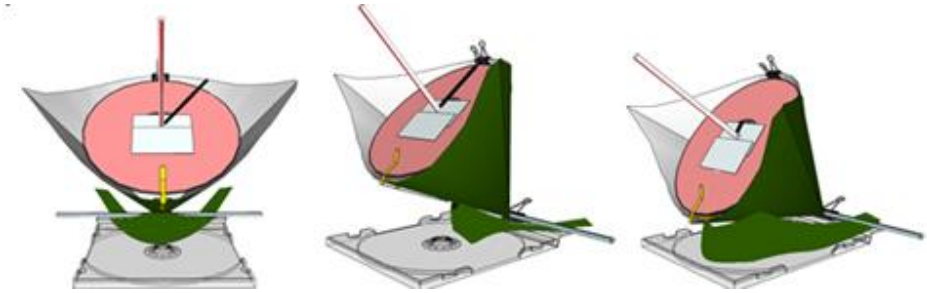
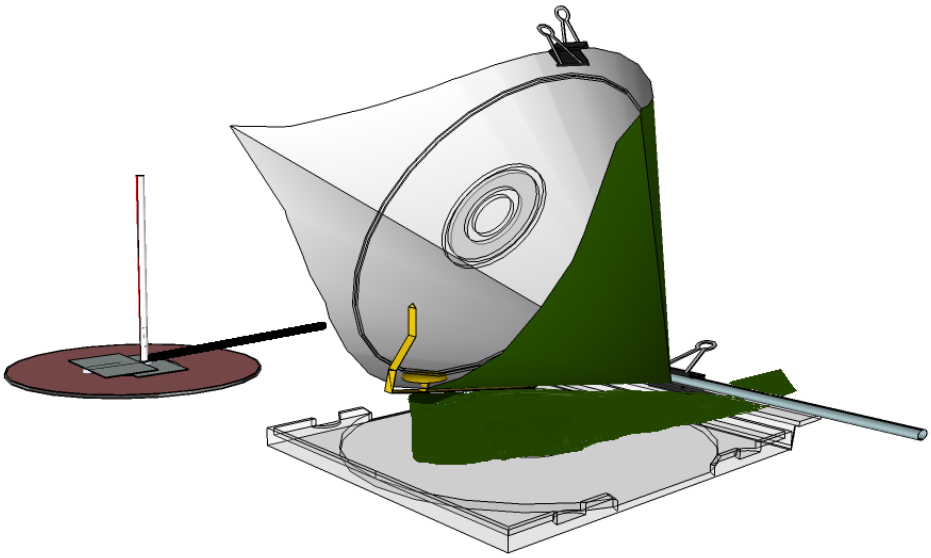
SOLAR CONE COOKER

A heated renewable energy device!



Explore heating and “cooking” with sunlight using an easy to make mini solar collector using common materials. Use a pointer to align the cooker with the sun’s position and remove the pointer to let in the light.



Curriculum topics:

- Solar Heating
- Radiant Energy
- Apparent Motion of Sun
- Reflectivity

Subjects:

Physical Science, Earth/Space Science

Grade range:

3 – 12

Who we are:

Resource Area for Teaching (RAFT) helps educators transform the learning experience by inspiring joy through hands-on learning.

