



PLASTIC CUP SOLAR PROJECTOR

TEKS - ASTR 2021

1C - use appropriate safety equipment and practices during laboratory, classroom, and field investigations as outlined in Texas Education Agency approved safety standards;






1D - use appropriate tools such as gnomons; sundials; Planisphere; star charts; globe of the Earth; diffraction gratings; spectrosopes; color filters; lenses of multiple focal lengths; concave, plane, and convex mirrors; binoculars; telescopes; celestial sphere; online astronomical databases; and online access to observatories;

OBJECTIVE

Students will make a solar projector in order to safely view the Sun before, during and after the eclipse using Safe solar projection methods.



MATERIALS

- Plastic or paper Cup (opaque) 
- Tape 
- Lenses from reading glasses. (Include various  magnifications e.g. 1X, 2X - sometimes called “power”)
- Scissors or something else to punch a hole in the cup. 
- White paper or card for projection 

MAKING THE SOLAR PROJECTOR

STEP 1:

Using the scissors and cut out/poke a hole about 1 cm in diameter into the bottom of your cup.



STEP 2:

Using the lens from the reading glasses and tape. Secure the lens onto the bottom of the cup over the hole from step one.



STEP 3:

While outside on a sunny day turn the cup upside down so the lens is facing the Sun. Project the image onto a sheet of white paper.

*Based on the power you will need to move the cup closer or further from the paper to get the image clear ("in focus").



INQUIRY:

Using cups with various magnifications test to see how far away the image is in focus from the paper for various powers.

- Which power produces the largest image?
- Which power has the image in focus farthest away?
- What is the relationship between power and the distance to the image?
- How might you get an even bigger image?



TEACHER GUIDE

CAUTIONS:

The cups are only used for PROJECTION ONLY. Do not allow the students to look at the sun through them. Lenses mounted curved side out.



INQUIRY ANSWERS:

The largest image is from the lens with the LEAST power (e.g. 1X image is bigger than 2X). It is also the one with the image in focus farther away. The higher the power, the shorter the focal distance. The “focal distance” is one divided by the power, in meters. So, to get a bigger image you want a lens with a smaller power. The “power” of a lens is measured in “diopters”, which is $1/m$.

EXTENSION:

Use a 0.5 power lens to make a projection telescope. 0.5X reading glasses can be ordered from Amazon, or you can find “2000 mm FL” lenses from an optical house.

For the tube, use a mailing tube or a roll of an old poster. Length 60-100 cm, diameter 6-8 cm. Tape the lens on one end with opaque tape, leaving a ~1 cm hole in the center uncovered (doesn't have to be round!). The bigger the hole, the brighter the image but the harder it is to focus. The lens allows a bigger hole so much brighter image than a pinhole projection. The telescope will project a ~2cm image at a distance of 2m.

