

What's Cooking?

Student Objectives

The student:

- can explain how the Sun's radiation, as heat, can be captured and used
- given a solar oven, can explain what makes it work and how to improve on the design
- can explain how solar cookers can benefit people in other countries and cultures as well as be useful to us.

Materials (construction):

- Use materials list for type of cooker selected
- Science Journal

Materials (cooking):

- oven thermometer, or thermometer that has a range to at least 300°F or infrared 'gun type' thermometer
- pot holders
- disposable aluminum cooking pans ("brownie" size works well), black pots with lids, oven roasting bags, plastic wrap or clear glass covered casseroles
- WAPI (Water Pasteurization Indicator)

Key Words:

conduction
convection
glazing
insulation
radiation
reflector
solar collector
solar thermal
transmission

Time:

1 – 2 class periods to build cookers
1 class for cooking

Background Information

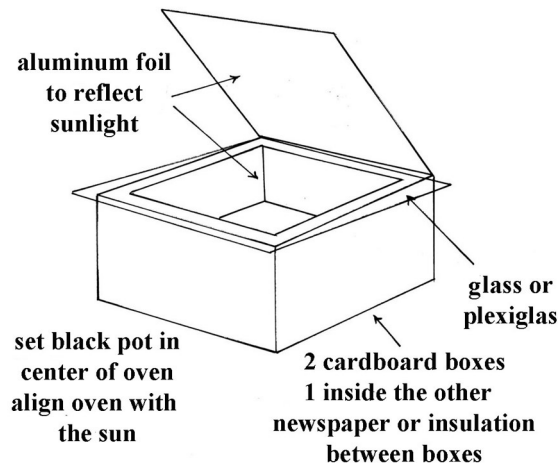
A solar cooker is a type of solar thermal collector. It "gathers" and traps the Sun's thermal (heat) energy. Heat is produced when high frequency light (visible and ultraviolet) is converted into low frequency infrared radiation. Ultraviolet and visible light easily pass through glass, however when they strike a darkened surface they are converted into long wave infrared radiation (heat). The glass (called glazing on a solar collector) traps these long waves. For example, on a sunny day, your car with the windows rolled up becomes a solar collector. The glass lets in the Sun's energy, traps the thermal energy, and the air inside your car becomes hot. As more light enters the car, the air gets even hotter, until we say that it feels like an oven inside!

Solar cookers are improving the quality of life for many people around the world. Solar ovens have been introduced in parts of South America, Africa, and India. In these areas, it is typical for a woman to spend nearly half her workday looking for and collecting firewood. Also, respiratory problems in the children of these areas have been linked to fumes created by the burning of poor quality wood. The use of solar cookers helps to reduce the dependency on firewood. In addition, some women have turned their talents for building cookers into businesses, by building and selling cookers for added income.

Besides cooking, solar ovens can be used to purify water. This is beneficial for areas where obtaining safe drinking water is a problem.

There are three basic types of solar cookers on the market today: box, parabolic reflector and panel cookers.

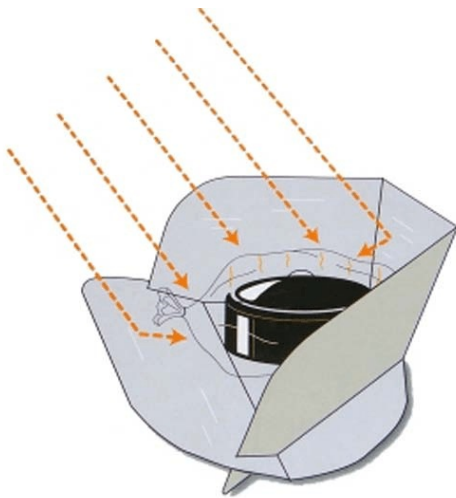
Box cookers



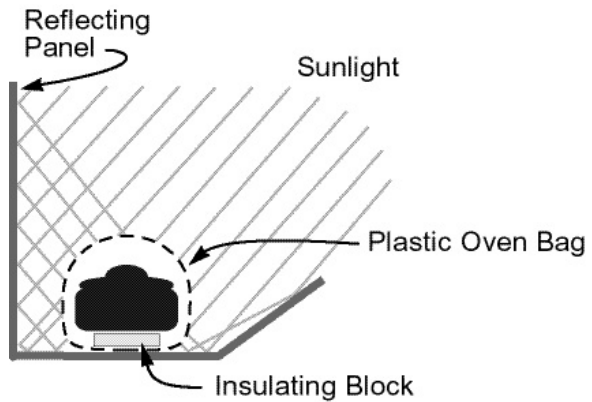
Box cookers (also known as box ovens) can cook the same foods you would cook in a standard oven or a slow cooker. As the name suggests, they have an interior chamber (“box”), although it does not have to be square shaped. They use reflectors to concentrate more sunlight into the box, glazing to allow sunlight into the box and then trap the heat, and insulation to retain as much heat as possible. Commercially made box ovens can reach 400° on a clear sunny day. Box ovens can be easily made from inexpensive or recycled materials, and are suitable for classroom construction and cooking.

