Build Your Own Eclipse Viewer

Safety Warning: Never look directly at the Sun because it can harm your eyes.

Ages

- 8 and up

Activity Time

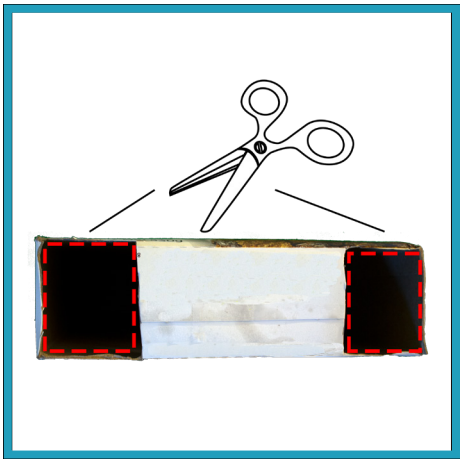
- 20-40 minutes

Materials

- Cereal box or rectangular box
- Tape
- Aluminum Foil
- White paper
- Scissors or craft knife
- Strip of white paper
- Small pointy object (such as a pen, pencil, or thumb tack)

Materials

Instructions



1. On one short side of your box, cut two holes with your scissors or craft knife. If necessary, secure this side of the box with tap to hold it together after cutting.

2. Cover one of the holes with foil and secure it with tape.

3. Poke a small hole in the center of the foil using a pen, pencil, or other small pointy object.

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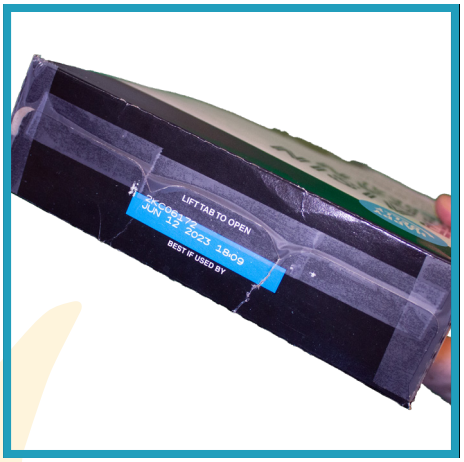
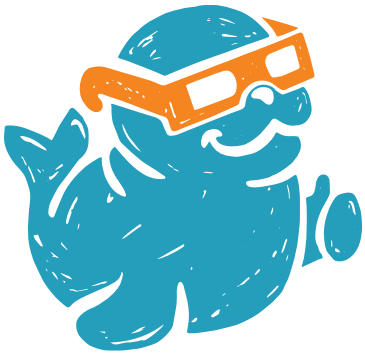
4. Using the short side of your box as a guide, trim a strip of white paper so that it is slightly smaller than the short side of the box. This will ensure that your piece of paper fits into the inside of your box without getting crumpled.

5. Tape your strip of white paper inside the short edge of the box opposite from the side you cut the holes in step 1.



6. Seal this end of the box with tape along all edges. This will help prevent light from leaking into your eclipse viewer.



7. You've now completed your eclipse viewer! Take it outside to safely view the Sun.

You can use your eclipse viewer to safely view the Sun by standing with your back to the Sun and aiming the foil pinhole toward the Sun. Adjust the angle of your eclipse viewer relative to the Sun until you see an image of the Sun projected onto the piece of paper on the opposite side of the box! By projecting an image of the Sun using only a small fraction of the Sun's light, you can safely watch as the Sun is covered by the moon during an eclipse!

