Chapter 10  Lenses and the Eye

In this chapter, the study of refraction is first applied to lenses, and then students are introduced to image formation in pinhole cameras, converging lenses, and diverging lenses. The chapter concludes with applications to human vision and vision defects.

BACKGROUND INFORMATION

Lenses are a very important application of the concept of the refraction of light. The terms “convex lens” and “concave lens” do not convey in any obvious way how the lenses manipulate light; therefore, the terms “converging lens” and “diverging lens” are used throughout these sections.

Related Background Resources


Nelson Web site: www.science.nelson.com for specific Web links

PLANNING

Suggested Time
Try This Activity—20 minutes

Core Instructional Resources

• Solutions Manual
• Colour Transparencies
• Lab and Study Blackline Masters
• Reference to the Appendixes

TEACHING SUGGESTIONS

TRY THIS ACTIVITY

Magnifying Effect of Liquids in Cylinders

• The purpose of this activity is to expose students to simple situations in which magnification occurs. It is also a diagnostic activity. It can be used to consolidate knowledge and skill from Chapter 9.

BEFORE

Teacher Preparation

Time:  20 minutes

Materials and Equipment:

Each group of two or three students will need graduated cylinder 250-mL, 500-mL, and 1000-mL beakers pencil or straw thermometer

Try This Activity

• Small children often look through water-filled glasses to see how objects on the other side are magnified. Older students use thermometers in science class, yet many may not realize that the bore is magnified due to the shape of the glass.
• The liquid produces an image that is virtual and bigger than the object. Students should draw a ray diagram viewed from above. They should choose two points on the object, A and B. Angles and the size of the eye should be greatly exaggerated so that the rays are clearly visible. If the eye were drawn to scale, the rays would be so close together that refraction at the curved surface of the cylinder near the eye would not be visible. Similar ray diagrams may be drawn for situations in which the object is placed in the centre of the cylinder or behind the cylinder.

To draw diagrams like this efficiently, students should follow these steps:

1. Draw the cylinder and position of the object.
2. Estimate the position and the size of the image.
3. Draw the image.
4. Select two points on the object, A and B, and label their locations on the image A’ and B’.
5. For each point A’ and B’ on the image, trace two rays back to the eye.
6. Where the rays intersect the cylinder on the side of the eye, draw rays to the object points A and B.
7. Use dotted lines and arrows where necessary. Draw normals at points of contact using the centre of the cylinder as a guide.
Safety and Disposal:
• Students may spill water. Be prepared with paper towel.

Assessment:
• The activity can serve as a diagnostic tool. First, it will indicate how well students can draw ray diagrams for new situations. Second, it may reveal how much students understand magnification.

Student Preparation
• No preparation is required.

DURING
• Since the pencil may be considered to consist of many points, students may have difficulty getting started with their ray diagrams. Suggest choosing a single point on the pencil. Two rays drawn from the selected point can then be used to locate the position of an image point. Alternatively, suggest the procedure mentioned in Teaching Suggestions, above.

AFTER
• Show students the Blackline Master: Magnifying Effects. It would be instructive for them to assess their own ray diagrams and, where applicable, attempt to understand why they were unable to draw correct ones.

Extensions/Modifications:
• Students can be challenged to
  • Make Jell-O lenses.
  • Predict the magnifying effects of shapes other than cylinders.
  • Predict which shapes magnify more than others.
  • Predict the above from the ray diagrams.