Three Nations ENERGY

SOLAR S'MORES

OR HOW TO BUILD A SOLAR OVEN!

Make a way to cook and keep the environment safe at the same time!

How Do Solar Ovens Work?

Solar ovens use light from the sun to cook food. Something reflective like foil is used to direct as much light as possible into the box where the food will be cooked. The light hitting the inside creates heat that is trapped by layers of clear material like plastic wrap.

On a hot sunny day this oven could raise the inside temperature to 200 °C, easily hot enough to cook s'mores.

Supplies Needed:

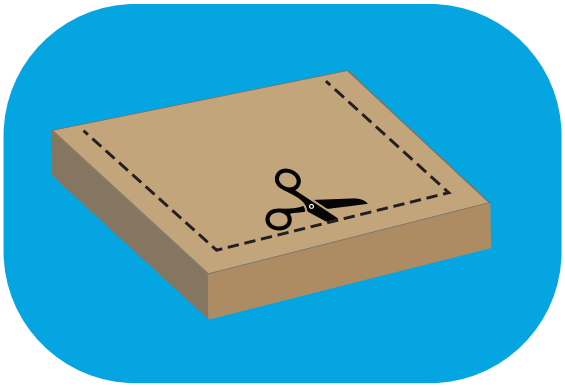
- Pizza box *(It's always better to reuse than recycle!)*
- Ruler
- Felt marker
- Aluminum foil
- Box cutter
- Glue
- Scissors
- Clear plastic wrap
- Tape
- Black construction paper
- Straw

Step 1

Collect all of your supplies!

Step 2

On the top of the lid, measure 2 cm from the front and each side. Draw a square so that it touches the back side of the lid.



Step 3

Cut the front and two sides of the square, leaving the back edge attached. This will make a flap that folds up.

Did You Know?

Plants use sunlight to make their food (called photosynthesis).

Animals get their energy by eating the plants.

Sunlight makes heat energy that drives ocean currents, wind and weather!

In fact, nearly all energy on Earth originates from sunlight.

Powerful stuff!

Step 4

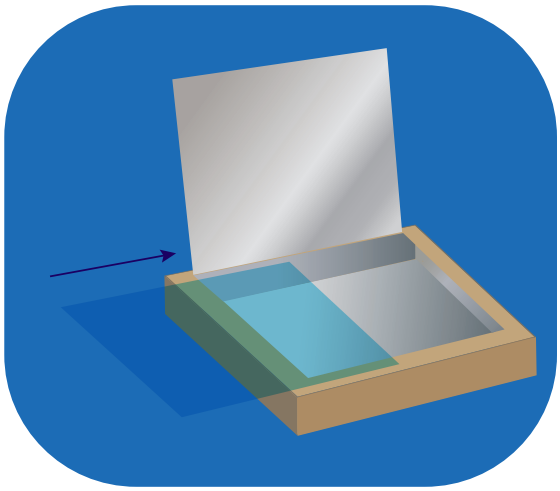
Take a piece of foil and glue it to the inside of the flap you just made, shiny side out.

Glue more foil to the inside of the box so it is also covered, shiny side out.

Step 5

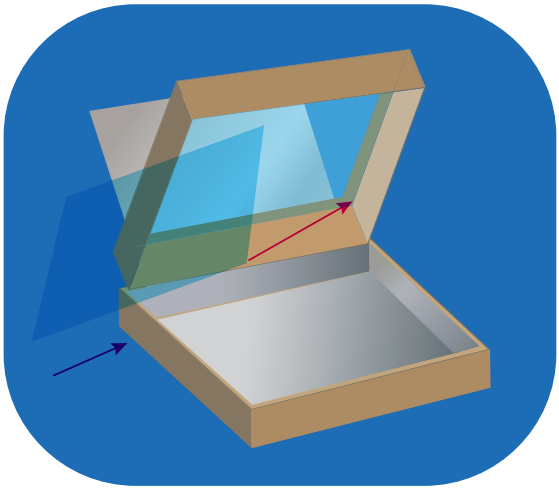
Next you are going to make a “double pane” window.

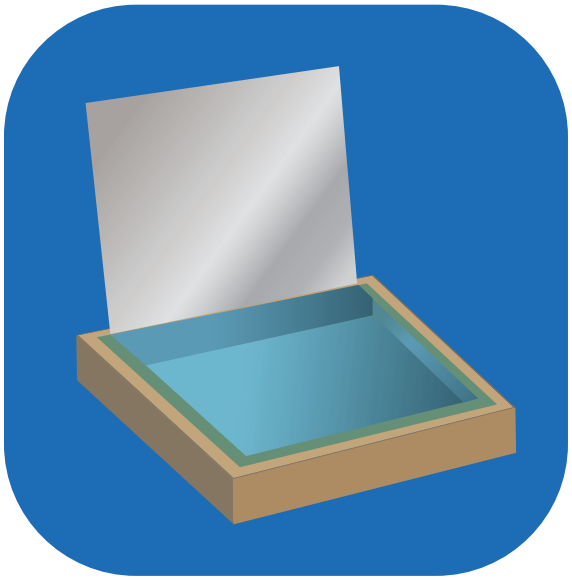
Tape a piece of plastic wrap to the lid of the box, completely covering the hole you made when you cut the flap.



