

Laboratory #7
Pinhole Physics

In the early days of photography an inexpensive form of camera was made with just a small opening (a pinhole) in a cardboard box and a sheet of film. In today's lab you will have the opportunity to discover how such a camera would work by playing with light which passes through a pinhole. You should read through this entire write-up before beginning the lab and, while doing so, try to anticipate what will happen. In fact it is a good idea to figure out the answers to the questions before actually making the appropriate observations. All of the questions in this write-up should be answered in the lab book—but give the answer in the form of a complete sentence—not just a “yes” or “no.”

In groups of three or four, you will have a sheet of aluminum foil, a pin for making a hole in the foil, and an unfrosted light bulb—unfrosted so that you can see the filament. Use a sheet of paper for a screen.

First measure the size of the filament to the best of your ability. This size is called h_o .

Now, make a small hole in the foil and hold the foil between the light and screen. Let the light from the bulb go through the hole. In your lab book sketch the arrangement of the light, pinhole and screen. Also sketch what the “image” on the screen looks like. Is the image shaped like the hole? If, not what does its shape resemble?

Put the foil 20 cm from the light bulb, that distance is called d_o . And put the screen 20 cm from the foil, that distance is d_i . Measure the size of the image on the screen, the size is called h_i . Put these three numbers, h_i , d_o , and d_i in a table.

Make three more measurements of h_i , d_o , and d_i with the values of (d_o, d_i) being (20 cm, 40 cm), (40 cm, 20 cm), and (40 cm, 40 cm). And enter all of this data in your table.

On your sketch of the apparatus include the paths of some rays of light from bulb to image. By comparing similar triangles and using the data in your table find one simple mathematical equation which relates d_o , the distance from the object (filament) to the pinhole, d_i , the distance from the image to the pinhole, h_o , the height of the object, and h_i , the height of the image.

Is the image that you see rightside-up or upside-down? Figure out some procedure to test this experimentally and describe this in a sentence.

Make a half dozen holes in the foil, put some pretty close together. Note what the screen looks like.

Use the pin to make one hole rather large and note the size of the image. If the radius of the hole were exactly tripled, by how much would the image size change? What change do you observe when the hole is enlarged?