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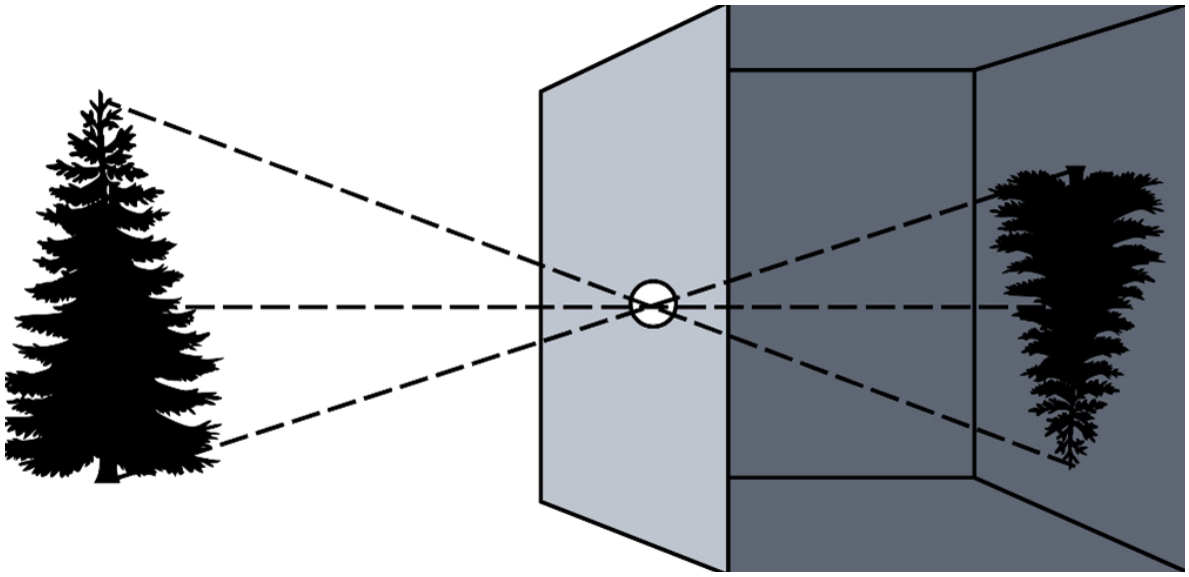
Eclipse Viewer Science Guide

Viewing a solar eclipse is fun and exciting! But how do we view solar eclipses safely when looking directly at the Sun can cause permanent damage to our eyes? One of the safest ways to view an eclipse is by projecting an image of the Sun through a pinhole projector.

Pinhole projectors work by focusing light through a tiny pinhole known as an aperture to create a simple lens, as in the diagram below. Light travels in a straight line, so the light reflecting off the tree is focused through the aperture on the box. By focusing this light, the tree can be projected from the pinhole onto the back of the box.



Above is a diagram of a simple pinhole projector. The light reflected from the tree on the left is focused through the pinhole aperture and reflected in reverse onto the back of the box.

Note how the projected image of the tree is upside down relative to the tree itself. As the light reflects off the tree and is focused through the aperture, the light from the top of the tree is reflected downwards and the light from the bottom of the tree upwards. This image inversion happens in all light that travels through a lens such as in cameras or even our own eyes. Cameras use mirrors or prisms to re-reverse this image so it is right side up before recording the image. Human brains must compensate for the upside-down images received from our eyes and use special organs in our ears to correctly orient the images we are seeing with the way we are looking at them!

Pinhole projectors, or pinhole cameras, are a variation of one of the oldest types of photographic devices called a camera obscura, a Latin phrase that means “dark chamber.” These devices have been used not just to project eclipses but have had other uses throughout history. Renaissance painters used cameras obscura as drawing aids. Ancient Chinese texts describe sundials with a pinhole aperture that would project an image of the Sun to indicate the time of day. Some archeologists even believe that paleolithic peoples may have used a camera obscura to aid in the creation of early cave paintings!

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Eclipse Viewer Engineering Design Challenge

Making a Solar Viewer Out of Any Box

You can challenge yourself to make an eclipse viewer from any box in four steps! To complete this challenge, you need to include the three essential elements of a camera obscura eclipse viewer:

1. **Projection Screen**
2. **Aperture**
3. **Viewing Window**

The projection screen can be any non reflective and light colored material (*construction paper, wax paper, a cutout from an old white t-shirt*) and should be attached firmly to the side of the box opposite from the aperture. The aperture is the small hole (*or lens*) that the light from the Sun will be focused through to project onto the projection screen and can be made by poking a small hole in your box or covering a larger hole in your box with an opaque (*non-see-through*) material and poking a small hole through the material. Remember, the aperture and projection screen MUST be opposite to each other. The viewing window can be cut anywhere on the box and should be large enough to view the projection of the Sun but small enough and in a position on your box that doesn't allow light to spill over onto your projection.

Four Step Challenge

Build a solar viewer with these four steps:

1. Select your box.
2. Create your projection screen.
3. Create your aperture and viewing window.
4. Project the Sun into your viewer!

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Tips and Tricks

- Does your box have open gaps that might allow light into your viewer? Consider covering those with duct tape or dark paper so that the only light entering your viewer is from the aperture.
- Place your viewing window in an inconvenient place on your box? You can always cover that first attempt with foil, black paper, or duct tape and cut a new one in a better position!
- The example diagram shows an aperture made by covering a large hole opposite the projection screen with aluminum foil and poking a small hole in it. You can use any material that blocks light to make your aperture like black paper, a thin piece of dark plastic, or duct tape.
- How do you think using differently sized boxes might change the way your solar viewer projects an image of the Sun? What do you think would happen if you use a shorter or longer box? Make many versions of this solar viewer and find out!