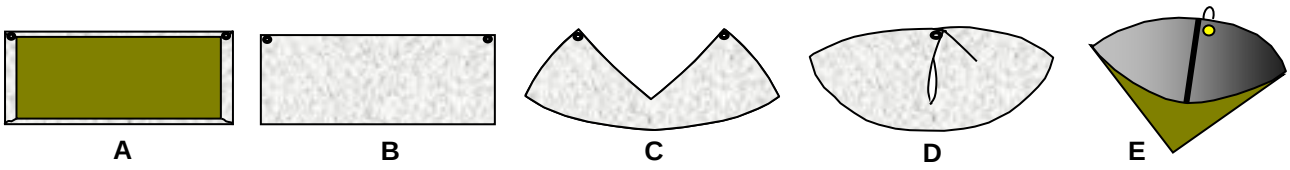
For more ideas visit
https://raft.net

Materials required per solar cooker

- Foil rectangle, 6” x 11” (x1)
- Folder section, 5” x 10” (x1)
- Folder section, 1” x 12” (x1)
- Paper fastener, 1 ½” long (x1)
- CD media tray, clear (x1)
- Mini binder clip (x1)
- Small binder clip (x1)
- Drinking straw (x1)
- Small paperclip (x1)
- Sip/stir straw, opaque (x1)
- Portion cup with lid, 1-2 oz. (x1)
- Standard CD (x1)
- Clear CD (x1)
- Tape or label
- Single hole punch (not included)
- Pushpin (not included)
- Water, crayon shaving, or small precooked food sample w/o food safety issue! (not included)
- Optional: Thermometer (not included)

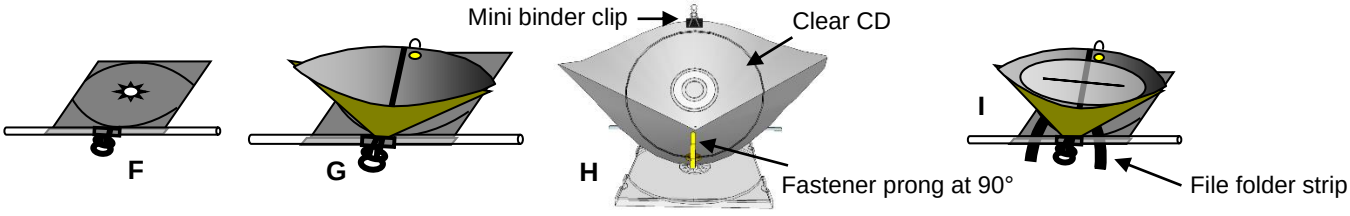
Set-Up

1 Place the foil rectangle on a flat surface, dull side up. Center the 5” x 10” file folder section over the foil rectangle. Fold the 4 exposed foil edges over the sides of the file folder section (**A**).



2 Punch holes in the corners of one long side of the foil covered rectangle (**B**). Bring the 2 holes together to form a cone shape with the foil on the inside (**C**). Insert the paper fastener by starting from the inside of the cone and going through the overlapped holes (**D**). Separate and flatten the prongs to secure the fastener to the cone (**E**). Align one of the prongs to the seam of the cone. Bend the other prong to a 90° (right) angle toward the opening of the cone (**H**).

3 With the media tray right side up attach a small binder clip to the media tray in the middle of the side with the raised ledge. Insert the drinking straw between the media tray and the small binder clip (**F**). Move the straw until the center is under the small binder clip.

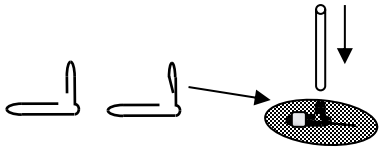


4 Overlap the edges of the cone tip and flatten for about ½ inch. Open the binder clip slightly, insert the flattened cone tip under the binder clip, and engage the clip to attach the cone to the media tray (**G**). Attach a mini binder clip to the edge on the cone on the opposite side from the seam (**H**).

5 Insert a clear CD under the 90° bent fastener prong and the edge of the mini binder clip (**H**). Adjust the fastener and cone as needed so the edges of the clear CD make contact with the cone.

6 Loop the 1” x 12” file folder strip around the base of the cone and under the straw with one end on each side of the binder clip (**I**). Cover the center hole of a standard CD (label side) with opaque tape or label.

7 Bend a paperclip at a right angle (90°). Put the paperclip on the CD so the small loop is upright and centered on the covered CD hole and then tape the larger loop to the CD. Pinch and insert the opaque sip/stir straw over the upright paperclip loop on the CD (shown below).