Step 6

Close the top and tape a piece of plastic wrap to the outside part of the window.





Did You Know?

Light travels through space to Earth as a wave.

When this wave of light shines on something, its causes the molecules to start vibrating faster. When this happens, it makes more heat!

Just like when you rub your hands together quickly. Try it! Feel them heating up? This is what sunlight does to tiny molecules.

Something lightly colored, such as snow reflects most of the light that touches it, keeping it cool.

Dark colored things absorb most of the light that touches them, so very little is reflected. This means the molecules vibrate more and make more heat.

Step 7

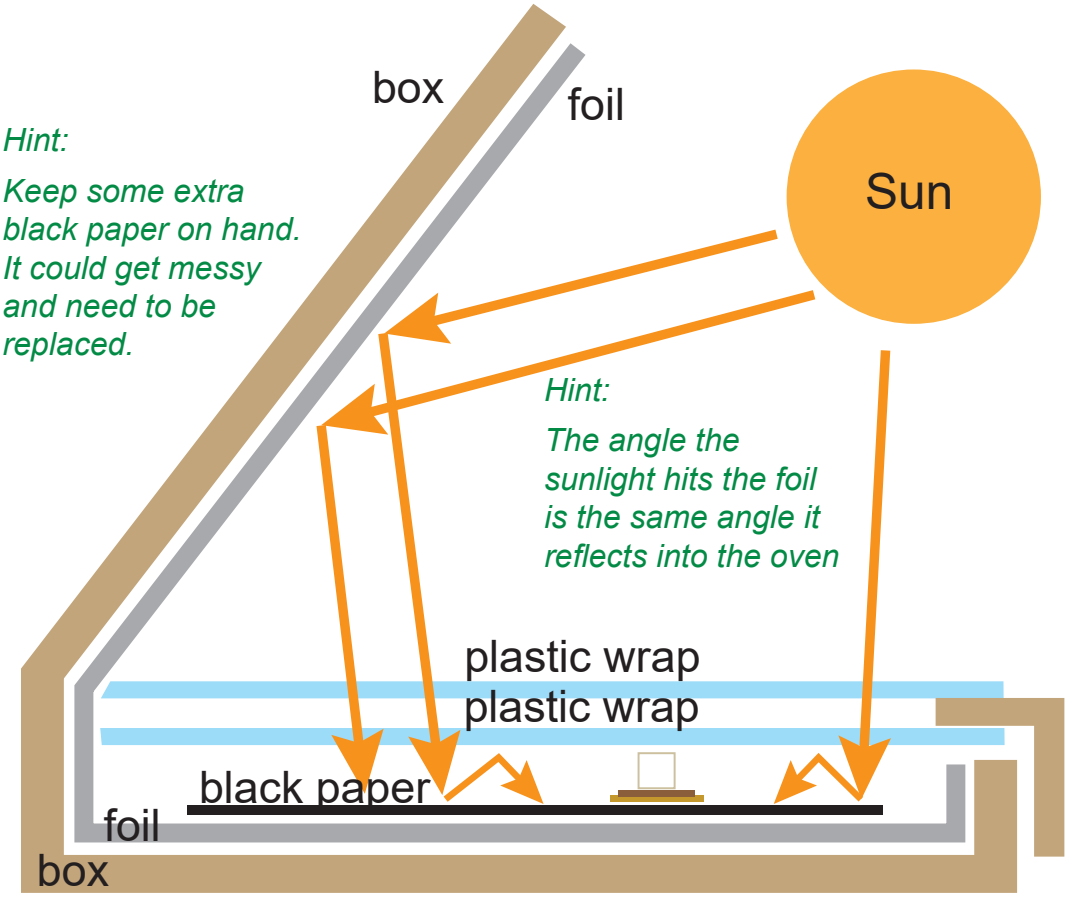
Cut your black paper to size and lay it inside the bottom of the box.

The black construction paper helps to absorb the suns heat!

Attach a straw (or other stick) to hold the lid open as shown.

Step 8 - Get Cooking!

Place your oven in the sun and put your s'mores inside. Adjust the straw to help angle the sun into the oven. Watch and enjoy!



Hint:

Keep some extra black paper on hand. It could get messy and need to be replaced.

Hint:

The angle the sunlight hits the foil is the same angle it reflects into the oven

Did You Know?

Your solar oven works like a greenhouse, the **transparent** plastic allows sunlight in and helps trap the heat.

The black construction paper helps **absorb the light** and make more heat.

The aluminum foil **reflects the light** onto the food.

On a hot sunny day this oven could raise the temperature up to 200 °C.

CHALLENGE!

What else could you cook in your oven?

How hot does it get if it is cloudy?

Is morning or afternoon better, what about direct or indirect sunlight?