Panel cooker

Panel cookers can cook the same foods that you would cook in a covered pot on top of the stove. They use reflectors to “gather” a larger area of sunlight and direct it towards a black cooking pot that is placed in a high temperature oven bag. The air inside the bag that surrounds the pot is the insulation that retains the heat. The temperature inside the pot of a panel cooker can reach and maintain boiling. Panel cookers can be easily made in the classroom from inexpensive materials, and are simple to use for cooking on clear sunny days.

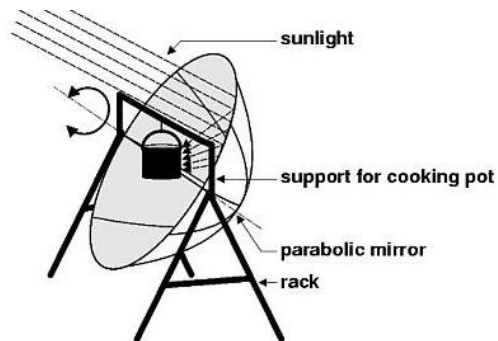


Panel Cooker



Parabolic reflector

Parabolic cookers produce the highest temperatures, and can be used to fry or grill food; pot lids and cooking bags are not necessary. Parabolic cookers use reflectors to concentrate a large amount of sunlight into a single focal point, where the temperature can reach 500°. In the classroom, parabolic shaped cookers can be easily made from recycled satellite dishes or large umbrellas. However, the temperature can get very high at the focal point. Appropriate safety should be practiced while cooking.



Procedure (prior to class)

Note: You may decide to have all the students make the same type of cooker (either individually or in groups), or you could have different groups make different types of cookers (and test them against each other). Three cooker plans are included in this lesson, and many more may be found on the internet.

It would be helpful to construct one cooker of each type that is to be made by the students so that it can serve as a model for the class to look at during the construction process. If this is not possible, gather some photos from online sources to have available for the students.

Procedure (during class time)

1. Ask the students when it would be beneficial to use a solar cooker instead of a conventional electric or gas range/oven. (*after a hurricane or during a power outage,*

during the summer when you don't want to heat up the house, when you want to conserve electricity, camping/recreational use, and just for fun!)

2. Tell the students that in other parts of the world, solar cookers are used more than they are here in the United States. Ask them why they think that is so. After they have given some suggestions, show them a few videos from the Internet Sites section. Lead a discussion about the benefits of solar cooking. Points to include are:
 - Solar cooking doesn't need any other 'fuel' except sunlight to work, so there isn't any resource depletion.
 - Solar cooking does not emit any smoke or fumes that can be hazardous to health.
 - Solar cooking takes less time than gathering wood, peat, dung or other traditional fuels.
 - Solar cooking can help keep family members safe in areas where collecting firewood or fuel can be dangerous.
 - Solar cooked food is healthier.
 - Solar cookers can be used to pasteurize water.
3. Show (and pass around) a WAPI (Water Pasteurization Indicator). Have the students tell you what they learned about water purification during *Rain Machine - Solar Still*. Explain how the WAPI works with a solar cooker.
 - Suspend the WAPI in the water to be pasteurized with the wax at the top of the cylinder.
 - You can then leave it unattended (you don't need to watch for it to boil).
 - When the wax melts and drops to the bottom of the cylinder, you know that the water got hot enough to pasteurize it and make it safe to drink.
 - The WAPI can be used again and again by just turning it over before inserting it in the water.
4. Tell the students that they will be constructing and testing solar cookers.
5. Explain the construction procedure for the cooker, and show an example or a photo.
6. Explain the common problems to avoid that would make the cooker not work properly.
7. Break the students into groups (and assign cooker design).
8. Pass out plans.
9. Help as needed during construction.
10. Students should complete their Science Journal pages.

Key Words & Definitions

- **conduction** – the movement of heat or cold through materials that are solid
- **convection** – the movement of heat through air or in liquids
- **glazing** – the clear material (i.e. glass or plastic wrap) that lets in light and traps heat
- **insulation** – material used to reduce heat loss or gain
- **radiation** – the way we receive heat from the Sun each day. The energy is emitted in the form of waves/particles, and can move from one object to another without heating the area in between.
- **reflector** – shiny device used to alter the path of light
- **solar collector** – a device that collects and traps solar energy

- **solar thermal** – using the Sun’s energy to heat something

Related Research

1. Research food preparation in other times and in other places. Was the Sun used in food preparation and food storage? How? Where? When? To these people, what were the advantages and disadvantages of using the Sun for cooking?
2. Biomass (fuel wood) is the world’s largest source of cooking fuel. What are some of the social, economic and environmental impacts of the widespread use of wood for cooking?
3. Research the Integrated (solar) Cooking Method. What is it? What devices does it use? In what areas of the world is it being promoted? Why?
4. Diocles was a Greek mathematician from 200 BC. What mathematical property did he prove that is relevant to us today?

