



ECLIPSE CLASSROOM ACTIVITIES

CREATE A MILK CARTON CAMERA TO OBSERVE THE ECLIPSE!

OBJECTIVES

- Develop an understanding of how light rays can project a photographic image
- Be able to explain how a pinhole camera works
- Have fun and impress others with your fascinating creation

TIME FRAME

- Once you have the materials, the activity takes no longer than about 30-40min
- Plan to build at least a day or two prior to the eclipse
- You can also do this activity at any other time, unrelated to the eclipse.

Warning: You must never look directly at the Sun, even when it is partially blocked by the Moon. Use your pinhole camera only to project sunlight through it; do not look through it toward the Sun. You can, however, view the eclipse with special eclipse glasses, described in our safe viewing guidelines.

GET EXCITED!

What better way to safely capture the beauty of the total solar eclipse this summer than with a camera that you create yourself! Through creating a camera of your own, you will learn how photos are able to be captured at the most basic level. You will also see how light travels in straight lines and becomes inverted when it passes through a small hole. It is surprisingly simple to make a camera of your own, so let's get started!

Note: This activity helps you build what is known as a pinhole camera. It is a "camera" because it makes an image, but it is an image that you can see only when you actually use the camera, since it will not be recorded on any film or electronic detector.

WHAT YOU'RE GOING TO NEED

- A ½ gallon milk or juice carton (paper cartons, not plastic)
You may want more than one carton, in case you poke too big of a hole and decide to start over.
- **Wax paper**, enough to cover the top of the milk carton
- **Scotch or masking tape**
- **A safety pin** (works best) or comparable pointy object to poke a hole
- **A bright flashlight or flood lamp**
- **Aluminum foil or reflective object** (metallic objects work great!)





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BUILDING YOUR CAMERA

STEP 1 - GATHER THE MATERIALS

- Gather the materials you need to make your camera (listed above).

STEP 2 - CREATE THE CAMERA

- Cut off the portion of the milk carton with the pour spout like this:



- Place your wax paper on a flat surface and place your milk carton (with the open side face-down) over it, so that the wax paper covers the opening completely. Cut the excess wax paper, leaving just enough around each side of the milk carton so you will be able to tape it to the carton.
- Turn the carton over and carefully tape the wax paper over the open top. Be careful not to allow any wrinkles or creases in the wax paper. This is very important because the wax paper is where you will see your image. Also make sure your tape is on the *outside* edge of the carton (not on the front face), like this:



*Be careful not to
wrinkle the wax paper*

Tape on the outside



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- Use the safety pin or pointy object to poke a very small hole at the other end of the milk carton. Make sure the hole is in the center like this:



- The hole should be no bigger than the width of the pin you use. Make sure the hole is a clean hole. We don't want anything distorting your image on the wax paper!

STEP 3 - EXPERIMENT WITH YOUR CAMERA

- In a dark or dimmed room, find an object that reflects light well and shine a flashlight or flood light on the object. (Alternatively, you can simply point your camera at a lamp, lightbulb, or any object that shines brightly.)
- Take your milk carton camera and point it at the lit up object so that the pinhole end faces the object and the wax paper end faces toward you, like this:





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- Look at the wax paper end and you should see an image of your object! Note: If you don't see anything, it probably means your image is out of focus. In that case, try moving your camera closer to or farther from the object. If you still are not seeing any image on your wax paper, then you may have too big a hole or something blocking your hole. Don't get discouraged, it takes a little practice.



