

Instructions

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Warning! — This set contains chemicals that may be harmful if misused. Read cautions on individual containers carefully. Not to be used by children except under adult supervision.

Only for use by children 8 years of age and older. Use only under careful supervision of adults who have familiarized themselves with the kit's written safety precautions.

Caution! — Read the instructions before use, follow them, and keep them on hand for reference.

Individual parts may have sharp points, corners, or edges. Do not injure yourself! Keep small children and animals away from the experiments.

Store the kit out of the reach of small children. Keep the packaging and instructions as they contain important safety information.

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Advice for Parents and Adults

With this science kit, your child can experiment with simple materials to assemble a solar cooker that demonstrates how the energy of the sun can be used for heating and cooking. In the world today, solar energy is becoming an increasingly important energy source. Solar power plants are expected to provide us with environmentally friendly, zero emission energy in the near future. In large solar thermal power plants, solar heated air spins turbines to generate electric power. With this solar cooker, children can see firsthand how solar energy works in a simple, easy to comprehend device.

Safety Information

It is common to have questions about the safety of a science kit. The experimental equipment in this kit meets US and European Safety Standards. These standards impose obligations on the manufacturer. such as forbidding the use of any particularly dangerous chemicals. The standards also stipulate that adults should assist their children with advice and assistance in their experiments. Tell your child specifically that he or she must follow all the instruc-

tions when experimenting. Before the experiment, please discuss the warnings and safety rules with your child.

Proper assembly and use of the solar cooker must be overseen by an adult. We hope you and your child have a lot of fun while experimenting with the solar cooker!

WARNING! HOT SURFACES!

The cooking pot gets very hot during operation. You must use the wooden clip, gloves, or oven mitts when moving or filling the cooking pot.

Caution! Sharp Points — The enclosed wooden skewers have sharp tips. Misuse may cause personal injury.

Caution! — Do not stare directly at the sun or at the concentrated sunlight reflecting off of the solar cooker.

Caution! — Do not leave the solar cooker unattended. There is a risk of fire when exposed to sunlight. This is particularly true in the vicinity of woods or dry grassy fields! Disassemble the cooker after each use.

Before experimenting, gather all the necessary parts. In addition to the parts in the kit, you will need all-purpose glue or a glue stick.







- 7 Triangular silver pieces
- 2. 7 Trapezoidal silver pieces
- 1 Small cardboard part
- 4. 3 Wooden clips
- 5. 1 Cooking pot

Solar Cooking Science Theory

Before we start to assemble and use the solar cooker (also called solar collector), we will first explore the scientific concepts behind the operation of the solar cooker.

Catching Solar Energy

The sun is an incredibly powerful energy source. In the sun, hydrogen atoms are combined together into helium atoms. This process, known as nuclear fusion, releases vast amounts of energy which are radiated outward from the sun into space in the form of electromagnetic energy, some of which we can see as visible light and feel as heat.

Because of the distance between the sun and Earth, the light rays that reach Earth are all almost parallel to one another. To take full advantage of these parallel light rays, you have to know how to catch them.



6. 1 Rubber band

7. 2 Wooden skewers

8. 1 Instruction sheet

The Magnifying Glass

One way to concentrate the sun's light and heat radiation is to use a **magnifying glass**. With this method, the rays passing through the lens are bent toward a single point, called the **focal point**. The illustration above shows how the parallel light is focused by the lens of the magnifying glass to converge at the focal point. The light and heat energy is concentrated at the focal point. Through this concentration of energy, very high temperatures can occur at the focal point. It can also get very bright at the focal point.

The Parabolic Mirror

The direction of the sun's rays can also be altered with a curved mirror, so that the rays converge at one focal point. The whole surface of the mirror reflects the parallel light rays toward this single point. As with the magnifying glass, it can get very hot and very bright at the focal point. But in this case, the focal point is right at the center of the mirror instead of some distance below the magnifying glass. Such a mirror is called a parabolic mirror because its curved reflector is in the shape of a parabola.

Focal point

Conversely, if there was a light source (e.g. a light bulb) at this focal point, its rays would be bent and reflected outward in parallel. That is how the reflectors for a flashlight and car headlights work.

These parabolic mirrors are called solar collectors, and can be used as solar cookers. We will now assemble the parts in this kit into a parabolic solar cooker.

01 Assembly

Solar Cooker Assembly

You will need:

- 7 Triangular silver pieces
- 7 Trapezoidal silver pieces
- 1 Small cardboard part
- 3 Wooden clips
- 1 Cooking pot 1 Rubber band
- 2 Wooden skewers

In addition, you will need all-purpose glue or a glue stick for the cardboard.

