTIVITIES

Activity 1 – Teacher Introduction (10 minutes)
Explain to the class that for the next unit of study, they will be learning about solar cookers, how they can be equally effective as conventional forms of cooking and how they can come in various designs. If you were able to contact a local person with a solar oven, arrange for him or her to visit your class on this introductory day for a brief demonstration. A great attention-getter would be to bake some cookies in the visitor’s oven for the students to enjoy. The class will build 3 different types of solar cookers and test, record and compare the heating capabilities of each cooker. Students will also complete an exercise to help them understand the relationship between Celsius and Fahrenheit degree measurements.

Activity 2 – Assessment of Current Student Knowledge (15 minutes)
To assess what students already know, prompt a class discussion based on the 3 questions listed below. Based on this discussion, create and display a graphic organizer of the points that were discussed, which can be displayed throughout the unit of study. Refer to the Teacher Resource Guide for sample organizers.

1. How can the sun be used to cook food?
2. Do you think people use the sun to cook food anywhere in the U.S.? In the world?

3. How do you think you could build a cooker using materials you have in your home? What kind of materials would you use?

See Teacher Resource Guide for alternative or additional assessment activity.

Activity 3 – Vocabulary and Reading Passage (45 minutes)

Each student will need a copy of the Reading Passage and the Student Data Sheets, which include reading comprehension questions, vocabulary words and the Lab Activity. (As an alternative to making copies, the Student Data Sheets can be displayed so the entire class can view them and copy the information into their science notebook.) Instruct students to study the Reading Passage and complete the questions and vocabulary. This activity will help them learn how the sun can be used to cook our food and about several designs of solar cookers that are currently used today. Key vocabulary words in the Reading Passage will assist them in understanding the Lab Activity instructions. For students who wish to learn more of the detailed principles about solar cookers, direct them to the appropriate resources. Suggested resources can be found in the Teacher Resource Guide. At the end of this activity, collect and grade the student's work. Return their graded work the following day.

Homework Assignment – Key Vocabulary List

1. Instruct students to create in their science notebooks meaningful sentences that reflect an understanding of the definition of each vocabulary word. Students should have written the definition of the words in their science notebooks during class. See Teacher Resource Guide for alternative vocabulary homework.
2. Collect and grade this assignment the next day.

Activity 4 – Celsius and Fahrenheit Worksheet (30 minutes)

1. This worksheet can be completed as an interactive class exercise as students will need direction from the teacher. Teacher can display the contents of the worksheet so the entire class can view it (overhead transparency, chalkboard, etc.) and work through it together. In this lesson students can also draw a comparison of Fahrenheit and Centigrade thermometers.
2. Tell the students that the freezing point on a Fahrenheit thermometer is 32°F and the freezing point of a Centigrade thermometer is 0°.
3. Instruct the students to label the boiling points of water
   (°F =212° and °C =100°).
4. Ask the students how many lines are on a Fahrenheit thermometer between the freezing and boiling point?
   (212 - 32 = 180 lines.)
5. Ask the students how many lines are on a Centigrade thermometer between the freezing and boiling points?
   (100 – 0 =100 lines)
6. Instruct students to determine the ratio of lines. The ratio of lines is 180 lines to 100 lines or 180/100. When this fraction is reduced by dividing by 20, the ratio of lines is simplified as:
   9 lines F
   5 lines C
   The rest of the Fahrenheit thermometer below zero can be drawn in.
7. It is apparent that the Fahrenheit thermometer has "an added piece on the bottom" after the freezing point (32 degrees F), to include a reading down to zero. The "extra piece" of the Fahrenheit thermometer is subtracted when converting to the shorter Centigrade thermometer scale. The extra 32° piece is added when converting from the shorter Centigrade scale to the longer Fahrenheit scale. Drawing these thermometers side by side, and

even adding some of the lines helps students visualize the reasonableness of their answers.

8. Based on the ratio of lines and the extra piece, help students derive the equation for converting degrees Fahrenheit to degrees Centigrade:
   $°F = (°C \times 9/5) + 32$
9. Ask students to convert 30°C to Fahrenheit:
   $°F = (30°C \times 9/5) + 32 = (54) + 32 = 86°F$
10. Ask students to derive an equation to convert degrees Centigrade to degrees Fahrenheit:
    $°C = 5/9 \times (°F - 32)$
11. Ask students to convert 60°F to Centigrade:
    $°C = 5/9 \times (60 - 32) = 5/9 \times 28 = 15.6°C$
12. Have students look at their drawings to estimate if these answers look reasonable.