To do and notice

1 After completing step 2 in the **Set-Up** section, widen the seam so a pointer finger can be inserted into the cone from its pointed tip. For a short time outside, point the cone at the Sun with both the "coned" finger and the pointer finger of the other hand. The finger in the cone should soon feel warmer than the other finger. Move the cone about and notice the difference in warmth when the cone **is** and **is not** pointed toward the Sun.

Go to the **Set-Up** section, step 3. Return when the cone cooker and CD/straw pointer are fully assembled.

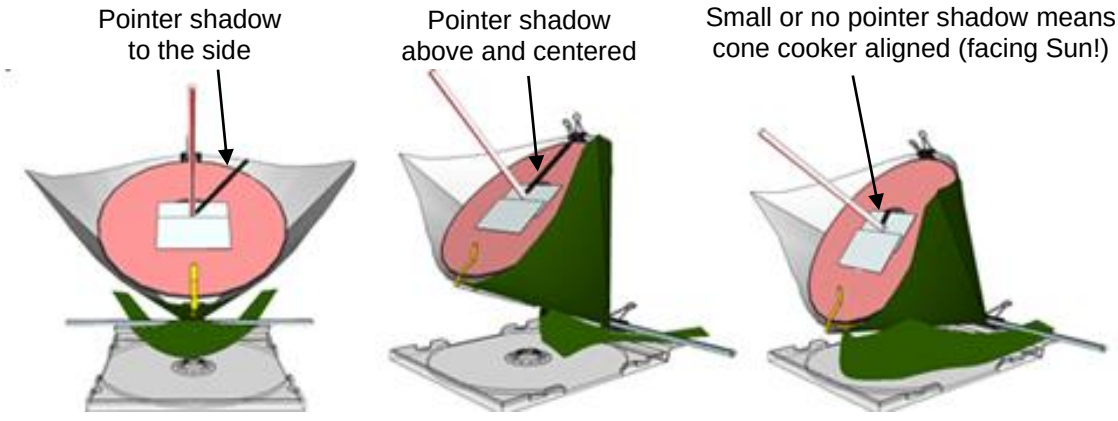
2 Fill a portion cup with a sample (water, crayon shavings, or small precooked food). Create a steam vent in a portion cup lid by poking a pinhole with a pushpin. Put the lid on the portion cup and place in the cone cooker.

3 Center the clear CD in the cone cooker with the lower edge resting on the bent fastener prong and the upper edge under the mini binder clip. Place the CD/straw pointer on top of the clear CD.

4 Place the cone cooker on flat surface in a sunny area. Put weights such as rocks or a bag of sand on the base, if windy. Turn the cooker until the shadow of the straw is directly above or below the base of the straw (shown below). 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.

5 Remove the CD/straw pointer and place nearby to track the movement of the sun. Check the cone cooker at set time 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?

6 Use an appropriate thermometer or briefly touch the container to gauge the degree of heating.



Content Standards:

NGSS

Definitions and Transfer of Energy:
4-PS3-2
4-PS3-4
MS-PS3-3
HS-PS3-3

Energy, Resources, and Environment:
4-ESS3-1

Evaluating & Reducing Human Impacts:
MS-ESS3-3
HS-LS2-7

Testing Variables (Engineering):
3-5-ETS1-3

The content 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 portion 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 curved sided reflectors. 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 ºC (140º F) for a translucent container and over 95 ºC (200º 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 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

Learn more

- Test to see how the cooker works when the hole in the clear CD is sealed with tape or if the clear CD is not used.
- Make a thick black line around the white portion cup with a permanent marker to test the potential effect on the rate of heat absorption.
- Use a scaled-up version of this cooker to cook vegetables.

Visit https://raft.net to view the following related activities!

Binder Cover Solar Collector
Reason for the Seasons
Shadow Play
Time for Shadows
View Binder Sundials

Resources

- YouTube video (3:11), National Geographic - https://bit.ly/3aqstqY
- Comprehensive solar cooker plans - http://solarcooking.org/plans/