Related Reading

- ***Catch the Wind, Harness the Sun: 22 Super-Charged Projects for Kids*** by Michael Caduto (Storey Publishing, 2011)
Twenty-two projects plus stories, background information, cartoons and photos covering solar thermal, photovoltaics, solar cooking, climate change, energy production and energy conservation.
- ***Cooking With Sunshine: The Complete Guide to Solar Cuisine with 150 Easy Sun-Cooked Recipes*** by Lorraine Anderson & Rick Palkovic (De Capo Press, 2006)
This book describes how to build your own inexpensive solar cooker, explains how solar cooking works and its benefits over traditional methods and then includes more than 100 recipes that emphasize healthy ingredients.
- ***Solar Energy Projects for the Evil Genius*** by Gavin Harper (McGraw-Hill, 2007)
This book includes more than 50 solar energy projects with plans, diagrams and schematics. Included are five solar cooking projects, along with solar stills, a solar powered ice-maker and solar electricity projects.

Internet Sites

<http://solarcooking.org/>

Solar Cooking International Network, solar cooking archive includes solar cooking articles and worldwide news.

http://solarcooking.wikia.com/wiki/Category:Solar_cooker_plans

Compendium of solar cooking plans and cooking advice.

<http://www.webquest.hawaii.edu/kahihi/puzzles/energytransfer/energy2.php>

Math & Science Webquests, Conduction, Convection and Radiation Puzzle. Students match conduction, convection and radiation with their definitions and an example.

Internet Video Sites

<https://www.youtube.com/watch?v=iCtg9hWXnPk>

German Public Broadcasting Network produced video on deforestation in Madagascar,

and how solar cooking can help solve the problem.

<http://www.youtube.com/watch?v=17-1uuvknF0>

Kyoto Box Cooker - International impact of solar cooking.

<https://www.youtube.com/watch?v=Ofn7jqPDTeY>

National Geographic produced video on solar cooking.

<http://www.youtube.com/watch?v=i1uN48oUpoo>

The Smokeless Village - tv news report from India with topics including air pollution, solar iron, and economics. This video features the parabolic cooker design.

<https://www.youtube.com/watch?v=Dn2v6fJT12s>

Solar Cooking Stops Rape in Africa - topics include refugee situation in Darfur and empowerment of women. This video features the cook-it design cooker.

<http://www.youtube.com/watch?v=edg8KPb6SS4>

Somalia's Solar Cooking Village - topics include deforestation and economic benefits of solar cooking. The video features the butterfly design (panel) cooker.

https://www.youtube.com/watch?v=C_yhZsGPj0o

Thirsty Planet video on how solar cookers can help with the potable water problem in West Africa.

Classroom Resources

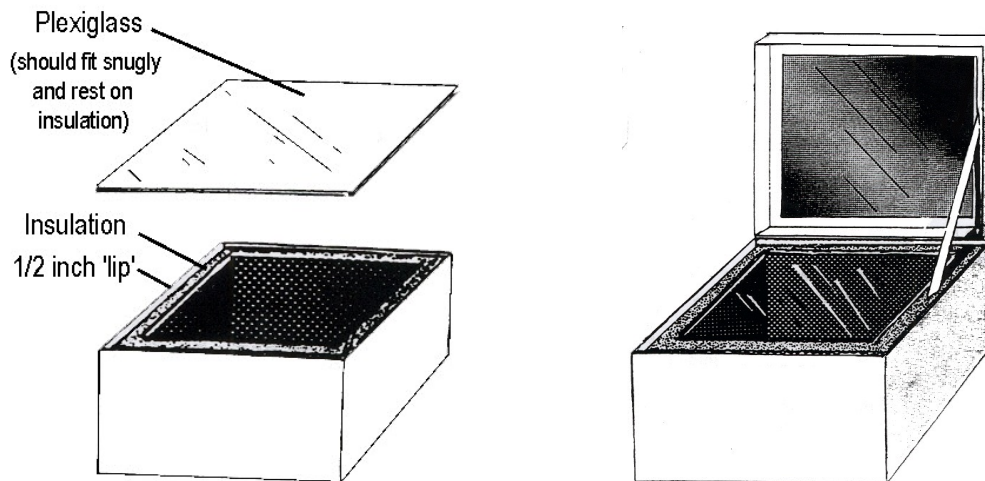
The WAPI (Water Pasteurization Indicator) can be purchased from Amazon or SunFlair

<https://sunflair.net/>

File Box Cooker

Materials

- file storage box, or other box 12" x 15" x 10"
- foil backed foam insulation board, approx. ½ sheet per oven
- plexiglass, pre-cut to 12" x 15"
- aluminum duct tape, 20 feet
- black construction paper, 12" x 15"
- aluminum foil or pieces of reflective mylar (emergency camping blanket), 18" x 21"
- scissors
- wooden dowel, stick or pencil



Procedure

1. Cut insulation material. Each oven requires:
 - (1) 12" x 15"
 - (2) 12" x 9 ½ "
 - (2) 15" x 9 ½ "
2. Put 12" x 15" piece of insulation inside the box on the bottom.
3. Put insulation around all the walls of the inside of the box.
4. Tape all seams: bottom, sides, and around the inside top of the box with aluminum tape.
5. Cover the inside of the box lid with foil for a reflector.
6. Cover the inside bottom of the oven with black construction paper.
7. Place the glazing (plexiglass) on the top of the oven. The glazing should sit firmly and the box should be airtight. If not, adjust the sides.

