

# RAFT IDEAS

**Topics:** Solar heating,  
Radiant energy

## Materials List

- ✓ Foil section, about 15 cm x 28 cm (6" x 11")
- ✓ File folder sections
- ✓ Brass brad (a paper fastener), ~ 2.5 cm (1") long
- ✓ Media tray from a CD case
- ✓ Binder clip, small
- ✓ Drinking straw
- ✓ 2 Paperclips
- ✓ CD
- ✓ Tape, masking
- ✓ Straw, opaque, sip and stir size
- ✓ Portion cup and lid, 30-60 ml (1-2 oz.)
- ✓ Clear CD (found in multi-packs of recordable disks)
- ✓ Single hole punch
- ✓ Pushpin
- ✓ Liquid or small food sample to heat (one without a food safety issue!)

This activity can be used to teach:

CO Science Standard 1:  
Physical Science

- Sun and Solar energy

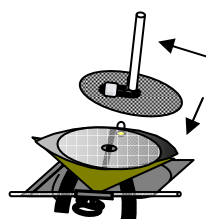
CO Science Standard 3:  
Earth Systems Science

- Renewable Energy
- 21<sup>st</sup> Century Skills
- Invention

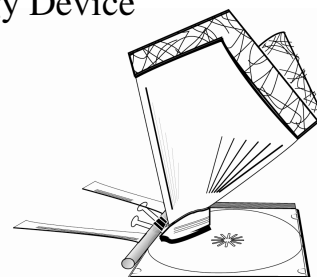
Grades: 4, 5, 6, 8, HS

## Solar Cone Cooker

### A Renewable Energy Device



Place the CD/straw over the clear CD and point at the Sun. Remove to uncover the clear CD, letting the sunlight enter.



Explore heating and "cooking" with sunlight using an easy to make mini solar cooker.

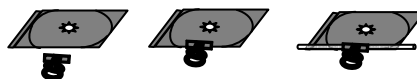
### Assembly

1. Cut foil to make a piece about 15 cm x 28 cm (6" x 11").
2. Cut a ~13 cm x 25 cm (5" x 10") section from a file folder.
3. Place the foil rectangle on a flat surface, dull side up.
4. Center the file folder section over the dull side of the foil rectangle.
5. Fold the 4 exposed foil edges over the sides of the file folder section.
6. Punch a hole in the 2 corners of only one long side of the foil covered rectangle.
7. Bring the 2 holes together to form a cone shape with the foil on the inside. Insert a brad by starting from the inside of the cone and going through the overlapped holes. Separate and flatten the prongs to securing the brad to the cone.

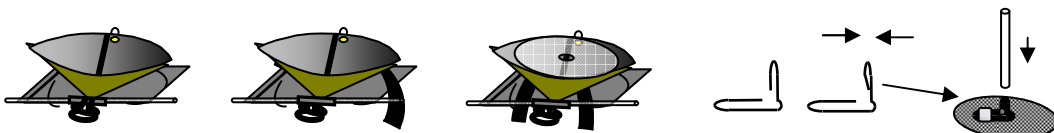


**Recommended:** Use the reflective cone in **To Do and Notice**, step 1. Then return to finish the assembly.

8. Attach a small binder clip to media tray in the middle of one of the sides having the molded arcs.
9. Turn the media tray upside down. Insert a straw between the media tray and the binder clip. Move the straw until the center is under the binder clip.



10. Flatten the cone's tip for about 1 cm (1/2") to help overlap the cone's seam.
11. Open the binder clip slightly and insert the flattened tip of the foil cone by positioning the seam against the media tray.
12. Loop a 2 cm x ~30 cm (3/4" x ~12") strip of file folder around the base of the cone and slip each end under the straw, one end on each side of the binder clip.
13. Bend a paperclip's smaller loop up to a right angle. Tape the larger loop onto the cone's seam, by the brad, with the small loop over the edge, pointing upward.
14. Use opaque tape to cover the center hole on the label side of the CD.
15. Bend a 2nd paperclip as in step 13. Place the paperclip on the CD so the small loop is upright and centered on the CD. Tape the larger loop to the CD.
16. Pinch and insert a small, opaque straw over the upright paperclip loop on the CD.



