Day 8 Light: Heat

Science

See if you can use light waves to generate heat and make your own solar oven! For this activity, you'll only need a few items: a box, a sheet of black paper, tin foil (reflective materials absorb more heat!), and plastic wrap. Use the attached handout to create your oven.

Additional resource:

Zoom: Cooking Cookies
http://ow.ly/Bg8E50AVr66

WQED education

Solar Oven S'mores

Can you cook a s'more without a fire or electricity?

@home

BEST FOR GRADES
3-6

ESTIMATED TIME
45-60 Minutes

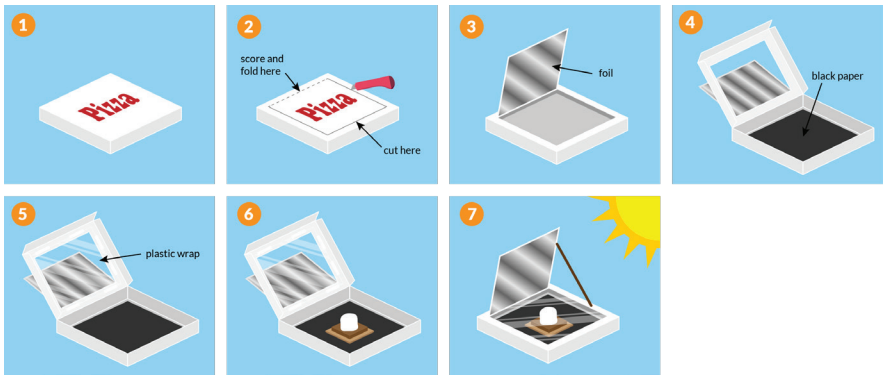
You Will Need

- ❑ Pizza Box
- ❑ Aluminum Foil
- ❑ Black Paper
- ❑ Clear Plastic Wrap
- ❑ Two Wooden Skewers
- ❑ Glue
- ❑ Tape
- ❑ Exacto knife or scissors (both require adult supervision)
- ❑ Graham Crackers *
- ❑ Marshmallows *
- ❑ Chocolate *
- ❑ A Sunny Day!

*Note: This experiment can be done with other types of food - try making nachos with tortilla chips and shredded cheese, or english muffin pizzas. If experimenting with a group of children, ask parents about any potential food allergies when choosing foods.

Directions

1. Ask student to create a testable question (a hypothesis). Example: Will it take longer than 10 minutes to cook the s'mores?
2. Cut a three sided flap on the top of the pizza box (1-2" from all sides)
3. Spread glue on the inside of the flap and cover with aluminum foil
4. Lay black paper on the bottom of the box
5. Tape layers of clear plastic across the opening that you cut in the lid.
6. Place a graham cracker, chocolate bar, and marshmallow inside the oven and close the lid with the flap propped open with wooden skewers
7. Aim your oven at the sun and check in every few minutes to check progress. Is the chocolate melting?



Discovery Questions

Beginning the Experiment

Where does most of the energy on our planet come from?

What is the purpose of the aluminum foil?

Why did we use black paper and not a different color?

Why do we need the plastic wrap?

During the Experiment

How does the angle of the "flap" of the solar cooker affect the cooker temperature?

How can you make it cook faster?

Do you think it would take the same amount of time to melt four s'mores as it does to melt one?

Is the evidence and data you are collecting helping you test your hypothesis question?

After the Experiment

What provided the heat to melt the s'mores?

How do you think it would work on an overcast day?

Which factors impacted the solar oven the most?

If you could start over, what might you do differently?

Science-U @ Home is brought to you by a grant from EQT

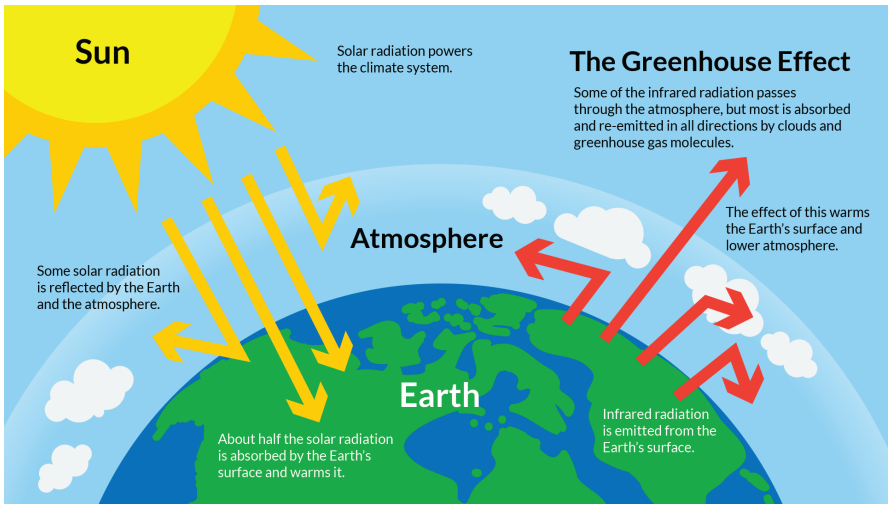
PennState

Solar Oven S'mores

The science powering the solar oven.