8. Attach the box lid by one long edge to the oven with an aluminum tape “hinge”. The rod or stick is used to adjust the tilt of this lid to capture more sunlight.

The common problems to avoid that can cause a box cooker to not work properly:

- All seams are not sealed tightly with aluminum tape. Make sure that all the seams are covered, both inside and around the inside top opening of the of the oven. The box lid is used as a reflector, so the tape is not critical there.
- The plexiglass glazing does not sit tightly on the top of the oven. Make sure that the top edges of the insulation are level and flat. Low spots may be filled in with extra pieces of aluminum tape.
- Sides of boxes are squeezed in while being taped, thereby making the top opening too small for the plexiglass to fit.

How to cook in your box cooker

1. Set the oven facing the Sun.
 2. Adjust the tilt of the oven (objects can be placed under one edge), and the tilt of the reflector (with a rod or stick) so that the Sun’s rays are directed into the body of the oven. Sunlight should be visible on the food in the box.
 3. Mix or prepare the food to be put in the cooker according to the recipe.
 4. Put the food in a covered dish, or cover tightly with plastic wrap. Do not cover your food with aluminum foil—it will reflect the sunlight away from your food. You can cook in any non-reflective pot, however thin black metal pots work best, and shallow ones work better than deeper ones.
 5. Lift glazing, set the dish and an oven thermometer on the bottom of the oven, and replace the glazing (you may tape around the edges of the glazing to make the box airtight).
 6. Move the cooker periodically (every 20 minutes or so) to follow the Sun as it moves across the sky.
 7. When food is done, be sure to use a pot holder to remove the glazing and also the food.
- Solar Cookers can get extremely hot!**

Cook-it Style Panel Cooker

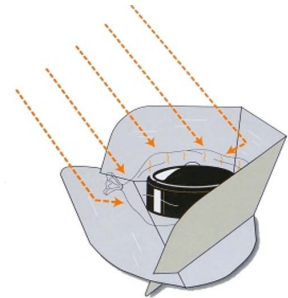
Materials

- Cook-it measurement sheet (next page)
- sheet of cardboard 48" x 36"
- mylar (from emergency "space" blanket)
- spray glue or white glue
- box cutter, scissors
- tape measure, ruler
- protractor

Procedure

Note: To make it easier for younger students, you may wish to make a full-sized pattern on craft paper for the students to trace onto the cardboard.