Activity 5 – Pre-Lab (45 minutes)

1. The teacher should read the Lab Activity instructions first.
2. Instruct students to wear sunglasses for this activity to ensure that bright reflection to the eyes is reduced. The teacher can determine if each group will construct one model of solar cooker, with different groups constructing different models for comparison, or if each group will build all three. To ensure that all students participate, instruct the groups to assign who will be responsible for each step in the activity before beginning. To prevent students from assigning similar tasks to the same students in each unit, the teacher may elect to assign the responsibilities.
3. Explain to the class that the purpose of the Lab Activity is to gain an understanding that solar cookers come in different designs and are simple to build. Students will build 3 simple solar cookers and test their heating abilities. They will graph their results. Before performing the lab, students can be given the lab instructions to read and summarize the steps involved. The summary can be in the form of a brief chart. Review safety guidelines before students conduct the lab. See Teacher Resource Guide for general safety guidelines. Demonstrate proper use and care of the equipment used in the activity.

Activity 6 – Lab Activity (45 minutes)

1. Divide the class into small groups and instruct each group to obtain the materials for one Lab Activity kit. You can instruct students to obtain materials for one solar cooker at a time.
2. Instruct students to follow the directions to build each solar cooker.
3. Once all the groups have completed building their assigned solar cookers, gather the materials you will be responsible for providing to the groups (water at room temperature and thermometers) and instruct students to follow you to the outside location to conduct the tests. Students should gather their 3 cookers, their timers and their sunglasses.
4. Once the groups have positioned their cookers so they will get the maximum exposure to the sun, distribute 200 ml of water in beakers to each group.
5. Instruct students to carefully place the beaker in the cooker and take an initial temperature reading, start the timer and continue taking readings according to their lab instructions.
6. Once all the groups have taken their temperature readings, instruct students to share their measurements and calculations and record them on their Lab Report Form.
7. Instruct students to create a graph of their temperature readings. A sample graph is provided on the next page.
8. Instruct students to complete the answers to the lab questions.

Activity 7 – Post-Lab (15 minutes)

After students have completed their Lab Report Forms and graphs, discuss their results and their answers to the lab report questions as a class.

Activity 8 – Assessment (30 minutes)
Distribute a copy of the Assessment Questions to each student. Instruct each student to work alone and answer the short answer and multiple-choice questions. Collect the handouts, grade and return them to the students.

ADDITIONAL ACTIVITY

Design and build an advanced solar cooker
Working in their same groups, students can research commercially available solar cookers and other resources for solar cooker construction through the Internet. A good place to start would be at www.solarcooking.org. Instruct students to identify the components and their specifications (such as cover glass thickness, type and rating of insulating material, type and rating of reflective panels, etc.) and propose a design that uses materials obtainable at a hardware or home improvement store. If time and resources are available, the groups can build and test their new designs. This activity can be expanded to be a solar cooker design contest by having each group be responsible for designing, building and cooking a common dish in a cooker. Winning results would be based on the speed with which the cooker produced the finished dish. Solar brownies, cookies or other desert bars would be popular choices and can be obtained as boxed or frozen ingredients.

