

# SOLAR S'MORES

## OR HOW TO BUILD A SOLAR OVEN!

### Supplies Needed:

- Pizza box
- Ruler
- Felt marker
- Aluminum foil
- Box cutter
- Glue
- Scissors
- Clear plastic wrap
- Tape
- Black construction paper
- Straw



### DID YOU KNOW?

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

Animals get their energy by eating the plants.

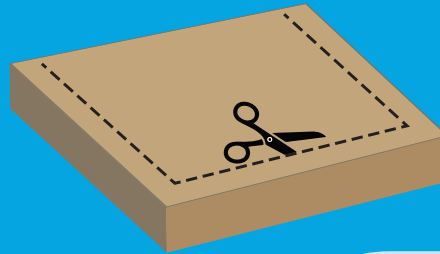
Sunlight makes heat energy that drives ocean currents, wind and weather!

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

**Powerful stuff!**

### Step 1

Collect all of your supplies!  
*If you need help with any of the steps please ask a teacher, parent, or leader.*



### 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

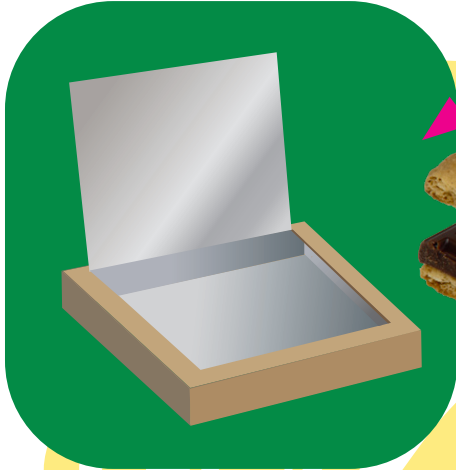
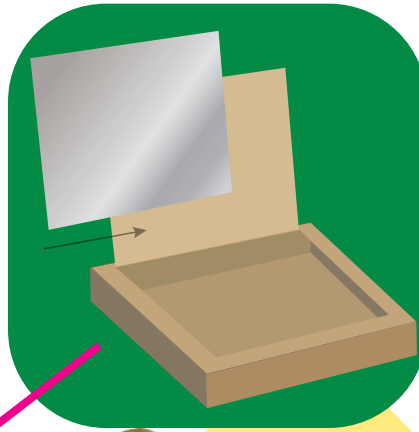
Cut the front and two sides of the square, leaving the back edge attached. This will make a flap that folds up.



### Step 4

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

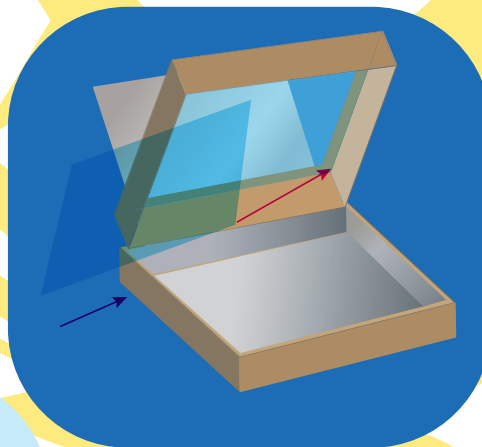
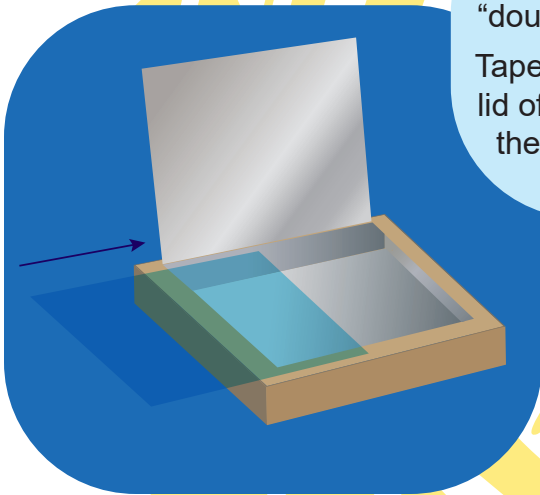
Glue more foil to the inside of the box so it is also covered, shiny side out.



### 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

Open the lid and tape a piece of plastic wrap to the inside part of the window.

### DID YOU KNOW?

Light travels through space to Earth as a wave.

When this wave of light shines on something, it 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.

### The Light & The Dark Side

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.

### See Through?

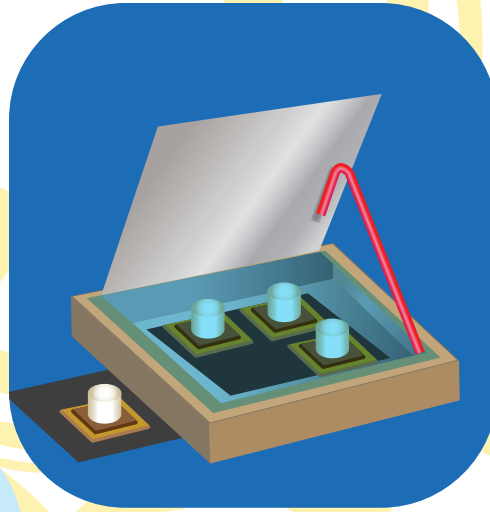
Transparent - light is able to pass through it  
Opaque - light can not pass through it.

What materials in your oven are transparent and which are opaque?

### Step 7

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

The black construction paper helps to absorb the sun's heat!



### DID YOU KNOW?

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

Using solar energy helps save the environment.