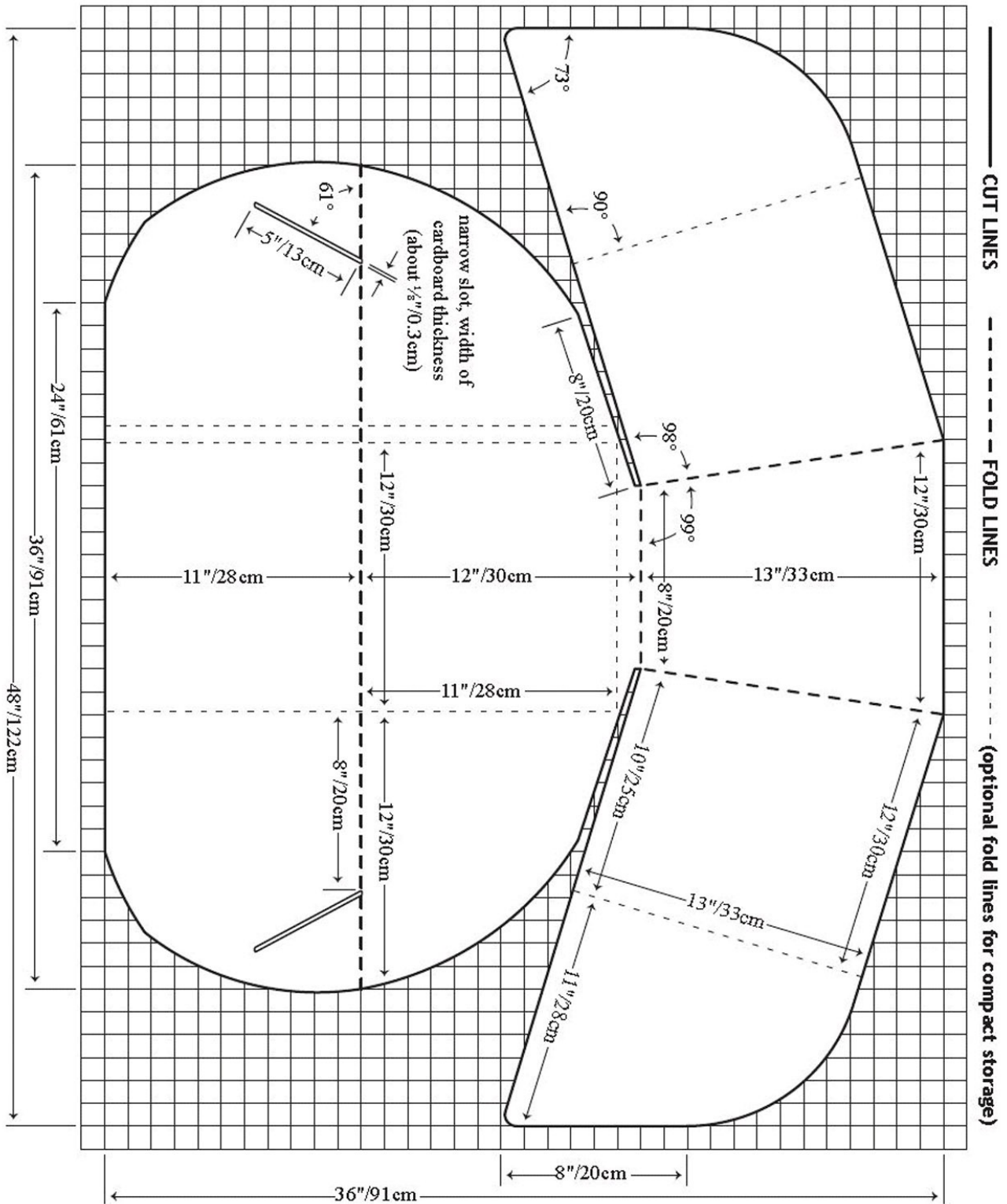
1. Using the measurement sheet, draw the cooker lines and fold lines onto the sheet of cardboard.
2. Cut out the cooker along the cutting lines. Fold the cardboard along the fold lines (Hint: It is easier to get a straight fold line if you firmly hold a yard stick or other straight edge along the fold line and then fold the other side up against the straight edge).
3. Affix the mylar to the side of the cooker that is on the inside of your folds. If using spray glue, spray the glue onto the cardboard and then place the mylar on top pressing out as many bubbles and creases as possible. A rubber roller or a plastic card (credit card, driver's license, etc.) can be helpful. If you are using white glue, thin the glue until it spreads easily with a paint brush.
4. Trim the mylar around the edges of the cooker.
5. Cut the two slits.



How to cook using your panel cooker

1. Set up the cooker and place it facing the Sun.
2. Mix or prepare the food to be put in the cooker according to the recipe.
3. Put the food in a covered black pot and put the whole dish in a high temperature baking bag. Seal tightly. Do not cover your food/pot with aluminum foil. It will reflect the sunlight away from your food.
4. If you do not have a black pot, you can paint the outside of a pot or canning jar black with paint designed for barbecue grills.
5. Place the pot in the center of the cooker. Move the cooker periodically (every 20 minutes or so) to follow the Sun as it moves across the sky.
6. When food is done, be sure to use a pot holder to remove the pot. **Solar Cookers can get extremely hot!**

Cook-it Measurements



Umbrella Parabolic Cooker

Materials

- large umbrella (minimum 120 cm diameter)
- mylar (from emergency “space” blanket)
- aluminum duct tape
- craft paper
- spray glue or white glue
- scissors
- hacksaw
- holder for pot (metal plant stand, small tripod, etc.)

Procedure

1. Open umbrella. Using the craft paper make a template of one of the triangular sections of the inside of the umbrella.
2. Using the template you made, trace enough sections onto the mylar to cover the inside of your umbrella. Cut out the sections.
3. Working outdoors or in a very well ventilated area, affix one section at a time to the inside of the umbrella with the spray glue (spraying the umbrella and then placing the mylar pieces). Press out as many bubbles and creases as possible. A rubber roller or a plastic card (credit card, driver’s license, etc.) can be helpful. If you are using white glue, thin the glue until it spreads easily with a paint brush.
4. Tape around the outside edges with aluminum tape.
5. Tape any loose or uncovered seams between sections with aluminum tape.
6. To trim the stick and handle at the focal point for the pot stand, take the umbrella outside on a sunny day. Place the umbrella on the ground and point the stick directly at the Sun. Mark the spot on the handle where the reflection of the Sun’s rays is the greatest.
7. Cut the stick 3" below your mark (shorter). This will enable you to place your pot in the focal point of the umbrella.
8. When cooking, your cooker will sit on the ground facing the Sun. You may need to place something behind your cooker to keep it pointed towards the Sun.
9. You want the bottom of your pot to be positioned in the focal point (3" above the top of your stick), so the plant stand or tripod will need to sit on top of part of the cooker. Make small cuts with scissors so the legs can go through the cooker and sit firmly on the ground below.

How to cook using your parabolic cooker

1. Mix or prepare the food to be put in the cooker according to the recipe.
2. Position the cooker so the face of the umbrella is pointing directly at the Sun. Position your pot stand so the pot will be in the focal point. **Remember, whatever is in the focal**

point of your cooker will get extremely hot! It is also recommended that you wear sunglasses while working with a parabolic cooker.