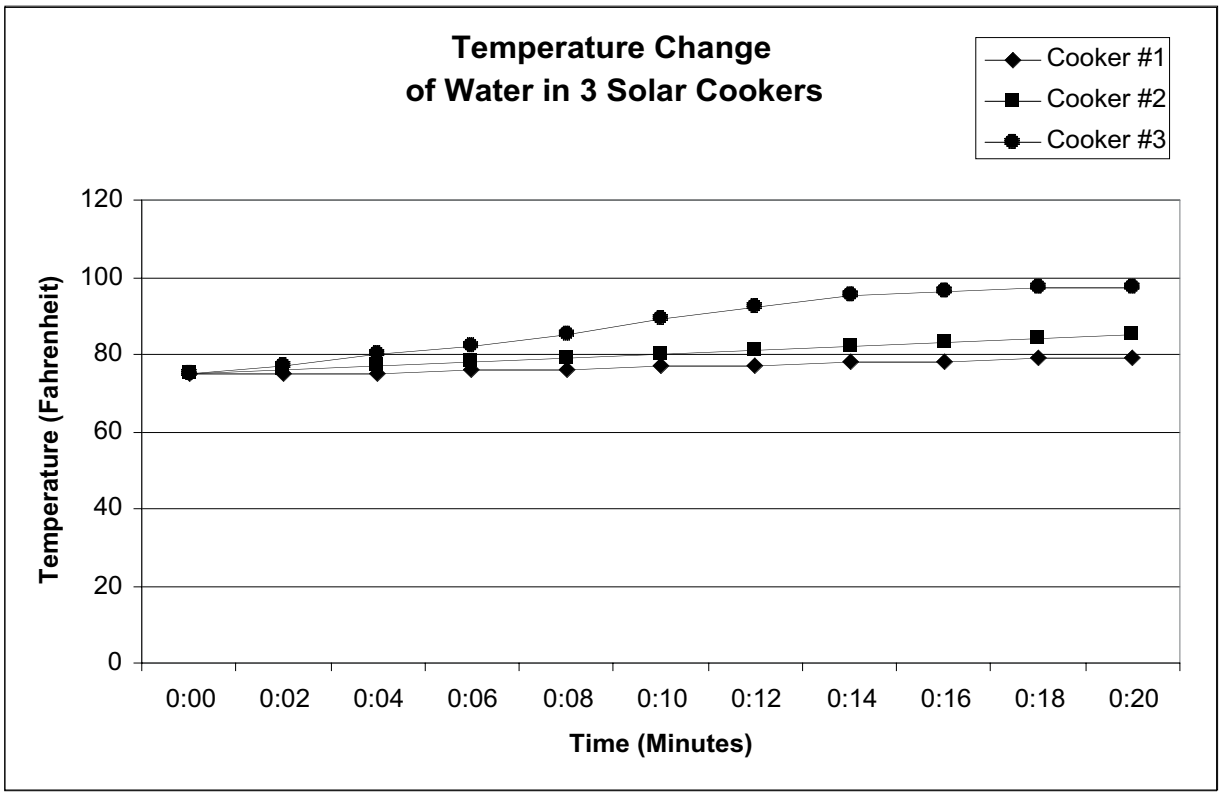

FIGURE 1. *Sample graph of heating abilities of 3 solar cookers*

Cooking With The Sun

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HIGHLIGHTS

- **Solar cookers can be used everyday or for solar picnics**
- **They come in many types**
- **They are easy to build, or can be bought ready-made**
- **Solar cooking works well, is easy, fun, and good for the environment**

SUMMARY

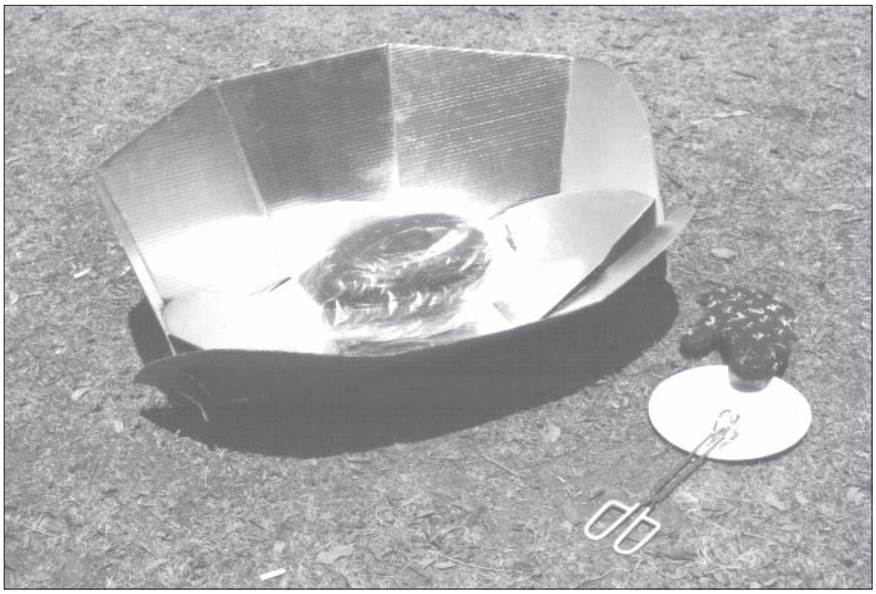
Most of you know how it can be hot enough to fry an egg on the pavement. But have you ever seriously considered actually cooking with the sun? In some parts of the world, solar cooking is very popular. In Texas it works just as well and can be used for everything from picnics to everyday cooking.

SOLAR COOKER BASICS

Solar cookers work because sunlight carries lots of power. For example, when sunlight hits a surface with an area of 1 square meter, there is about 1,000 watts of energy from the sun on that surface. Compare this to your toaster oven, which uses about 1,000 watts. In a solar cooker, sunlight is concentrated into a cooking area that gets hot enough to cook food. If more sunlight can be captured, more power can be generated. Solar cookers sometimes have an insulated cooking chamber to prevent heat from escaping.

SOLAR COOKER DESIGNS

Just as there are many kinds of conventional cookers (ovens, stovetops, broilers, microwave ovens), there are many kinds of solar cookers. The simplest type of solar cooker is the "Cookit"



SOURCE: JUDY PEARSON

FIGURE 1. PANEL COOKER *The "Cookit" panel cooker is simple but effective.*

FIGURE 2. BOX COOKER *Box cookers are excellent for slow cooking.*

shown in Figure 1. It consists of a single piece of cardboard with aluminum that is folded into a panel that acts like a reflector. A dark pot placed in a plastic bag can be the cooking container. The dark color allows more heat energy to be absorbed by the cooking container.