How does it work?

Solar ovens use solar energy—light and heat from the sun—to cook food. The oven is designed to absorb more heat than it releases. Rays of sunlight come to the earth at an angle. The foil reflects the ray, and bounces it into the opening of the box. Once it has gone through the plastic wrap, it heats up the air that is trapped inside. The black paper absorbs the heat at the bottom of the oven, and the plastic wrap helps the heat stay inside the box to cook the food.



The concept behind creating the solar oven is similar to the concept of the Earth's greenhouse effect. The greenhouse effect is a warming of the Earth's surface and the air above it. It is caused by gases in the air that trap energy from the sun. These heat-trapping gases are called greenhouse gases. The most common greenhouse gases are water vapor, carbon dioxide, and methane. These gases create a blanket-life effect, like the plastic wrap in your solar oven, that traps the sun's heat. Without the greenhouse effect, Earth would be too cold for life to exist.

Keywords

Solar Radiation
Light energy from the sun in the form of electromagnetic waves, including visible and ultraviolet light and infrared radiation

Nuclear Reactor
An apparatus or structure in which atomic material can be made to undergo a controlled, self-sustaining nuclear reaction with the consequent release of energy.

Infrared Radiation
A type of electromagnetic radiation; often referred to as heat rays. Infrared radiation is electromagnetic radiation of a wavelength longer than visible light but shorter than microwave radiation.

Direct Sunlight
Sun rays which have reached an object without obstruction.

Indirect Sunlight
Sun rays reaching an object with an obstruction creating a barrier between the rays and the object.

Greenhouse Effect
The greenhouse effect is a warming of Earth's surface and the air above it. It is caused by gases in the air that trap energy from the sun. These heat-trapping gases are called greenhouse gases. The most common greenhouse gases are water vapor, carbon dioxide, and methane. Without the greenhouse effect, Earth would be too cold for life to exist.

Insulation
Insulating materials reduce the flow of heat or electricity. Thermal insulation decreases the flow of heat from a hot region to a cooler one.

Science-U @ Home is brought to you by a grant from EQT

PennState

Day 8 Light: Heat

Social Studies

Why use a solar oven? Many of us have ovens in our homes which are powered by gas or electricity. However, not all places around the world have access to the same devices. Solar Ovens similar to the one you made can be helpful in many communities. Read more about how they are used around the world.

Solar Cookers in Developing Countries

March 27, 2005

Millions of people around the world cook their food over a smoky fire every day. It is often difficult to find wood for the fire. People who do not have wood must spend large amounts of money on cooking fuel. However, there is a much easier way to cook food using energy from the sun.

Solar cookers, or ovens, have been used for centuries. A Swiss scientist made the first solar oven in seventeen sixty-seven. Today, people are using solar cookers in many countries around the world. People use solar ovens to cook food and to heat drinking water to kill bacteria and other harmful organisms.

There are three kinds of solar ovens. The first is a box cooker. It is designed with a special wall that shines or reflects sunlight into the box. Heat gets trapped under a piece of glass or plastic covering the top of the cooker. A box oven is effective for slow cooking of large amounts of food.

The second kind of solar oven is a panel cooker. It includes several flat walls, or panels, that directly reflect the sun's light onto the food. The food is inside a separate container of plastic or glass that traps heat energy. People can build panel cookers quickly and with very few supplies. They do not cost much. In Kenya, for example, panel cookers are being manufactured for just two dollars.

The third kind of solar oven is a parabolic cooker. It has rounded walls that aim sunlight directly into the bottom of the oven. Food cooks quickly in parabolic ovens. However, these cookers are hard to make. They must be re-aimed often to follow the sun. Parabolic cookers can also cause burns and eye injuries if they are not used correctly.

You can make solar ovens from boxes or heavy paper. They will not catch fire. Paper burns at two hundred thirty-two degrees Celsius. A solar cooker never gets that hot. Solar ovens cook food at low temperatures over long periods of time. This permits people to leave food to cook while they do other things.