3. Place your food in your cooking pot or pan; open frying pans may be used with parabolic cookers.
4. Place the cooking pan on the pot holder. Be sure to watch your food. It can burn with a parabolic cooker.
5. For extended cooking, move the cooker periodically (every 10 minutes or so) to follow the Sun as it moves across the sky.

What's Cooking?

Florida NGSS Standards & Related Subject Common Core

			.1	.2	.3	.4	.5	.6	.7	.8	.9	.10	.11	.12
Grade 6														
Practice of Science	# 1	SC.6.N.1				X								
Earth Systems & Patterns	# 7	SC.6.E.7	X											
Grade 7														
Forms of Energy	# 10	SC.7.P.10	X	X										
Energy Transfer & Transformations	# 11	SC.7.P.11	X	X		X								

Sixth Grade Benchmarks

Science–Big Idea 1: The Practice of Science

- SC.6.N.1.4 - Discuss, compare, and negotiate methods used, results obtained, and explanations among groups of students conducting the same investigation.

Science–Big Idea 7: Earth Systems and Patterns

- SC.6.E.7.1 - Differentiate among radiation, conduction, and convection, the three mechanisms by which heat is transferred through Earth's system.

Seventh Grade Benchmarks

Science–Big Idea 10: Forms of Energy

- SC.7.P.10.1 - Illustrate that the Sun's energy arrives as radiation with a wide range of wavelengths, including infrared, visible, and ultraviolet, and that white light is made up of a spectrum of many different colors.
- SC.7.P.10.2 - Observe and explain that light can be reflected, refracted, and/or absorbed.

Science–Big Idea 11: Energy Transfer and Transformations

- SC.7.P.11.1 - Recognize that adding heat to or removing heat from a system may result in a temperature change and possibly a change of state.
- SC.7.P.11.2 - Investigate and describe the transformation of energy from one form to another.
- SC.7.P.11.4 - Observe and describe that heat flows in predictable ways, moving from warmer objects to cooler ones until they reach the same temperature.

National Next Generation Science Standards - Sixth to Eighth Grade Standards

Science–Energy

- MS-PS3-3 - Apply scientific principles to design, construct, and test a device that either minimizes or maximizes thermal energy transfer.

Science–Engineering

- MS-ETS1-2 - Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem.

What's Cooking?

Cooking Tips - Box Ovens

- Any recipe that would be suitable for a conventional oven will work in a box oven; also crock pot recipes are suitable for a box cooker.
- Foods generally use less liquids or cook in their own juices. This produces better tasting and more nutritious food.
- Foods never burn and rarely overcook in a box cooker.
- When cooking foods containing liquids, use lids on pans, cover tightly with plastic wrap, or use cooking bags to avoid condensation on the oven glass which blocks the solar radiation.
- Don't open your box cooker unless absolutely necessary! Every time you do, you let out the heat and slow down the cooking process.
- Use a meat thermometer instead of a timer to determine if the food is done.
- A Lazy Susan underneath your box cooker can help you rotate it easily to follow the Sun. Remember to adjust your box cooker every 20 minutes or so.
- Foods particularly suited for the classroom include: hot dogs, slice and bake cookies, brownies, rice mixes, cocktail sausages in barbeque sauce, nachos, baked apples, and kebobs.
- Some specific food tips:
 - Cook (steam) yellow and green vegetable in dark colored casseroles to prevent discoloration.
 - Vegetables and meats can be cooked with no water or added liquid.
 - Reduce liquids in cake recipes by one half.
 - Cook foods in their natural state (i.e. potatoes in skins and corn in husks).
 - Sprinkle some cinnamon on the top of baked goods to darken the surface.
 - Doughs and batters containing eggs and milk will brown easier.
 - Chewy dessert recipes such as brownies come out better than crispy ones.
 - Meats cook better if cut into small pieces.
 - If the recipe calls for the addition of oil, try adding it last, floating it on the top. This decreases the amount of evaporation (thereby decreasing the amount of heat loss). Stir in the oil at the end.

Temperature variations:

- On a clear and sunny day, a box oven will heat to 250°F and above. On these days you can cook or bake anything.
- On a partially cloudy day, the oven will heat to 200°F to 250°F. On these days you can easily cook meats, rice, baked potatoes, and frozen vegetables, but baking is not recommended.
- On a partially cloudy day, adjust your cooking time to account for the lower temperature. A rule of thumb is to figure twice the regular cooking time.