What other materials could you use for a solar oven?

Solar Oven Experiment: Will Clouds Make a Difference?

(optional - takes 2 days, 1 hour per day)

An experiment is testing an idea (hypothesis) to see if it is correct.

In science it is important to have something to compare with so we know when things change - this is called a base line.

PART 1 Cook some food on a hot sunny day, in direct sunlight.

We will compare future experiments to this, so it is important to write down what you do. Record these in the chart at the bottom of the page:

- Time of day
- Where you placed your oven
- Type and size of food
- How long it takes to cook your food
- Use a thermometer to test temperatures
  - Temperature outside ˚C
  - Temperature inside the box ˚C

Any other observations (things you saw, felt, smelled, heard or tasted):

_____

_____

_____

Make a hypothesis. Do you think it will cook faster or slower on a cloudy day? _____

What else do you think you could cook in your solar oven? _____

_____

Pro Tip! ***Take photographs of the temperature, time of day and angle of the sun on the ground, as an easy way to record this information.***

PART 2 On the next cloudy day do the experiment again the exact same way including:

- Time of day
- Where you placed your solar oven
- Type and size of food

Record the same information as before in the chart below.

It is important to only change one thing (variable) in an experiment so you know what is causing the difference.

PART 3 What did you find out? Did it cook as well as the first time? Explain why you think it did or did not. Look at some of the hints on the Activity Sheet where it says “Did You Know?”.

_____

_____

_____

_____

How about building a BIG solar cooker? (Wikimedia)

CHALLENGE! Try changing the design of the oven, could you use different materials? Try different foods and even make a solar cook book.

Experiment	Time of Day (keep this the same)	Cook Time (keep this the same) Min.	Outside Temperature ˚C	Inside Pizza Box Temperature ˚C
Part 1 - Sunny Day				
Part 2 - Cloudy Day				

What's Included

The resources are in 3 sections:

1. This Teacher Resource

2. Student Activity Sheet

Solar Oven Activity (approx. 45 min.)

This activity can be used without the fact sheet and experiment for a lighter, more fun approach.

Experiment (approx. 2 days - 1 hour each day) - Optional

This provides an additional, more in-depth look at the solar oven using scientific procedures

- Compare inside vs outside temperature
- Compare cloud cover vs clear sky
- Further experiments could be added;
  - Morning vs afternoon
  - Direct sunlight vs indirect sunlight
  - Material variations (try designing an oven out of different materials)

3. Solar Thermal Energy Fact Sheet *(Advanced)*

This reviews many relevant science concepts which can be drawn from the activity.

- The Importance of Sunlight
- Electromagnetic spectrum
- Thermal energy
- What is Albedo?
- Uses of Solar Thermal Energy
- More Resources (for students to explore)

Learning Outcomes

This is low cost activity with a variable time commitment that makes the learning experience fun!

The solar oven pizza box is a great opportunity to demonstrate how solar thermal energy can be harnessed to do work. This is demonstrated in a way they can see, feel and taste!

This is a great complimentary exercise if you and your students are exploring society's impact on the environment in regards to greenhouse gases, with a solution based, hands on project that makes learning fun.

This can also be used to connect the demonstration of solar thermal energy to other real-world low carbon technologies such as solar thermal space heating and solar thermal hot water technologies.

Curriculum Connections

Science 7- Key Concepts

- Heat transfer
- Thermal energy
- Temperature
- Insulation and thermal conductivity

Science 8 – Key Concepts

- Transmission and absorption of light (transparent and opaque materials, albedo)

Science 9 – Key Concepts

- Identify forms of energy (light and thermal energy)
- Energy transformation and transfer (light Energy to thermal energy).
- Renewable and non-renewable energy

All curriculum connections were derived from https://www.alberta.ca/programs-of-study.aspx.

More Resources

What Colors Absorb More Heat?
https://sciencing.com/colors-absorb-heat-8456008.html

Thermal Energy - Feel the Burn - SolarSchools.net
https://www.solarschools.net/knowledge-bank/energy/types/thermal

The 5 Most Common Examples Of Solar Power
https://news.energysage.com/most-common-solar-energy-uses/

Solar Energy to the Earth - Energy Education
https://energyeducation.ca/encyclopedia/Solar_energy_to_the_Earth

How exactly does light transform into heat - Scientific American
https://www.scientificamerican.com/article/how-exactly-does-light-tr/

Solar: A brilliant way to get energy - David Suzuki Foundation
https://davidsuzuki.org/story/solar-a-brilliant-way-to-get-energy/

Energy storage gives renewables a jump-star- David Suzuki Foundation
https://davidsuzuki.org/story/energy-storage-gives-renewables-a-jump-start/

VIDEO - Solar Thermal 101 - YouTube - Student Energy
https://www.youtube.com/watch?v=FgjfJGfusdE

VIDEO - Concentrating Solar Power-Power Towers - KeepItCleanCreative
https://www.youtube.com/watch?v=QTNU1JMhzxA