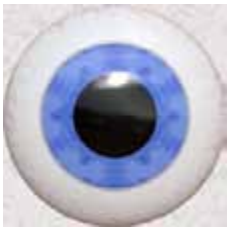
Optics: Light and Lenses

OBJECTIVES

1. Understand the basics of how an eye works.
2. Determine the focal point of a converging lens works.



WHAT YOU NEED

Part 1: Making a pinhole camera

- Cardboard/shoe box
- Black cardboard
- Transparent/tracing paper
- Aluminum foil
- Electrical tape
- Drawing pin
- Scissors

Part 2: Crossing light through a lens

- Glass jar
- Water
- Sheet of white paper
- Shoe box
- Stanley knife
- Torch
- Darkened room

WHAT TO DO

Part 1

1. Use a shoebox or make a cardboard box from template.
2. At one end of the box cut a square hole 1.5cm x 1.5cm in the centre.
3. Cover this hole by taping a piece of aluminum foil over it.
4. Use the drawing pin to make a hole no bigger than 2mm wide. By careful to make the whole as “clean” as possible.
5. At the other end of the box cut a wider hole so that a 2cm edge of the box is remaining.
6. Attached the transparent paper to this end of the box using the tape.
7. Cut another piece of cardboard to cover the viewing end of the box. This should be ~10cm wide and the length should equal the length of the box plus 5cm either side to bend down the side of the box.
8. Point the pinhole end at an Exit sign in the room or a well light object eg. A candle or light coming in through the window.
9. You should see an image on the viewing side of the camera.

TIP: When looking at an image through your pinhole camera make sure you are in a dark area and the object you are viewing is well light. Eg. Inside a dark room looking outside a window to a sunlight area.

Part 2

10. At one end of the shoebox, cut two slits in the middle about 2.5cm apart.
11. Place the white paper in the shoebox and place the glass of water ~1/3 toward the slits.
12. Turn off the lights and shine the torch through the holes.
13. Measure the distance from the glass to where the light crosses (focal point).

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QUESTIONS

1. In part 1, is the image projected on the viewing screen right side up or upside down? Explain.
2. In part 2, where does the focal point appear?
3. What factors would affect/change this focal point?
4. How do you think our eye adjusts its focus?

REAL WORLD APPLICATIONS OF LIGHT AND LENSES

Human vision. The human eye contains a flexible lens. As people age, the lens becomes less flexible, making it difficult to refocus the eyes from close objects to far objects. People with such problems often require corrective lenses or glasses.

The compound microscope uses a lens to produce an enlarged real image which is then magnified as a virtual image through the eyepiece.

Lighthouses. The beam from a lighthouse is only effective if is projected as a focused, parallel beam, which is achieved by placing the light source at the focal length.