Cooking Tips - Panel Cookers

- Most recipes that can be cooked on top of the stove without frequent stirring will work with a panel cooker. Crock-pot recipes will also work well.
- Always use lids on pans and place the whole pan in a tightly closed high temperature oven bag. Thin, shallow, aluminum or steel pans will heat faster.
- Foods generally use less liquids or cook in their own juices. This produces better tasting and more nutritious food.
- Foods never burn and rarely overcook in a panel cooker.
- Use a meat thermometer instead of a timer to determine if the food is done.
- A Lazy Susan underneath your panel cooker can help you rotate it easily to follow the Sun. Remember to adjust your panel cooker every 20 minutes or so.
- Foods particularly suited for the classroom include: rice mixes, chili, chowder, stew, baked beans, and couscous.
- Some specific food tips:
 - Cook (steam) yellow and green vegetables in dark colored casseroles to prevent discoloration.
 - Vegetables and meats can be cooked with no water or added liquid.
 - Meats cook better if cut into small pieces.

Temperature variations:

- On a clear and sunny day a panel cooker will heat the contents to boiling for a sustained time. On these days you can cook anything.
- On a partially cloudy day, the panel cooker will heat the contents above pasteurization temperature (149°), and probably to boiling. On these days you can easily cook most things, but extra care should be taken with meats (check the temperature).
- On a partially cloudy day, adjust your cooking time to account for the lower temperature. A rule of thumb is to figure twice the regular cooking time.

Cooking Tips - Parabolic Cookers

- Most recipes that can be cooked on top of the stove, in a frying pan, or on a grill, can be cooked with a parabolic cooker. Foods will brown with a parabolic cooker.
- Always use heavy metal pans. Do not use high temperature baking bags. Lids on pots are not necessary, but may be desired for some recipes that need additional heat to melt something (i.e. grilled cheese sandwiches).
- Be mindful of observers that don't know the power of solar cooking. They can get burned easily just because they don't realize how hot the focal point of a parabola can get.
- Foods particularly suited for the classroom include: hot dogs, hamburgers, kebobs, bacon, grilled vegetables, and fried eggs.
- Some specific food tips:
 - Keep an eye on your food! Parabolic cookers can get very hot, and also tend to cook in only one area. You may need to turn or rotate your food. Cast iron cookware can help to spread out the heat.
 - Unlike other solar cookers, parabolic cookers can burn food. Conversely, if your food is not cooking you probably don't have your pan in the focal point.

Temperature variations:

- On a clear sunny day, a parabolic cooker can reach 500° at its focal point. On these days you can cook anything, and cook it quickly!
- On a partially cloudy day, a parabolic cooker's temperature will vary with the cloud cover. Cooking will take a little longer.
- On a very cloudy day, you may not get enough rays of sunlight to effectively reflect them into a focal point, making cooking difficult. To retain all available heat, try putting a lid on your pot or putting your food inside a high temperature baking bag that is then put in a pan.

What's Cooking?

The following recipes were student created and prepared for the Solar Energy Cook-Off as part of the annual Energy Whiz competition held at the Florida Solar Energy Center in May. More information about the event and many more award winning solar recipes can be found at:

<http://www.fsec.ucf.edu/go/solarcookoff>

Grandma's Italian Wedding Soup

Suitable for all cookers, and sunny or partly cloudy weather conditions

1st Place Elementary Division, 2012

2 cups chicken stock
6 frozen mini meatballs
½ cup orzo
Chopped fresh basil, oregano, parsley and garlic to taste
Salt and pepper to taste
20 baby spinach leaves

Mix chicken stock, meatballs, orzo, herbs and garlic together in a dutch oven or similar pot. Place pot in cooker. Simmer for 1½ hours. (In a parabolic cooker, stir frequently and cook for less time.) Meanwhile wash the spinach leaves thoroughly, pat dry, then shred into thin strips. Add spinach, salt and pepper, and simmer for another 20 minutes (less time for a parabolic).

Creamy Potato Soup

Suitable for all cookers, and sunny weather conditions

1st Place Middle Division, 2013

1 lb Yukon potatoes (smaller ones are best)
2 packages pre-cooked bacon, crumbled
1 Tablespoon butter
1 cup green onions, sliced
1 can (10½ oz) chicken broth
2 cups water
½ cup instant mashed potato granules
2 cups Gruyere cheese, finely grated
½ teaspoon salt
¼ teaspoon pepper
2 cups heavy cream

Bake potatoes in cooker until tender (Box cooker - place potatoes directly in cooker; Panel cooker - put in pot and high temperature bag; Parabolic - put in covered pot with 1/4" water).

Cut into small cubes and set aside. Melt butter, add onions and one package bacon crumbles. Place in cooker until onion is tender. Add chicken broth and water, bring to boil. Remove from cooker and gradually stir in instant potatoes, blending until smooth. Add salt, pepper, cheese and reserved baked potatoes; stir. Place back in cooker until cheese is melted. Stir in cream. Serve garnished with bacon crumbles.

All-American French Cassoulet

Suitable for box and panel cookers, and sunny weather conditions

1st Place Middle School Division, 2009

1 can (15 oz) great northern white beans, or cannellini beans
1 lb lamb, cut in 3/4" pieces
1 lb beef rib meat, cut off the bone, cut in 3/4" pieces
1 lb thick cut hickory smoked bacon
1 lb garlic & herb flavored sausage, cut in 1" pieces
1 bouquet garni with any of your favorite fresh herbs (team used fresh sage and thyme)
1 cup grape tomatoes, cut in half
1 cup carrots, cut small
4 - 5 cloves garlic, minced
1 can beef gravy
Finishing salt
10 - 12 homemade crostini for garnish
Sage leaves for garnish

Precook (or use parabolic): Pan sear all sides of the lamb and beef. Do not cook meat—meat will fully cook in the box or panel cooker to release flavor into the sauce.

