Cooking Chemistry

Activity 1—Build Your Own Solar Oven

A solar oven is a box that traps some of the sun's energy to make the air inside the box hotter than the air outside. In other words, the solar oven is like super greenhouse!

Materials Needed:

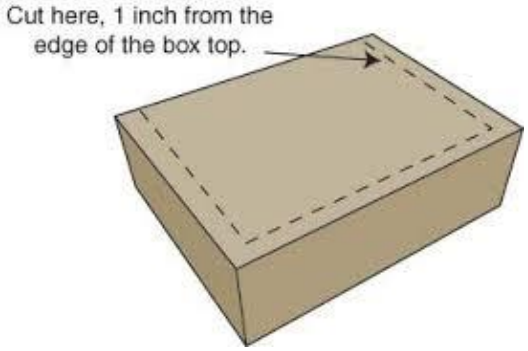
- A cardboard box with an attached lid. Lid should have flaps so that the box can be closed tightly. A clean pizza box will do. Box should be at least 3 inches deep and big enough to place a pie pan inside.
- Aluminum foil; foil sheets
- Clear plastic wrap
- Glue stick
- Tape (transparent, duct tape, masking tape, etc.)
- Wooden stick, about 12" long to prop open the box (skewer, chop stick, etc.)
- Ruler or metal straight edge
- Box cutter or X-acto knife (with adult supervision)
- Black construction paper to fit on the bottom (optional)

What To Do:

USE CAUTION:

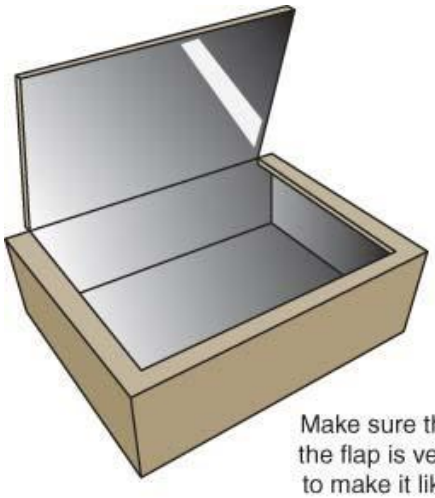
Have an adult help cut the box with box cutter or X-acto knife.

1. Using a ruler or straight edge as a guide, cut a three-sided flap out of the top of the box, leaving at least a 1-1.5 inch border around the 3 sides of the box.



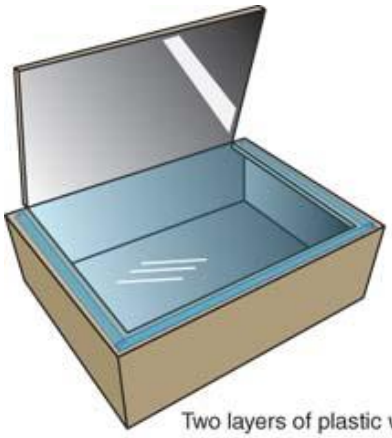
2. Cover the bottom (inside) of the flap with the foil, spreading a coat of glue/glue stick on to the cardboard first and making the foil as smooth as possible.

3. Line the inside of the box with the foil or sheets of foil, gluing it down and making it as smooth as possible.



Make sure the foil inside the flap is very smooth, to make it like a mirror.

4. Tape 2 layers of plastic wrap across the opening you cut in the lid- one layer on top and one layer on the bottom of the lid.



Two layers of plastic wrap over the opening will help keep heat in, while still letting all the light shine through.

5. Test the wooden stick to prop open the lid. You may have to tape the stick to make it stay put.

NOW Let's Start Cooking ….

Set the oven in direct sun with the flap propped up to reflect the light into the box. You'll probably have to tape to prop open. Preheat the oven for at least 30 minutes. Use the included thermometer to check the temperature. How hot is the oven getting? Write down the temperature inside the solar cooker when you first place your s'mores

in it. Then, check the temperature again when you notice the marshmallow and chocolate melting.

STEAM Connections

In this activity, *solar energy—electromagnetic rays* emitted by the sun—is used to cook the food. When sunlight, which is a form of *radiation*, hits *matter*, the *molecules* that make up the *matte*r start vibrating, which generates *heat*. You are manipulating the sun's rays through the design of your box so that the heat is trapped. The foil *reflects* the *light waves* from the sun into the closed box, causing the box's molecules to vibrate and heat up. The black paper *absorbs* the light, generating extra heat. The plastic covering the opening in the lid traps the heat, increasing the temperature inside the box. This type of oven uses a natural, clean form of energy to generate heat, while a traditional kitchen oven uses heating coils powered by gas or electricity.

Take it further: What happens if you modify the design of your solar cooker? Try to experiment with different design choices and build other versions! Supplies for multiple pizza box-stylre solar cookers are included in your kit. You can also decorate the outside of your oven to give it some style! What if you try a box with different dimensions? What if you use a different material to reflect light or create a smaller flap in the lid? Do different designs take a longer or shorter time to heat? Do they get hotter or not as hot?

Recipes to Try:

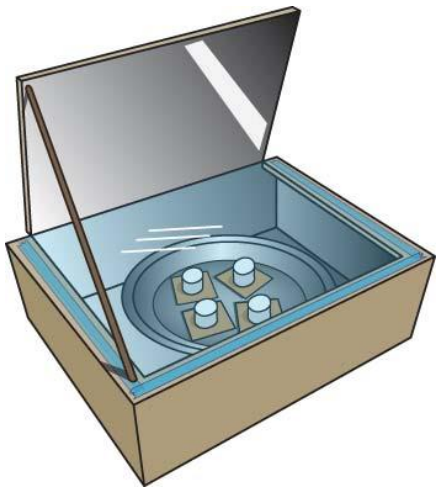
SUN S'MORES – you will need- (a few of the ingredients will be provided in the kit)
Ingredients:

- Graham crackers
- Large marshmallows
- Plain chocolate bars (thin)
- Aluminum pan

Instructions:

1. Break the Graham crackers in half to make squares. Place four squares in the aluminum pie pan. Place a marshmallow on each.
2. Place the pan in the preheated oven.

3. Close the oven lid (the part with the plastic wrap on it) tightly, and prop the flap to reflect the sunlight into the box.



4. Depending how hot the day is, and how directly the sunlight shines on the oven, the marshmallows will take 30-60 minutes to get soft and squishy.

5. Then, open the oven lid and place a piece of chocolate (about half the size the Graham cracker square on top of the chocolate and press down gently to squash the marshmallow.
   NOTE: For Solar S'Mores, place the marshmallow UNDER the chocolate which will melt faster than the marshmallow.

6. Close the lid of the solar oven and let the sun heat it up for a few more minutes more to melt the chocolate bar.

7. Enjoy!

The Sci Guys Science at Home: Pizza Box S'Mores
https://www.youtube.com/watch?v=pjsrRi2Bxl0

SOLAR NACHOS
Solar Nachos is a great treat to make in a solar oven because all you need is to melt the cheese.
Ingredients:

- 2 cups of tortilla chips
- ½ to 1 cup of cheddar or Mexi-blend cheese

Instructions:

1. Place the tortilla chips in an aluminum pie plate.
2. Sprinkle the cheese on top.
3. Place the pie pan up very close to the reflector lid.
4. Heat until the cheese is melted.
5. ENJOY!

Vocabulary Used in This Activity:

- absorb/absorption
- electromagnetic rays
- energy
- heat
- light waves
- matter
- molecules
- reflect/reflection
- solar radiation