Figure 2 shows a solar box cooker. A solar box cooker consists of an insulated box, black on the inside (to absorb sunlight) with a transparent cover (usually glass), and one or more reflective panels that allow more sunlight to enter the cooking chamber. Food is placed inside the chamber in a dark-colored pot. Box cookers can reach temperatures in the mid to high 200 degrees F.

Solar cookers that use parabolic designs, as shown in Figure 3, have a dish reflector with a parabolic shape. The dish reflects sunlight into the focal region of the parabolic curve. A dark colored pot is usually placed at this focal region to get the most sunlight. Depending on the size of the reflector, very high temperatures can be reached. Parabolic solar cookers may have a large area to collect sunlight and therefore can generate high power; but they typically do not have an insulated cooking chamber. Therefore, these solar cookers are used similarly to a conventional stovetop.

Some solar cookers use both a parabolic cooker, which can focus direct sunlight in a particular area resulting in high heat, and an insulated cooking chamber. These cookers are called solar concentrator ovens. These ovens operate like a conventional oven because they can reach high temperatures. Figure 4 shows one such unit that is sold commercially.

As you can see from these examples, there are many different types of solar cookers that can be made. There are even cookers that are built into a south wall, cookers that can fold into backpacks, cookers that are like stovetops and more.

COOKING WITH A SOLAR COOKER

Just as we cook differently with stovetops, ovens and microwaves, different types of solar cookers are used differently. A parabolic solar cooker might be used like a stovetop by

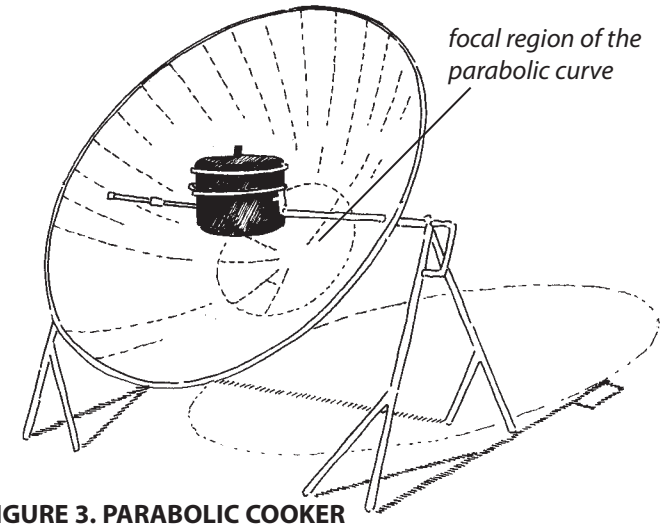
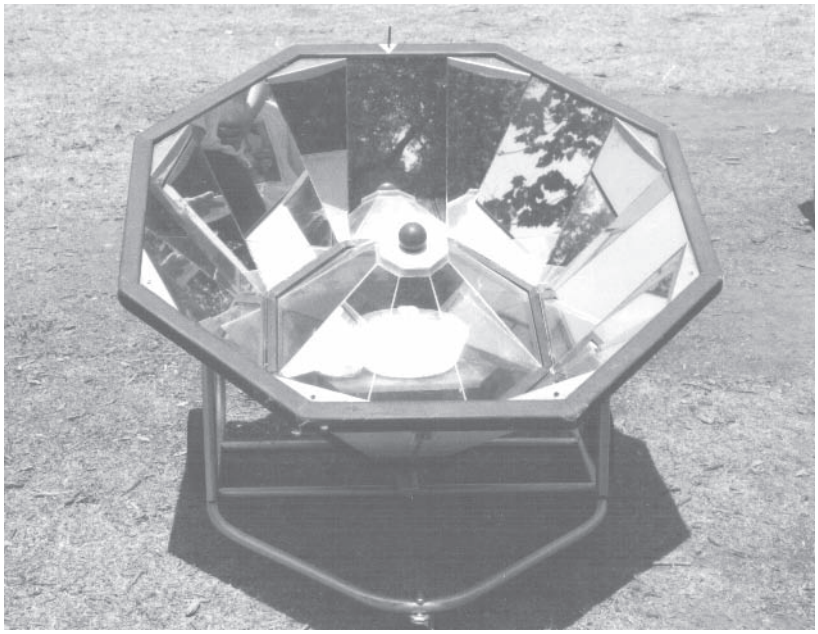


FIGURE 3. PARABOLIC COOKER
Parabolic solar cookers reflect sunlight into a fixed point.



