

I...A Simple Magnifier.

Introduction

Why do scientists use instruments? To help people understand the world around them, scientists use instruments. These instruments are extensions of human tool-making abilities to extend our senses and often to greatly amplify them. A magnifying glass is one simple instrument. High-tech satellites often contain more complex ones. Specific instruments are "fine tuned" by scientists to communicate only the information that is needed. This lesson will focus on why scientists needed to develop instruments through hands-on experiences making some basic scientific instruments. Throughout this unit the students will be completing activities that will provide models for the scientific instruments currently in use on the IMAGE satellite that was launched March 25, 2000.

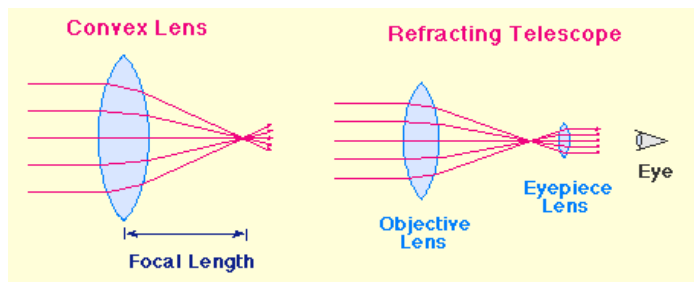
Materials

3 x 5 index card with 1 inch hole cut out
Clear tape
Water
Clear glass bottles and jars
Old magazines or newspapers



Objectives

- The students will explore how a scientist develops tools in order to learn more about the world.
- The students will use hands on experiences to make scientific instruments and to alter them to "fine tune" what information the instrument can communicate.



Telescope materials -

Option 1: Two convex lenses- 38mm dia./(two different FL) DCX Lens work well (Edmund Scientific <http://www.edsci.com>)

Two mailing tubes (different diameters)
Manilla folder
Scissors

Option 2 Edmund Scientific has a Refractor Telescope Kit that includes lenses, tubes and everything else needed for \$16.95 - if you order online, there is a discount for multiple items

Option 3 The Astronomical Society of the Pacific (1-800-335-2624) has a kit with 10 telescopes for \$64.95 (KT 103) with all of the necessary parts for constructing simple refractors.

Procedure:

- In this activity the students will see that water, bottles, and jars can act as magnifiers. Sometimes instruments are developed by accidental discovery, to see how this happens, you will need to have a "accident" occur in the classroom. Have newspapers or magazines on a desk or table, and have an overhead film sheet on top. "Accidentally" spill some water on the transparency sheet and see if any of the students can notice something that has occurred. They should notice that where the water drops are, the print is slightly larger. The students should be able to reproduce this effect by placing a piece of clear tape across the hole in the index card. Students should have the newspaper or magazine on a flat surface and be holding the index card over it. Carefully place a drop of water on the tape, and have the students look down at the newspaper through the water. Does the print look different? The students should continue to experiment with the amount of water on the index card, the distance between the water and the print, and the distance the card is from the eye. The students should write about their observations in their learning logs or in chart form. Here is a sample chart

When I	I saw that	I learned that
_____	_____	_____

- Continue the "accident" approach by leaving a glass bottle close to the newspaper or magazine. Mention that you have noticed something else that is interesting, and see if the students can describe what they think is happening. Have the students explore on their own whether glass jars and bottles can also act as magnifiers. Direct the students to find out whether the shape of the glass influences the magnification, whether the distance between the glass and the print changes the magnification, and whether adding water to the jar or bottle would make a difference. The students should also explore how the print is changed with the different magnifiers. Then have a discussion to see why the water and some of the bottles were able to magnify the print. The students should write about their observations in their learning logs or in chart form.
- Now that the students have seen that glass bottles can act as magnifiers, initiate a discussion with the students about what scientific instruments they have seen that operate like the glass bottles. Hopefully the students will mention, magnifying glasses, microscopes, and telescopes. All of these instruments use glass lenses to help scientists see things that could not be seen in as much detail without these instruments. Continue the discussion to include why scientists had to "fine tune" basic instruments to find them useful. Use the example of why a scientist would need to develop a more convenient method of magnification, than carrying around a glass bottle, especially when viewing objects far away in the sky. The next activity is for the students to build a simple instrument, the telescope. Students should write the procedure they used to build a telescope. As they write the steps, they should include hints to the readers for successful completion of a telescope. There are two options on how to complete this project.

(Option 1 - Instructions) The students should take the lens that has the shortest focal length, and construct a manilla folder "frame" that will hold the lens inside the cardboard tube with the smallest diameter, this will be called the eyepiece lens. (The frame is a circle of folder that has its outside diameter the same as the diameter of the smaller cardboard tube, and its inside diameter the same as the diameter of the lens- it will look like a washer when completed.) Then construct a manilla folder frame that will hold the lens with the longer focal point inside the larger diameter cardboard tube for the objective lens. Slide the two tubes together. You can look through the eyepiece (smaller tube) and slide the tubes in and out until you have a clear image.

(Option 2 - Instructions) Use the directions in the Refractor Telescope Kit to construct your telescope.

Conclusions:

The students will explore why scientists developed new instruments to learn more about the world. These early instruments were changed to allow the scientist to find out specific information in his or her field of study. The students will explore how a scientist needed to make modifications to these instruments as new information was needed.