Layer in a casserole dish—beans, garlic, bouquet garni, carrots and tomatoes. Then place all meats on top except the bacon. Place casserole in solar cooker. Cook in solar cooker for 3 hours. Cook bacon separately in solar cooker, then drain and chop. When serving, remove bouquet garni. Garnish each plate with finishing salt, then spoon cassoulet on top. Sprinkle with bacon and garnish with a crostini on the corner of each plate and a sage leaf on the side.

Baked Tilapia with Coconut-Cilantro Sauce

Suitable for box cookers, and sunny or partly cloudy weather conditions

1st Place High School Division, 2013

Canola oil spray
(4) 6 oz pieces tilapia filet
1/4 teaspoon kosher salt, plus more for seasoning
1/2 cup light reduced-fat coconut milk
1/2 cup cilantro leaves, plus more for garnish
1 teaspoon peeled, chopped fresh ginger
1/2 teaspoon garam masala
2 garlic cloves

½ jalapeno pepper, seeded and chopped

Spray a baking pan with oil spray. Place fish in pan and sprinkle with salt and pepper. Combine coconut milk and remaining ingredients in a blender and pulse until fairly smooth. Pour the coconut mixture over the fish. Bake until the fish is just opaque in the center, about 15 minutes. Garnish with more cilantro and serve. (Note: Garam masala is a popular spice from India. It is available at specialty stores and some grocery stores.)

Mahi Mahi Soft Tacos

Suitable for parabolic cookers, and sunny or lightly cloudy weather conditions

1st Place High School Division, 2012

4 mahi-mahi filets
2 Tablespoons butter, melted
1½ cups tomato, chopped
¼ cup red onion, finely chopped
1 jalapeno, finely chopped
3 cloves garlic, minced
Juice of ½ lime
½ head lettuce, chopped
8 flour tortillas

Grill fish on both sides, brushing with butter (approx. 20 minutes). Combine tomatoes, onion, jalapeno, garlic and lime. When fish is done in the center, flake with a fork. Set aside and keep warm. Lightly grill the tortillas in a cast iron skillet until they are warm and brown. Layer fish, lettuce, and pico de gallo on tortilla. Roll.

Lemon Cupcakes with Strawberries

Suitable for box cookers, and sunny weather conditions

1st Place Elementary Division, 2014

¼ cup softened butter
Heaping ¼ cup sugar
Rind of ¼ lemon, grated
1 egg
½ teaspoon vanilla extract
½ cup flour
½ Tablespoon milk
½ cup sliced strawberries
Whipped cream
Orange slices for garnish

Combine butter, sugar and lemon rind. Mix well with a wooden spoon until fluffy. Gradually beat in egg and vanilla. Mix in flour until combined. Add milk and mix well. Cupcake batter should have a smooth consistency. Cook for 40 – 45 minutes. Let cupcakes cool. Cut the

cupcakes in half (horizontally) and sandwich the strawberry slices with a dollop of whipped cream in between the cupcake layers. Top cupcake with whipped cream. Garnish plate with strawberry slices and orange slice. Enjoy!

Chocolate Bread Pudding

Suitable for box cookers, and sunny or lightly cloudy weather conditions

1st Place Middle School Division, 2013

4 large stale chocolate muffins, broken into small pieces

2 cups cream

4 eggs

2 Tablespoons butter

6 large strawberries, washed and dried

1 cup melting chocolate

Whipped cream

½ cup strawberry preserves

1 teaspoon honey

Set up oven and let it preheat. Meanwhile, slightly beat eggs and cream in a bowl. Blend in muffin pieces and allow to sit for 30 minutes (put in cooler). Butter pan or spray with cooking spray. Put muffin mixture in pan. Cover and bake until set in center (1 – 1½ hours depending on weather). Meanwhile, put chocolate in a small pan and put in oven, let chocolate melt. Dip strawberries into chocolate. Chill on waxed paper in cooler. Place strawberry preserves in another small pan, heat in oven until runny. Add water, stir; add honey, stir. To serve, put a swish of sauce on plate, top with a slice of bread pudding and garnish with chocolate covered strawberry.

What's Cooking?

1. In the space below, draw a diagram of your solar cooker and label its parts.

2. Explain the functions of each of the parts labeled above.

3. What was the highest temperature you observed in your cooker?

4. What are some advantages and disadvantages of using the Sun's energy for cooking?

5. What are some other applications for solar cookers in Florida?

6. Imagine you are in a contest to see who can design a box cooker that will get the hottest. You have several weeks to try out different materials and building techniques. What are some of the things that you would like to experiment with? Why?