SOURCE: JUDY PEARSON

FIGURE 4. CONCENTRATOR OVEN *Solar concentrator ovens combine a parabolic cooker and an insulated chamber to reach high temperatures.*

heating a pan or pot to a high temperature. A box cooker is most effective when it is used like a crock-pot (slow cooking or low heat over a long time). And a solar concentrator oven can be used like a conventional oven.

Let's consider the simple box cooker. On a sunny day in Texas, May through September, it will reach temperatures around 250 degrees, which will cook or bake most foods. The slow cooking brings out the flavor in many foods. Expect to cook food in this type of solar cooker about twice as long as with a conventional oven. But since it is almost impossible to burn food in this type of cooker, it does not matter how long food is left to cook. People who use solar box cookers usually prepare their dish, put it in the cooker, and go away until it is ready to eat. They can also move the oven a couple of times as the sun moves across the sky to better capture sunlight.

In general, solar cookers work best on bright, sunny days, and when the sun is high. But they can still cook food even if the sky is hazy or partly cloudy.

Because solar cookers use the sun as their source of heat, they save natural resources. They also can help keep your house cool in the summer by keeping the cooking heat outside!

Where you live and the weather can affect how well a solar cooker cooks food. The type of conditions that could affect it are: how high above sea level (higher altitudes should be better), latitude, seasonal rainfall and air pollution.

HOW TO GET A SOLAR COOKER

A good way to get a solar cooker is to build one yourself. The "Cookit" design shown in Figure 1 has the simplest design and can be very effective. A simple box cooker can be made in a couple of hours at home from scrap cardboard, aluminum foil, a piece of glass and some black paint. After building one from plans, some people decide to design their own. Many of the most successful designs started in just this way.

If you are more serious about cooking than building, then ready-made solar cookers are available, many of which can match conventional ovens in performance.

Understanding the Reading Passage

1. In your own words, describe the basic idea of how a solar cooker works.

   _____

   _____

   _____

2. If you wanted to bake a pot of beans that needed to be cooked at a low heat for a long time, what is the best type of solar cooker to use? Why? _____

   _____

3. What kinds of food or dishes would you bake in each of the solar cookers described in the Reading Passage? Explain why you think the cooker would cook your selected dish well.

   Box cooker: _____

   _____

   Parabolic cooker: _____

   _____

   Concentrator cooker: _____

   _____

Vocabulary

Based on the Reading Passage, write down your understanding of these words or word pairs and verify your definitions in a dictionary, on the Internet if available or with your teacher:

absorb _____

altitude _____

conventional _____

insulated _____

latitude _____

parabolic _____

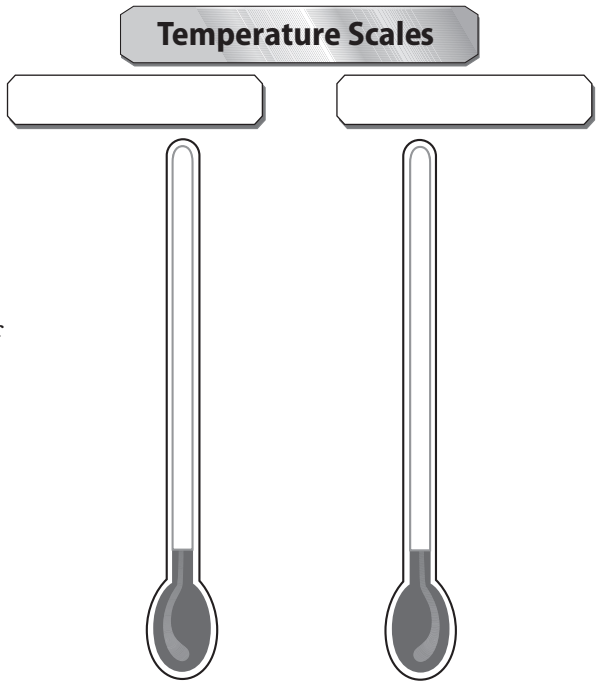
reflector _____

square meter _____

transparent _____

Worksheet: Understanding the Relationship between Degrees Fahrenheit and Degrees Celsius

EXERCISES



1. Label the two thermometers. One will be a Fahrenheit thermometer and one will a Celsius thermometer.

2. On your thermometer drawings, indicate the freezing points.

3. On your thermometer drawings, indicate the boiling points of water.

4. How many lines are there on your Fahrenheit thermometer drawing between the freezing and boiling points? _____

5. How many lines are there on your Celsius thermometer drawing between the freezing and boiling points? _____

6. What is the ratio of Fahrenheit lines to Celsius lines? _____

7. Simplify this ratio: _____

8. Extend the Fahrenheit thermometer drawing so that 0° F appears. _____

9. How many lines are there of this "extra piece" on the bottom of the Fahrenheit thermometer? _____

10. Based on the ratio of Fahrenheit to Celsius lines (question #6) and the lines of the "extra piece" on the Fahrenheit thermometer (question #8), what is the equation for converting Fahrenheit degrees to Celsius degrees? _____

