30

Computer Activity: Lenses

Thin Lens

Purpose

To acquire a qualitative understanding of concave and convex lenses.

Required Equipment and Supplies

Good Stuff software
Apple II Series computer
convex lens
concave lens

Discussion

Before studying about lenses in your text, some hands-on experience is important for understanding them. This activity should help you see some of the interesting properties of different lenses.

Procedure

Boot the *Good Stuff* disk and select the program "Thin Lens." Select the option for converging lens. A ray diagram consisting of an object arrow and its image as formed by the rays will appear as shown in Figure 30.1. The *focal length, f,* of the lens is the distance from its center to the point where parallel light along the lens axis (principal axis) converges to a *focus*. Initially, the object and image are located at a distance $2f$ from the lens. Use the arrow keys to move the object along the principal axis. Is it magnified or reduced, compared to the object? Is the image *erect* (right-side up) or *inverted* (upside down)? Can the image be projected (a *real* image) or not (a *virtual* image)? Are there places where images are not formed at all? Record your observations as to the nature of the image you observe on the computer in the data tables for each kind of lens. Check to see how the image on the screen corresponds to images formed by real lenses in your hand!

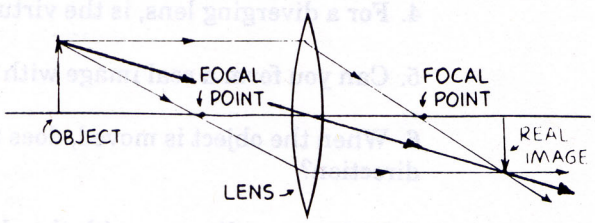

Figure 30.1

Data Table 30.1

NATURE OF IMAGE - CONVERGING LENS			
POSITION OF OBJECT	REAL OR VIRTUAL	MAGNIFIED	INVERTED OR ERECT
BEYOND 2f			
AT 2f			
AT f			
WITHIN f			

Data Table 30.2

NATURE OF IMAGE - DIVERGING LENS			
POSITION OF OBJECT	REAL OR VIRTUAL	MAGNIFIED	INVERTED OR ERECT
BEYOND 2f			
AT 2f			
AT f			
WITHIN f			

Analysis

1. Where, in relation to one focal length from the lens, is the object when the image appears right-side-up (erect)?

2. What is the relative size of the image (magnified or reduced) compared to the object? Is the image real or virtual? (If it's real, it can be projected on a screen of some kind. If it's virtual, it cannot.)

3. Can the object be located in a position where a real image is not formed?

4. For a diverging lens, is the virtual image enlarged or reduced?

5. Can you form a real image with a diverging lens?

6. When the object is moved, does the image always move in the same direction?

7. Make a ray diagram with the object at $2f$. Show the location of the image formed by the lens. If o is the distance from the lens to the object, and i is the distance from the lens to the image, use the thin lens approximation to derive the formula $1/f = 1/o + 1/i$.