



Activity 1: DIY Telescopes

Introduction

Telescopes take our eyes beyond Earth to the stars and planets of the night sky. The curves of a telescope's glass or plastic lenses make this possible. The curved surface bends light — or **refracts** it — and the light changes direction. This change in direction makes objects seen through the telescope's lenses seem bigger than they really are.

The refracting telescope uses **lenses** to bring more light rays to a focus in your eye. Kids can make a simple refracting telescope with a tube that contains two lenses: one at the front end which gathers light, called the **objective lens**; and another that is closest to the user's eye, called the **eyepiece**. The objective lens collects the light. The eyepiece lens takes the collected light and **magnifies** what you are looking at.

Supplies (for each telescope)

- A pair of weak reading glasses — the kind you can get from the drugstore
- A small, strong magnifying glass
- Heavy cardstock or cardboard tubes, about 10-12 inches long, with a diameter slightly larger than your magnifying glass lens
- Masking tape
- Scissors

If kids working will be working in small groups, be sure to have enough of items 1-3 for each group.

Get kids thinking

To observe objects in space, you need to get a closer look! **Ask kids:** Why can't you see things that are very far away? What can you do to observe things that are far, far away? What kinds of tools or technology do you know about that can help you take a closer look at objects that are very distant?

Kick off discussion with older kids with this TED-Ed video: *The Story Behind Your Glasses*
<https://ed.ted.com/lessons/the-story-behind-your-glasses-eva-timothy>



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Let's get started!

Have kids look at the supplies you've provided for making a refracting telescope. Explain what the lenses are. Talk about how a telescope works and discuss what kinds of information telescopes provide about the solar system and beyond.

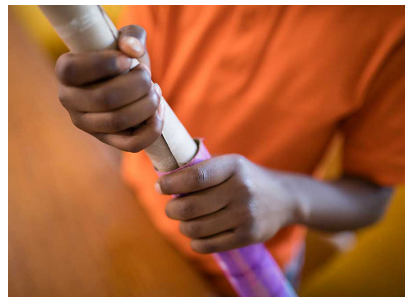
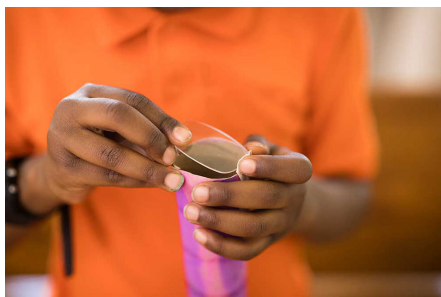
Let kids play a role in engineering their telescope. Explain that the tube that holds the lenses is really two tubes — one that fits inside the other — that need to have openings that can hold the lenses. **Ask kids:** Will the lenses fit into the bottom of the cardboard tube? How can they make them fit?

Experiment together to either narrow a tube by cutting along its length, making the tube smaller as it is fitted around the lens and then taped into shape, or to create a larger tube by rolling cardstock to the diameter of the lens and taping it into shape.

Warning: Never, under any circumstances, should kids point their telescope at the sun. The ultraviolet (UV) rays from the sun will permanently damage their eyes.

Once everyone understands how to make tubes and safe use of the telescopes, provide these instructions for making the telescope:

1. Form a tube for the stronger lens (your magnifying glass). The lens should be at the bottom of the tube and with the edges of the lens taped neatly to the tube to keep it secure. This is the telescope's eyepiece.
2. Form a tube for the objective lens that is either bigger or smaller in diameter than your first tube. Tape the lens neatly to the end of the tube.
3. Insert the empty end of one tube into the empty end of the other tube. Look through the eyepiece and point the other end of the telescope at a distant object. Slide the two tubes in and out until the object comes into focus. If it is difficult to focus the telescope, experiment with lengthening the tube.



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Ask kids: What do you see? Are you surprised to find things upside down?

To help kids think more about why images appear upside down, have them look at their reflection in a spoon and talk about the similarities between the curve of the spoon and the way light is curved through the lens of their telescope.

Do kids have ideas for how they could make their telescope more effective or powerful?
Not show upside-down images?



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More telescope and astronomy activities

Make Your Own Hand-Held Hubble

http://hubblesite.org/the_telescope/hand-held_hubble/

Observing with NASA

<https://mo-www.cfa.harvard.edu/OWN/index.html>