11. Based on this equation, convert 30 °C to °F _____

12. What is the equation for converting Celsius degrees to Fahrenheit degrees? _____

13. Based on this equation, convert 60 °F to °C _____

Lab Activity: Constructing and Testing Solar Cookers

Introduction

The purpose of this activity is to gain an understanding that solar cookers come in different designs and are simple to build. You will build 3 simple solar cookers and test their heating abilities.

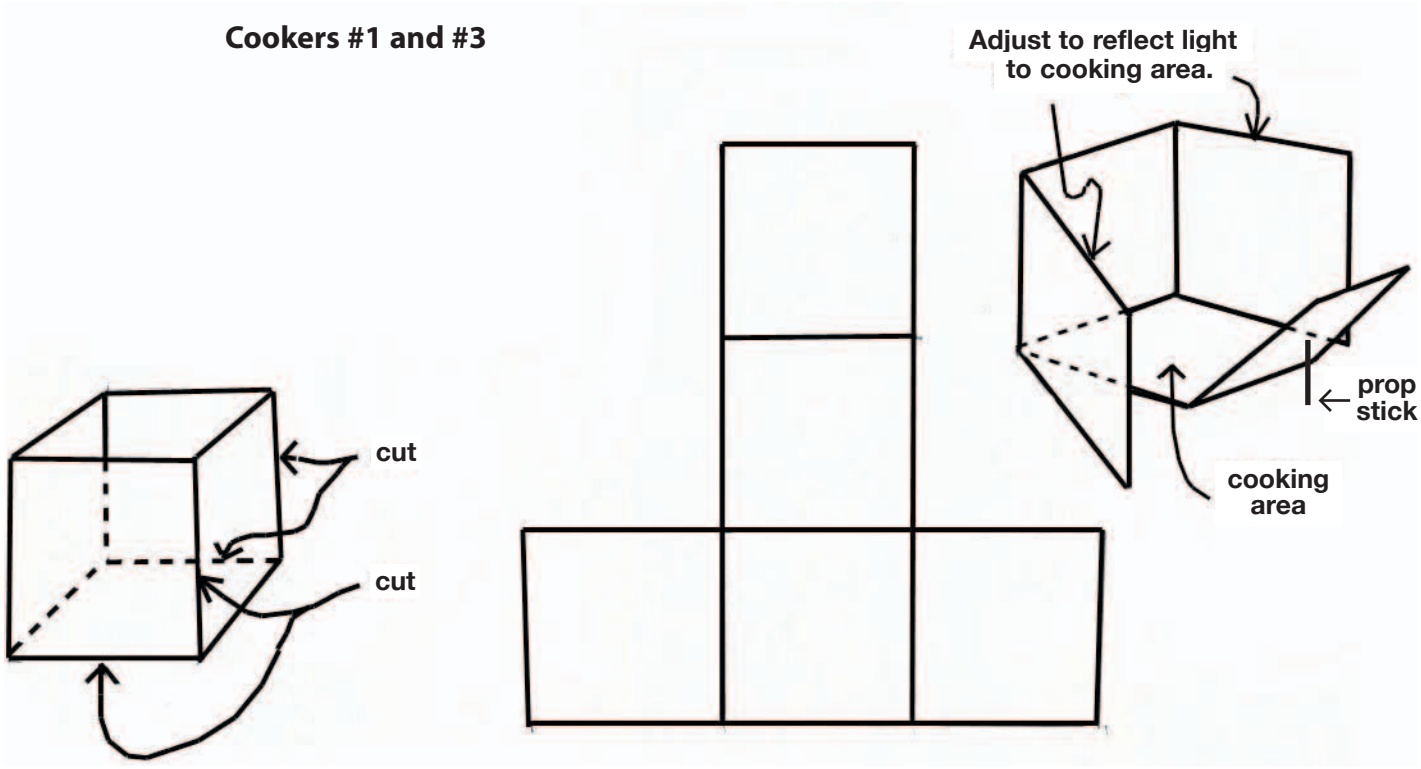
Before You Start

Review the vocabulary words from the Reading Passage. Ask your teacher if you are unsure of any of the meanings. Divide up all the steps in the Lab Activity first, so that everyone has a clear job to do.

