

CONCEPTUAL PHYSICS**Activity**

27.6 Light: Shadows

PINHOLE CAMERA

Purpose

In this activity, you will observe images formed by a simple convex lens and compare cameras with and without a lens.

Required Equipment and Supplies

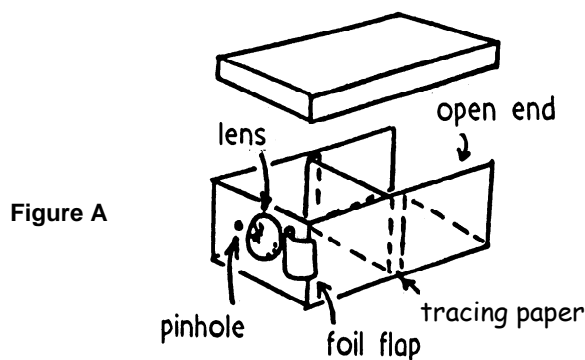
covered shoebox
25-mm converging lens
tracing paper
aluminum foil
masking tape

Discussion

The first camera used a pinhole opening to let light in. Because the hole is so small, light rays that enter cannot overlap. This is why a clear image is formed on the inner back wall of the camera. Because the opening was small, a long time was required to expose the film sufficiently. A lens allows more light to pass through and still focus the light onto the film. Cameras with lenses require much less time for exposure, and the pictures came to be called “snapshots.”

Procedure

Step 1: Construct a camera as shown in Figure A. It is a shoebox with a hole about an inch or so in diameter on one end, some tracing paper taped in the center to act as a screen, and an opening for viewing the screen on the other end. Tape some foil over the lens hole of the box. Poke a pinhole in the middle of the foil. Point the camera toward a brightly illuminated scene, such as the window during the daytime. Light enters the pinhole and falls on the tracing paper. Observe the image of the scene on the tracing paper.



1. Is the image on the screen upside down (inverted)?

2. Is the image on the screen reversed left to right?

Step 2: Now remove the pinhole foil and tape a lens over the hole in the box. You now have a lens camera. Move it around and watch people or other scenery.

3. Is the image on the screen upside down (inverted)?

4. Is the image on the screen reversed left to right?

Step 3: Unlike a lens camera, pinhole cameras focus equally well on objects at practically all distances. Aim the camera lens at nearby objects and see if the lens focuses them.

5. Does the lens focus nearby objects as well as it does on distant ones?

Step 4: Draw a ray diagram as follows. First, draw a ray for light that passes from the top of a distant object through a pinhole and onto a screen. Second, draw another ray for light that passes from the bottom of the object through the pinhole and onto the screen. Then sketch the image created on the screen by the pinhole.

Summing Up

1. Why is the image created by the pinhole dimmer than the one created by the lens?

2. How is a pinhole camera similar to your eye? Do you think that the images formed on the retina of your eye are upside down? Your explanation might include a diagram.