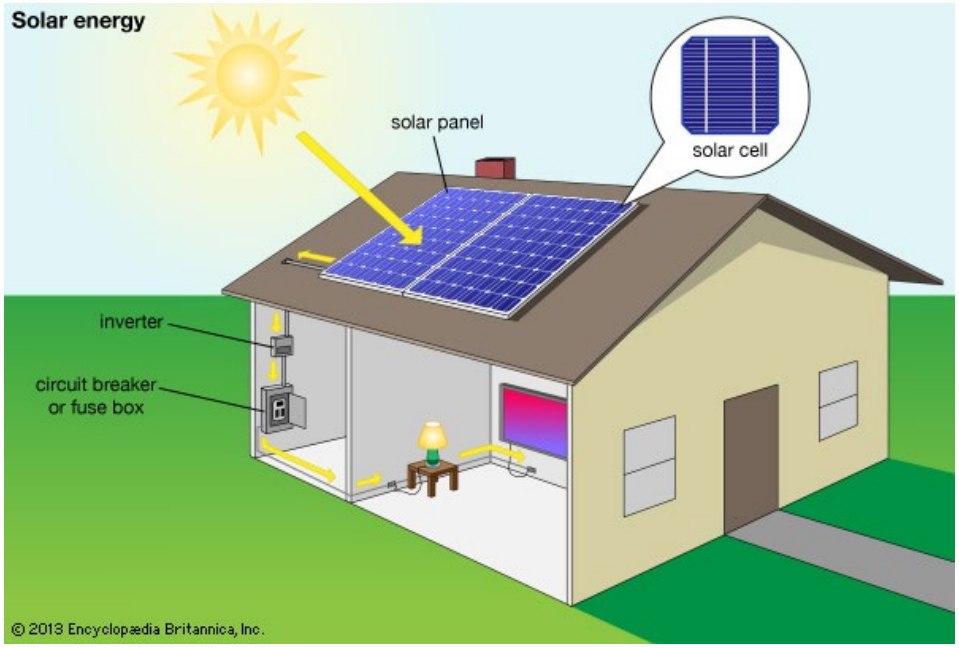
To learn more about solar cooking, you can write to Solar Cookers International. The address is nineteen nineteen Twenty-First Street, Sacramento, California, nine-five-eight-one-four, USA. Or you can visit the group's Internet Web site. The address is www.solarcooking.org.

This VOA Special English Development Report was written by Jill Moss.
Taken from: https://learningenglish.voanews.com/a/a-23-solar-cookers-83126737/125024.html

---

Around the world, the sun's energy is also used to power many objects. This is called solar power. Learn more about it here:

CyberChase clip: pbskids.org/video/cyberchase/2365192014/



Day 8 Light: Heat

Math

Time to experiment! You will need two ice cubes and your solar oven. Put one cube in the oven and leave one outside the oven. Measure how much time elapses as each ice cube melts. Which ice cube melts the fastest? Why?

How Fast Will Ice Melt?

Materials: – 3oz. Dixie cups, Tablespoon, Salt, Sugar, Flour, Water, Freezer, Sharpie Marker, Chart, Stop Watch.

Overview: Have you ever noticed, on a hot summer day, that the ice cubes in a glass of water or lemonade melt into a liquid extra fast? That is because the heat from the sun causes water in the ice to turn from solid to liquid.

However, temperature is not the only thing that affects how a liquid melts. For example, the oceans contain a lot of dissolved salts. A substance that dissolves in water is called a solute. When certain solutes are mixed with water/ice, they lower the melting/freezing point below 32°F. This makes the ice melt at a lower (colder) temperature than normal. In this activity, you'll investigate how several solutes (salt, sugar, and flour) affect water's freezing point.

***Think about the following questions and write down your predictions*:**

1. Do you think all of the ice cubes will melt at the same time? Why?
2. If you said "no" to question 1, which ice block do you think will be the first to completely finish melting?
3. Do you think there will be a big difference between the ice block that melts the fastest and the ice block that melts the slowest?

Directions:

1. Use the Sharpie Marker to write one of the following on each the cups:
   - Plain, Salt, Sugar, Flour
2. Pour the same amount of water into the four Dixie cups
3. Put one tablespoon of the labeled substance (Salt, Sugar, Flour) in each cup (gently stir each cup for about 30 seconds
4. Place each cup in the freezer and allow them to freeze for 3 hours
5. Remove each cup from the freezer and place them outside in the sunlight
6. Press "start" on your stopwatch and watch as your ice samples start to melt. When one of the ice cubes melts completely, record the time under the correct column for that sample. Keep the timer running and record the time it takes for each ice cube to fully melt. You may stop the stopwatch after the last ice cube melts.
7. Use the chart to write down how long it takes for each of the cups of ice to melt.

Day 8 Light: Heat

Math

NAME _____

How Fast Will Ice Melt? Chart

WATER	SALT	FLOUR	SUGAR
_____ min.	_____ min.	_____ min.	_____ min.

Extension activity:

Melting ice around the globe is a concern for many scientists. Find out more here: https://bit.ly/3ko257o

WQED education

Day 8 Light: Heat
English Language Arts

Now that you have your solar oven, use it to conduct some experiments of your own. Using the Scientific Method and the attached sheet, write down the steps of a possible experiment, conduct the experiment, and record what happens!

WQED education

Day 8 Light: Heat
English Language Arts

Conduct an Experiment

Ask a question 	*What would happen if….*
Make a prediction 	*I think...*
Make a plan and follow it 	
Observe 	*I noticed...*
Record the results 	
Share your conclusion 	*This means...*

WQED education