Materials

Obtain an equipment kit from your teacher. Check that it contains the following materials:

- 1 timer
- sunglasses per student
- Materials for Solar Cooker #1 (box panel cooker)
  - 1 cardboard box approximately 30 cm per side
  - cutting tool
  - rubber cement
  - aluminum foil
  - prop stick
- Materials for Solar Cooker #2 (simple cone cooker)
  - 1 90 x 90 cm poster board
  - aluminum foil
  - rubber cement
  - hole punch tool
  - 3 brass brads
  - 1 box 30 cm x 30 cm x 30 cm (i.e. copier paper box without lid)
- Materials for Solar Cooker #3 (modified box panel cooker)
  - 1 cardboard box approximately 30 cm per side
  - cutting tool
  - black paint
  - paint brush

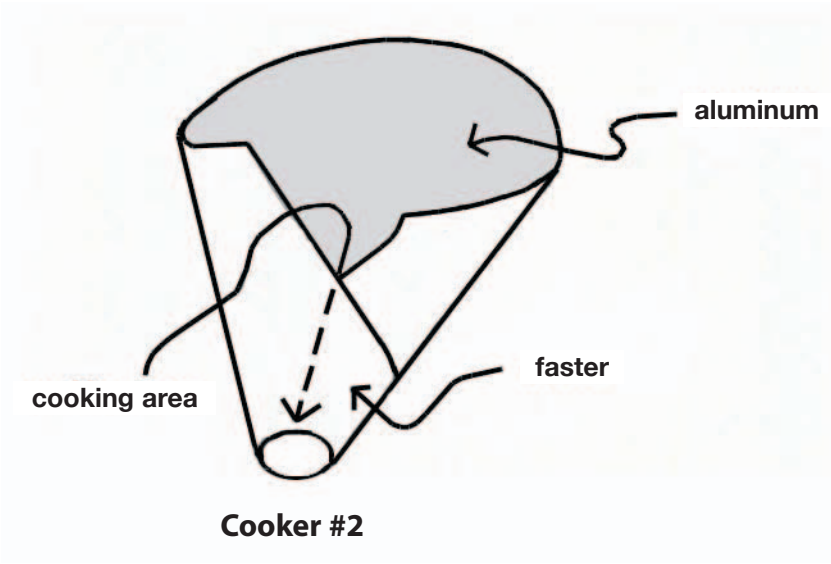


STUDENT DATA SHEET

Constructing the Solar Cookers

Cooker #1: Box Panel Cooker

1. Cut off the top flaps of the box so the box is now cover-less.
2. Cut along 2 consecutive corners of the box on each opposite side.
3. Open up the box to lay flat on the floor or a table.
4. Measure a piece of aluminum foil to cover the inside surface of the box and glue it down.
5. Adjust the side sections of the box to reflect light on the cooking area.
6. Prop up the front flap with the stick to direct light on the cooking area.



Cooker #2

Cooker #2: Simple Cone Cooker

1. Glue aluminum foil to the 90 cm x 90 cm poster board.
2. Roll the poster board into a cone, as shown, without damaging the aluminum foil.
3. Punch holes through the poster board and fasten with brads. The holes should be punched so that the overlapping parts of the poster board can be secured together by the brads. This should prevent the poster board from opening, and keep it in a cone shape.
4. Place weights in the box so it will not move in the wind.
5. Place the solar cooker in the box, narrow side down.

Cooker #3

Follow the directions for Cooker #1, The Box Panel Cooker, but instead of using aluminum foil, paint the inside of the box black (the 4 side panels and the bottom of the box).

Testing the Solar Cookers

Note: Your teacher may instruct you to build one cooker or all 3 cookers. Follow the directions below based on the number of cookers you were instructed to build.

1. As the teacher directs, gather your cooker(s), sunglasses and timer and proceed to the outdoor cooking site.
2. Position your cooker(s) for maximum sunlight outdoors. Face the opening of the cooker directly at the sun.
3. Wait for your teacher to pour 200 ml of water into a 250 ml beaker and provide you with a thermometer for each beaker used.
4. Take an initial temperature reading of your water. Record the temperature on your Lab Report Form.
5. Carefully place the beaker with water in the cooking chamber of your solar cooker(s).
6. Start the timer and record the temperature of the water every 2 minutes for 14 minutes and record the readings on your Lab Report Form.
7. Collect the materials as the teacher directs and return to the classroom.
8. Complete the answers to the questions on your Lab Report Form.
9. Based on the temperature readings you measured, develop a graph showing the change in temperature over time for each cooker you built.
10. Share results with the class to determine which cookers generated the highest temperature.

Lab Report Form: Constructing and Testing Solar Cookers

Date _____

Purpose of this lab is to _____

_____

Instructions

Follow the instructions listed in the Lab Activity and record your measurements in the Data Table below. Once you have completed all the measurements and calculations, answer the questions at the end of this form.