17. To create a steam vent poke a pinhole into the lid of a portion cup.

## To Do and Notice

### Be aware of the following safety issues:

- Protect the eyes with sunglasses when using the solar cone cooker with sunlight!
- Although small in size the cone cooker can heat items until burning hot!
- Select a food (tea, cocoa, marshmallow, precooked hot dog, etc.) that is safe to eat warmed but not cooked.
- Use appropriate caution when handling or tasting hot liquids or foods!

1. After the brad has been inserted, widen the seam so a pointer finger can be inserted into the cone from the cone's pointed end. While outside (and for a short time!) point at the Sun the "coned" finger and the pointer finger of the other hand. The finger in the cone should soon feel warmer than the finger not in the cone. Move the cone about and notice the difference in warmth when the cone is and is not pointed toward the Sun.

Go to the **Assembly** section's step 8. Return when the cone cooker and CD/straw pointer are fully assembled.

2. Fill a portion cup with an appropriate liquid or food. **Avoid choices that might involve food safety issues!**
3. Put the lid, with the venting pinhole, on the portion cup and place in the cone cooker.
4. Center the clear CD in the cone cooker with the lower edge resting on the paperclip.
5. Place the CD/straw pointer on top of the clear CD.
6. Place the cone cooker on flat surface in a sunny area. Put weights (bag of sand, rock) on the base, if windy.
7. Turn the cooker until the shadow of the straw is directly above or below the base of the straw. Pull or loosen the file folder strip to raise or lower the cooker's cone until the shadow of the straw is as short as possible.
8. Remove the CD/straw pointer and place nearby to track the movement of the sun.
9. Check the cone cooker at set intervals. Can warm air be felt leaving the hole in the clear CD? Are drops of moisture visible on the underside of the clear CD?
10. Use an appropriate thermometer, briefly touch the container, or carefully taste the item to gauge the degree of heating.

## The Science Behind the Activity

Light rays can travel through a material (air, clear CD), reflect from a material (foil), and/or be absorbed (dark and/or dense materials – the plastic cup). The energy from the absorbed light rays can be converted into chemical energy (photosynthesis), electrical energy (solar cells), or thermal energy (heating water, air, etc.). The Sun provides a daily source of free and non-polluting energy that can be collected and converted. Solar cookers can have flat or a curved sided reflector(s). Curved sided solar cookers do not need to track the Sun's movement as closely as flat-sided cookers. Parabolic and cylindrical cookers will focus sunlight to a single point or line, which can become dangerously hot. A cone or funnel cooker creates a more diffuse area of concentrated sunlight. The item being heated can still become mouth burning hot! This scaled down version can reach temperatures of 60 °C (140+° F), for a translucent container, and over 95 °C (200° F), for a dark plastic container (and the plastic will melt!). The sides of the cone cooker do not become very warm because the foil reflects the sunlight. The media tray, if black, will warm up because most of the sunlight is absorbed. The portion cup becomes even warmer because of the extra sunlight that is reflected from the foil and strikes the container. The clear CD helps to contain the warm air inside the cooker, while blocking colder air from entering the cooker and cooling the container.

## Taking It Further

How would the cooker work if the hole in the clear CD were sealed with tape or if the clear CD were not used? Making a black line around the white container with a permanent marker will increase rate of heat absorption. The more area that is colored black the higher will be the rate of heat absorption, but the plastic can melt if too much of the container is colored black!

**Web Resources** (Visit [www.raft.net/more](http://www.raft.net/more) for how-to videos and more ideas!)

- This site has it **all**. There are illustrated plans, news on solar cookers, photos of solar cookers and people using them around the world, and many useful links: [www.solarcooking.org](http://www.solarcooking.org)
- This site has details on how to make a large cone/funnel cooker - <http://solarcooking.org/plans/funnel.htm>