Assembly

We will start with the silver pieces that form the parabolic mirror. First we will attach one triangular silver piece to each trapezoidal silver piece. Place the one triangular piece and one trapezoidal piece with their white cardboard sides facing up. See Figure 1.



Apply glue to the silver side of the two adhesive flaps on the triangular piece, as shown in Figure 2. Position the flaps on the trapezoidal piece as shown, and press the two parts firmly together. Follow the instructions for the specific glue you are using to be sure of the appropriate drying time.

Repeat for all 14 of the silver pieces. When they have all been glued together, you will have seven assembled sections. Be sure to allow enough time for the glue to dry completely.





Cut the rubber band at a point 25 centimeters (about 10 inches) from one of its ends. You will now have one short and one long piece of elastic cord.

Tie the ends of the short elastic cord together to form an elastic ring. Repeat for the long cord to form a larger elastic ring.

Piece together the seven silver sections, one at a time using the tabs and slots on each piece, as shown in Figure 4. They will fit together in the shape of a parabola, like an umbrella. Make sure the points of each piece fit together as shown in Figure 5.



Stretch the elastic rings into place on the parabolic shape. Make sure the elastic rings are securely hooked under the tabs all the way around.

02 Assembly

Finishing the Solar Cooker

Now we will finish the solar cooker and test it. You will need the two wooden clips, the small cardboard piece, and the cooking pot. Put these parts together as shown in Figures 7 and 8 below.



Now, you have finished building your solar cooker! The seven sections can be taken apart and reassembled easily, making your solar cooker very portable. As you can see, your solar cooker is not a perfectly curved parabola. The cross section is a polygon with flat sides, instead of a curved parabola. This means the sun's rays are not reflected to one exact point, but they are all reflected onto the

cooking pot to heat it up.

03 Experiment

Testing the Solar Cooker

Let's put the solar cooker to work and see what we can make! To start, you have to take the solar cooker outside on a sunny say. The solar cooker must be oriented towards the sun, so that the sun's rays come into it as straight as possible.

This solar cooker is designed so that it captures the sun's rays best between 11 a.m. and 3 p.m. in the summer time. If the sun is higher or lower in the sky, you may need to use a towel or some cardboard to prop the solar cooker up so it is directly facing the sun. Depending on your location, the time of day, and the time of year, your solar cooker will need to be oriented differently. You will have to experiment to find which position works best.

Make sure you set up the cooking pot as shown in Figure 8, on the stand made with the wooden clips. This helps keep the pot level and in the best position at center of the solar cooker.

WARNING! The cooker and cooking pot can get very hot! Make sure you use the wooden clip as a handle for the pot. Do not touch metal parts with your bare hands if they have been in the sun. Use gloves or oven mitts.

04 Experiment

Solar Fondue

Now you can test out some recipes in your solar cooker! Let's start with a chocolate fondue recipe.

All you need to do is set up your solar cooker and put small pieces of chocolate (e.g. chocolate chips) into the cooking pot. When the chocolate has melted, remove the cooking pot from the solar cooker using the wooden clip as a handle. Then use



the skewers to dip pieces of fruit into the chocolate. Wait a few moments for the chocolate to cool on the fruit, and then enjoy!

05 Experiment

Your Own Solar Cookbook

Experiment with cooking the following items in your solar cooker. How long does each thing take to cook at a particular time of the year? What factors affect the performance of the solar cooker?

| Food | Date and Starting Time | Length of Cook Time |
|----------------------|---------------------------|------------------------|
| Boiled Water for Tea | | |
| Toasted Bread | | |
| Heated Soup | | |
| Baked Potato | | |
| Roasted Nuts | | |
| Hard Boiled Egg | | |

Important! After each use, you must rinse out the cooking pot and make sure it is clean. Do not eat food that is under-cooked or food to which you are allergic! Make sure that you wipe up any spills inside the solar cooker immediately with a clean towel.

Real World Solar Cooking

Solar cookers like the one in this kit are used all over the world. In developing countries and in countries where poverty prevails, fuel and electricity are expensive and difficult to obtain. Solar cooking is used in these places because the only energy needed is provided by the sun free of charge! Solar cookers are also used by campers and hikers who want to cook in remote places without power.

Solar cookers demonstrate an important clean, renewable energy technology that is used not only for cooking, but also for heating buildings and generating electricity.