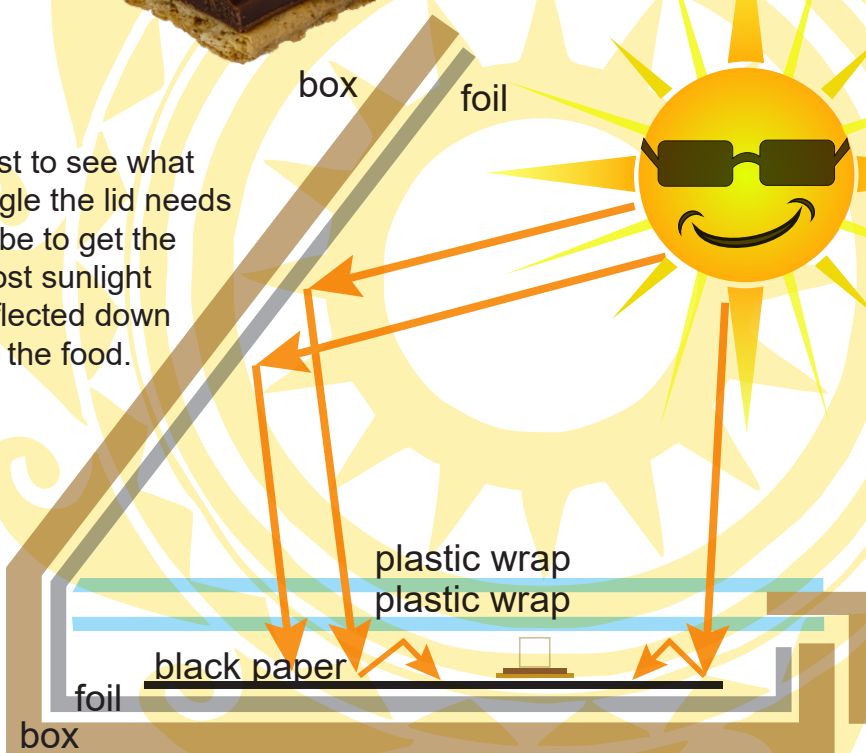
### Step 8 - Get Cooking!

Place your oven in the sun, you can use a straw to help angle the sun into the oven. Enjoy!



Wikimedia

Test to see what angle the lid needs to be to get the most sunlight reflected down on the food.



### More Dark & Light Side

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?

# Solar Oven Experiment: Will Clouds Make a Difference?

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

**What is an experiment?**

**It is testing an idea to see if it is correct.**

**In science it is important to have something to compare with so we know when things change.**

**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 this information 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
  - Temperature inside the pizza box

Write any other observations (things you saw, felt, smelled, heard or tasted) here:

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

Make a guess. Do you think it will cook faster or slower on a cloudy day? \_\_\_\_\_

**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 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?".

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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)	Outside Temperature	Inside Pizza Box Temperature
Sunny Day				
Cloudy Day				

### What's Included

The resources are in 3 sections:

#### 1. This Teacher Resource

#### 2. Student Activity Sheet

- Solar Oven Activity “Solar S’mores” (single day, approx. 1 hour) This activity can be used without the fact sheet and experiment for a lighter, more fun approach.
- Optional Experiment Sheet (2 days needed, 1+ hour per day)
  - 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 (design a solar oven using different materials)

#### 3. Heat from Solar Energy Fact Sheet (See “Solar Thermal Energy Fact Sheet Basic”)

- Importance of Sunlight
- How Light Makes Heat
- How Color Makes a Difference
- Uses of Heat from Solar Energy
- More Information (for teachers and students to explore)

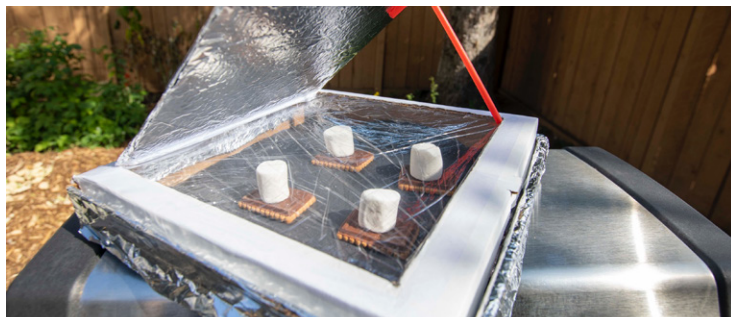
### Overview

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

The solar oven pizza box is a great opportunity to demonstrate solar thermal energy at work in a way students 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.

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

There are multiple connections to the grades 4,5 and 6 science curriculum:

#### Grade 4 - Key Concepts

- Waste in Our World
  - Identify materials that can be reused or recycled.
- Light and Shadows
  - Demonstrate that light travels outward from a source and continues unless blocked by an opaque material.
  - Describing changes in the size and location of Sun shadows throughout the day.
  - Classifying materials as transparent, partly transparent (translucent) or opaque.
  - Recognize that light can be reflected and that shiny surfaces, such as polished metals and mirrors, are good reflectors.

#### Grade 5 – Key Concepts

- Weather Watch
  - Predicting where, within a given indoor or outdoor environment, one is likely to find the warmest and coolest temperatures.
  - Recording weather over a period of time.
  - Describe the effects of the Sun’s energy on daily and seasonal changes in temperature 24-hour and yearly cycles of change.

#### Grade 6 -Topic C: Sky Science

Skills - Science Inquiry & Problem Solving Through Technology

- Construct and use a device for plotting the apparent movement of the Sun over the course of a day; e.g., construct and use a sundial or shadow stick. Useful for positioning solar oven.
- Describe seasonal changes in the length of the day and night and in the angle of the Sun above the horizon. Again, useful knowledge for use of solar technology.

### Video

This video covers many of the topics listed above:

Bill Nye the Science Guy - S01E15 Seasons  
<https://www.youtube.com/watch?v=a9z-aGB3atg>

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