

Topics: Solar Heating,
Radiant Energy,
Sunlight Absorption

Materials List

- ✓ Auto sunshade, reflective
- ✓ Hook & loop fastener, adhesive (or use glue/sewing)
- ✓ Bucket, box, or waste basket.
- ✓ Square cake rack, wire in/out tray, or =
- ✓ Stick, about 66 cm (27") in length
- ✓ Small dark cooking pot or black can
- ✓ Water or food sample (one without a food safety issue!)
- ✓ Oven cooking bag or clear plastic bag.
- ✓ Hot mitt/ pot holder
- ✓ Opt.: Thermometer

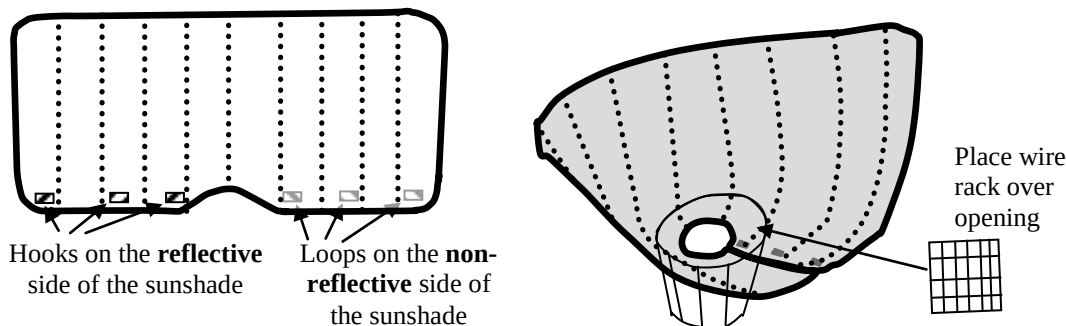
This activity can be used to teach:

Next Generation Science:

- Energy can be transferred/ converted (Physical Science, Grade 4, 3-2, 3-4; High School, 3-3)
- Thermal energy (Middle School, Physical Science 3-3)
- Evaluate/Reduce Human Impacts (Earth/Space Science, Middle School, 3-3; High School, 3-2, 3-4; Life Science, High School, 2-7)

Auto Sunshade Solar Collector

A Renewable Energy Device



Explore heating with sunlight using a solar collector that is easy to make and store.

Assembly

1. On the **reflective side** of the sunshade attach three 2.5 cm (1") long strips of "hooks" near the edge as shown above. Secure the first strip 10 cm (4") from the end of the sunshade, and then place the second and third strips at 18 cm (7") intervals away from the first strip, as shown above.
2. On the **non-reflective side** of the sunshade attach three 2.5 cm (1") long strips of "loops" near the edge as shown. Secure the first strip 10 cm (4") from the end of the sunshade and then place the second and third strips at 18 cm (7") intervals from the first strip, as shown above.
3. With the reflective side up, pull the "loops" edge toward and over the "hooks" edge, overlap the closest pair of "loops" and "hooks", and press the strips together. In the same manner secure the next pairs of "loops" and "hooks" together to transform the flat sunshade into a 3-dimensional "funnel" shape.
4. Set the funnel into the opening of a bucket, box, or wastebasket.
5. Place a square cake rack (standard size is about 25 cm (10")) or a wire in/out tray inside the funnel so that the corners are over the edges of the bucket underneath.
6. In windy weather, wedge a stick across the funnel to help stabilize the sides.

To Do and Notice

Be aware of the following **safety issues**:

- Protect the eyes with sunglasses when using the solar collector in sunlight!
 - Select a food (for example tea, cocoa, marshmallow, or precooked hot dog) that is safe to eat when only warmed.
 - Use appropriate caution when handling or tasting hot liquids or foods!
1. Place the solar collector on a flat surface in a sunny area. If the weather is or may become windy, place in an area where the wind will be blocked.
 2. While standing behind the collector turn the collector so the left side is pointing toward the sun, with the right side at about a right angle (90°) to the left side.
 3. Fill a dark pot with an appropriate liquid or food. **Avoid choices that might involve food safety issues!**
 4. Place the pot in an oven bag, seal the bag, and place both on the rack.
 5. Check the solar collector at set intervals. Use an appropriate thermometer, briefly touch the container, or carefully taste the item to gauge the degree of heating. **Careful** – the item being heated can become hot enough to burn!
 6. When the contents are hot enough remove the pot using a hot mitt or pot holder.

The Science Behind the Activity

The Sun provides a daily source of free and non-polluting energy that can be collected and converted to provide a heat source. Part of the Sun's energy is emitted as sunlight that includes 3 types of light rays: infrared, visible, and ultraviolet. Often the word "light" is used in place of the more precise term "visible light", meaning the light visible to humans. Of the three types of light infrared provides the most heat energy, visible light some what less, and ultraviolet the least. Sunlight can travel through a transparent material (air, clear plastic), be reflected by a shiny surface (foil or reflective Mylar), and/or be absorbed by dark and/or dense materials (the dark cooking pot). Solar collectors can have flat or curved-sided reflector(s). Curve-sided solar collectors do not need to track the Sun's movement as closely as flat-sided collectors. Parabolic and cylindrical collectors will focus sunlight to a single point or line, which can become extremely hot. A flat panel collector creates a more diffuse area of concentrated sunlight. The reflective surface of the sunshade does not become very warm because the shiny surface reflects the sunlight. The pot containing the food becomes warmer because of the additional sunlight that is reflected from the foil and strikes the pot. Heat can be lost to the surrounding air so having the pot enclosed in a transparent oven bag will decrease the rate of heat loss and thus increase the rate of heating, maximizing the temperature that can be reached. This type of cooker can reach or exceed the pasteurization temperature of water.

Taking it Further

Experiment with one or more of the following questions:

- Would moving the solar collector to stay aimed at the Sun change the rate and degree of heating?
- How can the angle of the side panels be adjusted to better reflect sunlight toward the pot?
- What would happen if additional foil or Mylar sheets are placed on the ground in front of the cooking pot?

Web Resources (Visit www.raft.net/raft-idea?isid=572 for more resources)

- Many useful links on solar collectors and related topics can be found at <http://www.solarcooking.org/>