DATA TABLE. Temperature Readings of Water Placed in Solar Cookers

Time (minutes)	Cooker #1 Temperature	Cooker #2 Temperature	Cooker #3 Temperature
00:00 (initial)			
00:02			
00:04			
00:06			
00:08			
00:10			
00:12			
00:14			
Total Temperature Change			

DATA SUMMARY

1. Which solar cooker achieved the highest water temperature? Why? _____

   _____

   _____

2. In which solar cooker did the water temperature start to change the fastest? Why? _____

   _____

   _____

3. Did one cooker maintain a constant temperature for a long time? Which one and why? _____

   _____

   _____

4. What did you learn about solar cookers after completing this activity? _____

   _____

   _____

   _____

STUDENT DATA SHEET

Assessment Questions

1. In what circumstances would you use a solar cooker?

_____

_____

_____

_____

2. What local conditions might affect how well a solar cooker works?

_____

_____

_____

Multiple Choice Questions

1. Solar cookers:
   a) are easy to build
   b) can be used on picnics
   c) are used in some parts of the world daily
   d) all answers a, b, and c

2. Types of solar cookers include:
   a) box cookers
   b) cone cookers
   c) parabolic cookers
   d) all answers a, b, and c

3. Solar cookers require:
   a) reflective material
   b) dark glass covers
   c) firewood
   d) constant monitoring

4. You would be:
   a) disinterested in trying solar cooking
   b) interested in seeing a variety of solar cookers
   c) willing to try solar cooking
   d) b and c

5. Foods you would like to try in a solar cooker include:
   a) cake
   b) rice
   c) spaghetti sauce
   d) all answers a, b, and c

6. One of the precautions to take with solar cooking is:
   a) shade the cooker
   b) wear sunglasses
   c) never cook vegetables
   d) not to burn food

7. Solar box cooker temperatures tend to reach:
   a) 50°F
   b) 50°C
   c) 200 – 250°F
   d) 72°F

8. Solar energy:
   a) is non polluting
   b) is free
   c) conserves other forms of energy
   d) all answers a, b, and c

9. Ten degrees Centigrade is about:
   a) 2°F
   b) 50°F
   c) 196°F
   d) 150°F

TEACHER ANSWER KEY

Understanding the Reading Passage

1. A solar cooker concentrates sunlight into a cooking area where a dark colored pot holding food is placed. The cooker can contain an insulating material to prevent heat from escaping.
2. A box cooker, because although it cooks and heats food well, it doesn't reach the high temperatures as quickly as the other types do and won't let food burn if it's left to cook for a long time.
3. Accept students' answers provided they support their selections with explanations.
   Box cooker: can cook food slowly over time – beans, casseroles, stews, crock-pot dish
   Parabolic cooker: focuses sunlight/heat along a line through a certain point – hot dogs, s'mores
   Concentrator cooker: focuses sunlight/heat in a particular area and can reach high heat quickly – baked goods like brownies, cookies, bread, anything cooked in a conventional over

Lab Activity Data Summary

Accept students' answers based on their results. The actual results will depend on several factors including the construction of the cookers, the time of day the activity is conducted and the sunlight conditions.

Assessment Answers

1. use a solar cooker for picnics, camping, boating, backyard events, or use for all day cooking for regular meals, similar to a crock-pot
2. Geographical conditions that might affect the efficiency of a solar cooker include altitude (higher altitudes should be better), latitude, seasonal rainfall and air pollution.

Multiple Choice Question Answers

1 d; 2 d; 3 a; 4 d (best answer);
5 d (best answer); 6 b; 7 c; 8 d; 9 b

Vocabulary Definitions

absorb – to take in and engulf wholly

altitude – height above sea-level (the surface of the sea) of any point on Earth's surface or in atmosphere

conventional – to be in line with the accepted standard

insulated – material that blocks the flow of heat either into or out of a room or container; in hot weather it prevents heat from entering a home; in cold weather it prevents heat from leaving a home; in a solar cooker, it would keep heat from leaving the space around the cooking container

latitude – the location north or south in reference to the equator, which is designated at zero degrees; parallel lines that circle the globe both north and south of the equator (the poles are at 90 degrees North and South latitude).

parabolic – having the shape of a parabola which is a type of curve, any point of which is equally distant from a fixed point, called the focus, and a fixed straight line

reflector – a shiny material that concentrates or focuses the sun's rays

square meter – the area of space occupied by a length of 1 meter by a width of 1 meter (1 meter = 3.3 feet)

transparent– a clear material that allows sunlight to pass through, but traps the heat inside, such as glass or plastic

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