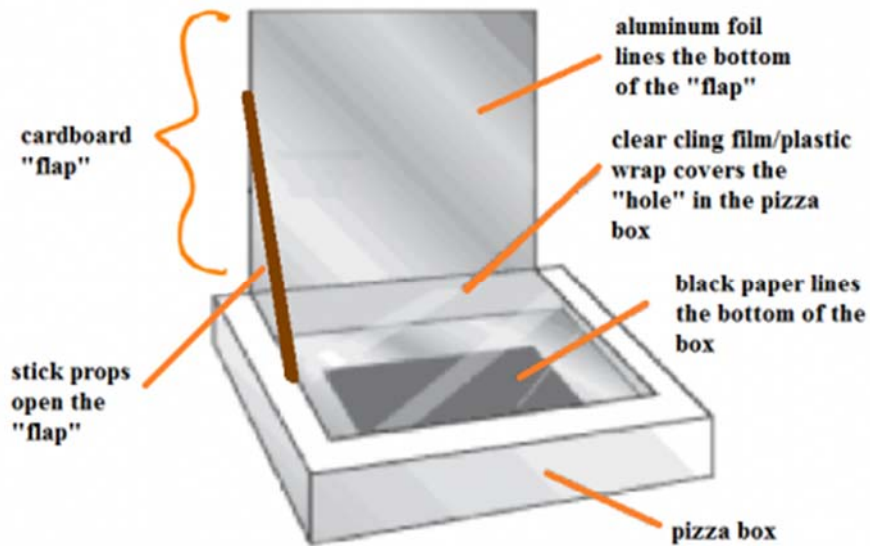


# Make A Pizza Box Solar Oven



The principles demonstrated are:

- **Solar Gain** - arranging for sunlight to enter a device as a source of energy. In this case, the gain is accomplished both by reflection and direct gain. This principle also includes using dark colored surfaces to absorb the solar energy that enters a device.
- **Insulation** - containing heat by trapping air inside and around a device to contain heat, and reflecting thermal radiation back into a device.

Besides explaining these principles in the process of building and using the ovens, here are several other points you might want to make:

- Cooking food takes a lot of energy! By using solar energy, we can save a lot on fuel.
- Cooking takes time, and the Sun will change position during that time. Therefore, somebody, such as a vigilant cook, may need to align the solar oven now and then to keep the sunlight entering. Mechanisms that track the sun and adjust the device automatically are called "heliostats" (like thermostat, but with "helio", which means "Sun", instead).
- Solar ovens have been used for a long time. In the 1830s, the British astronomer **John Herschel** used a solar collector box to cook food during an expedition to Africa. Nowadays, one can buy commercial solar ovens, ranging from small single dish units, to large units that can feed many people at once and that have to be hauled around on a trailer.
- Without the reflector flap, the solar oven becomes what is called a "flat plate collector". One of the first known uses of solar hot boxes was by the cooks of the Roman Emperor Tiberius who wanted to eat cucumbers all year round. The cooks satisfied his regal appetite by using a solar hot box, a kind of flat plate collector, to grow the cucumbers all winter

long! Nowadays, many people also use flat plate collectors to heat water for their pools and houses.

The simplest pizza box solar oven design, as given below, can get up to two hundred degrees Fahrenheit on a *warm* sunny day, enough, for example, to make "s'mores". Several optional features will enable the oven to get even hotter, which may be desirable in cooler weather, or for more serious cooking. One should allow ample time for cooking - roughly twice as long as would take in a conventional oven, and for smore's, it works best to leave the sandwiches open while cooking so that direct sunlight falls on the marshmallows and chocolate chips. We do not recommend trying to use the oven outside in temperatures below about 60 degrees Fahrenheit. If it is cool outside, try a sunny window sill.

Note: Many pizza shop owners will be more than willing to donate boxes. In return, you may want to ask a local reporter to cover the event, and ask the reporter to specifically mention the pizza shop's donation in any news article that appears.

#### Materials needed for a single oven (simplest design)

- 1 large size pizza box oven
- Several feet of aluminum foil
- 1 sheet black construction paper
- 2 1/2 feet of clear plastic wrap
- 4 feet of masking tape
- 2 feet of string

Note: Avoid materials that you think might become toxic when heated

#### Tools needed

- scissors (teachers or older students may also want to have an utility knife on hand, to better be able to cut cardboard with).
- ruler
- marker

#### Instructions

1. Assemble the pizza box, and open it up.
2. Glue aluminum foil to all *inside* surfaces of the sides except the top of the box, with the shiny surface facing *in*. This will create a "radiation trap" that will trap, by reflection, invisible (low-frequency) radiation that is radiated by the food and air inside the box.
3. On the top flap of the pizza box draw a square with a marker with edges spaced 1" from the four sides of the box.

4. Cut along *three* of the lines, on the sides and on the front edge of the box, **leaving the fourth line along the box's hinge uncut**. Then fold open the flap, making a crease on the fourth line (see the figure above). **Note:** Extra supervision may be needed during this step, because students often cut along the fourth line as well by mistake.
5. Glue aluminum foil to the inside surface of the top flap, **with shiny side visible!** This will form reflector, to reflect sunlight into the oven. Be careful to make as few wrinkles as possible, and smooth out whatever wrinkles occur.
6. Tape the black construction paper to the bottom of the box. This will help to absorb the incoming sunlight.
7. Carefully stretch the plastic wrap over the opening of the box, sealing the edges with tape to seal the air in.
8. Cover any air leaks around the box edges with tape, except while making sure that the box can still be opened, so you can place food inside the box and remove it later.
9. Go outside in the sunlight and place oven on a flat, level surface.
10. Place food on some foil (or a paper plate) and place inside the oven.
11. Use string and masking tape to tie back and adjust the reflector, so that sunlight is reflected into the oven, and especially onto the pie tin.
12. Let food cook, and check reflector angle now and then to make sure sunlight is getting inside the oven.
13. Enjoy your solar treat!

#### Optional Features

- Crumple up some sheets of newspaper and stuff them around the inside of the box, to provide extra insulation.
- Place a thermometer inside the oven as well, to measure the temperature.

The earliest pizza box solar oven design we are aware of was created in 1976 by Barbara Kerr.