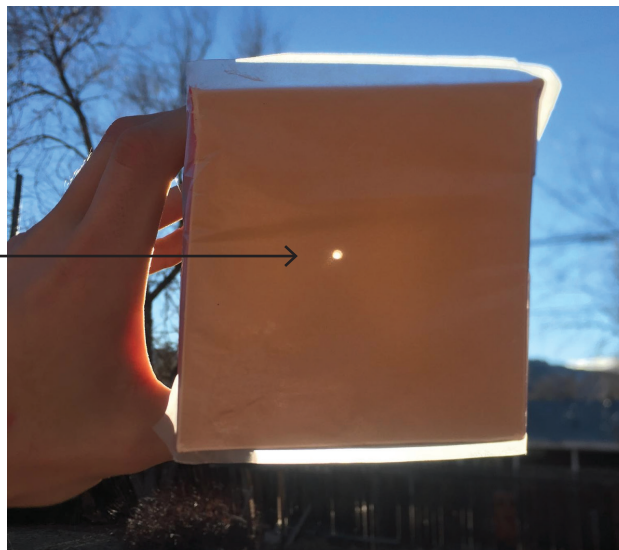
← *Amazing! You should see an inverted image on your wax paper.*

- Once you know your camera works for forming images, take it outside and test it with the Sun:

Hold the milk carton so the pinhole is facing the Sun and a tiny image of the Sun appears on the wax paper end. **Warning:** Do not look through the wax paper and hole directly at the Sun; instead, hold your camera so you can see the image on the wax paper without looking through it toward the Sun.

Note: All you will see on a normal day is a circular image of the Sun, which may make you think it is because of the circular hole. But it's an actual image, as you'll see more clearly on eclipse day!

Adjust the size of the pin hole to get a larger projection of the sun.





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USE YOUR CAMERA DURING THE ECLIPSE

STEP 4 - BRING YOUR MILK CARTON CAMERA ON ECLIPSE DAY!

- On eclipse day, use your camera the same way you did in testing it outside. That is, point the milk carton with the pinhole facing the eclipse, so that you can see the image displayed on the wax paper without looking toward the Sun.
- As the partial eclipse progresses, you should be able to see the Moon gradually covering more and more of the Sun.
- If you are not getting a clear image of the partially eclipsed Sun, then your hole may be too big.
- Note: For eclipse day, it is actually easier to simply project images through pinholes onto the ground or other sheets of paper – see the Pinhole Art Activity. However, it's still fun to have built a milk carton camera, which you can continue to use and experiment with for other purposes.

EXTENSIONS

FURTHER EXPERIMENTATION AND REFLECTION ON YOUR CREATION

- Are there ways to improve upon this design to make the image appear sharper/clearer? Less blurry?
- Why does the pinhole size matter for your camera? What does changing the size do to your image?
- Learn more about how your camera forms an image on the wax paper. Why is the image inverted (upside down)?
- Our eyes form images in much the same way as the pinhole camera. Instead of passing through a pinhole, light enters our eyes through the opening called the pupil. Instead of forming an image on the wax paper, the light coming through your pupil forms an image on the retina in the back of your eye. This means that, just as with the pinhole camera, the images formed on our retinas must be upside down. So why don't we see the world upside down?

REFLECT ON THE ECLIPSE

- Were you able to see an image of the Sun being covered by the Moon on your wax paper?
- If not, why do you think that is? How can you improve your camera?
- Ask yourself how the Moon covers the Sun like that. How often does this happen?
- Why are there eclipses in the first place? Learn more about eclipses and the difference between solar and lunar eclipses. When you next be able to observe some type of eclipse?



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BUILD A WORKING PINHOLE SHOEBOX CAMERA!

If you enjoyed this activity...

The following YouTube video will show you how to build a pinhole camera that can actually take and record pictures (including the eclipse). The process is more challenging but well worth the effort!

Link here - <https://www.youtube.com/watch?v=CDm1Mpixjuw>

CREATE A DYNAMIC WORK OF ART USING PINHOLES!

The following is a link to another fun activity related to this concept - https://docs.google.com/document/d/1YsK3R_0Ev9jLSKRUs4sVxRG5Xrpm8rIGdIIKM_zJ2JQ/edit#heading=h.4rcnvbezvxs

*NGSS STANDARDS FULFILLED

- Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost. 3-5-ETS1-1
- Develop a model to describe that light reflecting from objects and entering the eye allows objects to be seen. 4-PS4-2