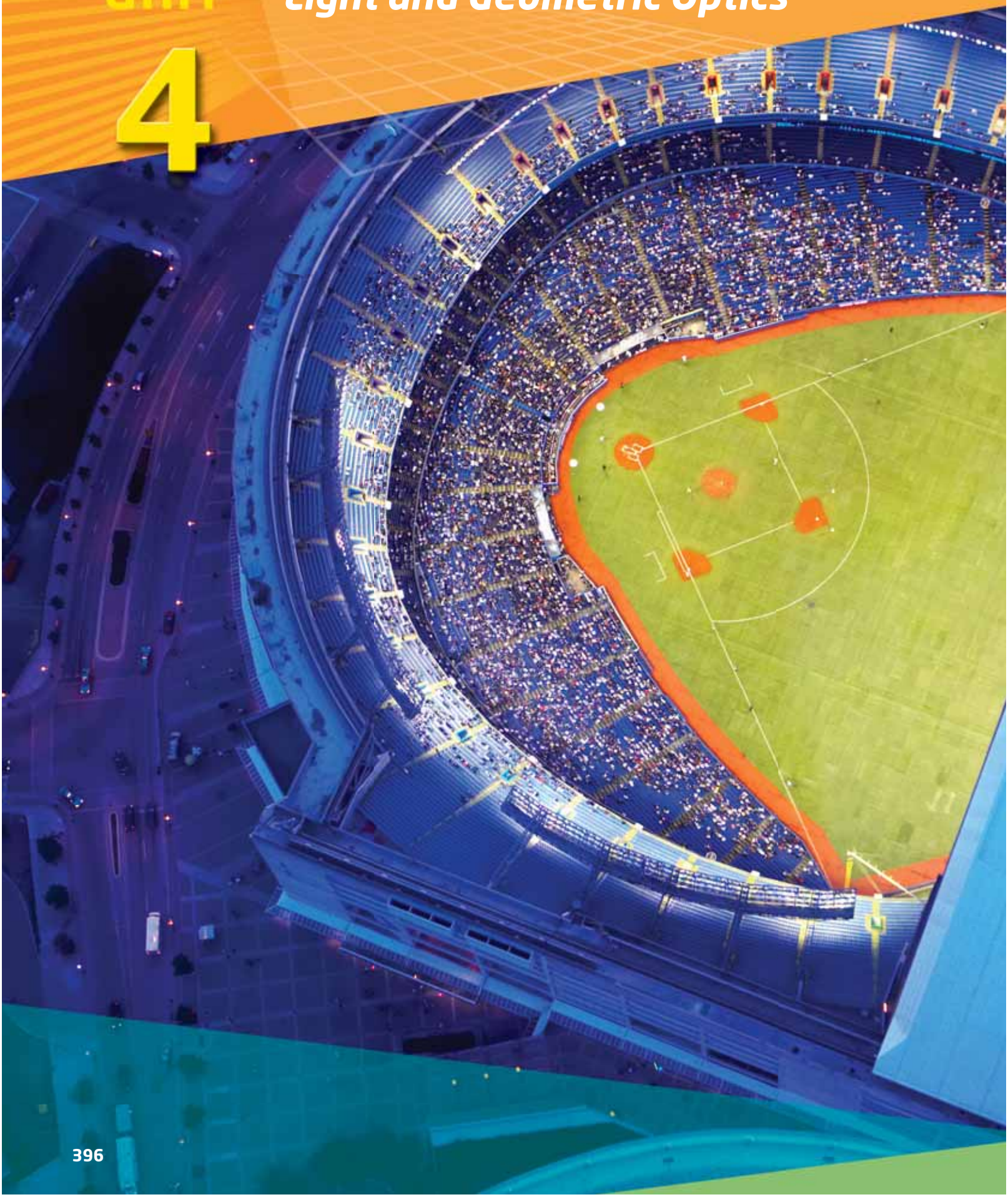
UNIT 4

Light and Geometric Optics



BIG IDEAS

- Society has benefited from the development of a range of optical devices and technologies.
- Light has characteristics and properties that can be manipulated with mirrors and lenses for a range of uses.

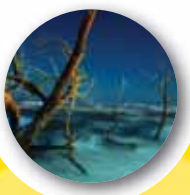
At one time, it would have been unthinkable for thousands of people to watch a sports event long after sunset. Today, our understanding of the properties of light has led to technologies that allow us to watch a baseball game at night, in a stadium lit up as if it were daytime.

But lighting outdoor spaces, such as stadiums, has drawbacks. It results in light pollution—a wasteful use of energy that disrupts the sleep of humans and the behaviour patterns of animals. Light pollution also interferes with astronomical observations and disconnects city dwellers from the night sky. Turning off the lights would be a solution, but this is often not practical. A more practical way to reduce light pollution is designing lights to illuminate only the intended area.

In this unit, you will learn about the properties of light and how understanding these properties has enabled scientists to develop optical technologies that benefit society.

How can lights be designed to limit light pollution in the surrounding areas?

Chapter 10
Light and Reflection



Chapter 11
Refraction

Chapter 12
Lenses and Lens Technologies

Get Ready for Unit 4

Concept Check

1. Examine the illustration below, and answer the following questions in your notebook.
   - **a.** Identify two sources of natural light and two sources of artificial light.
   - **b.** Name one source of natural light that is not shown in the illustration.
   - **c.** Name three sources of artificial light that are not shown in the illustration.
   - **d.** Identify six objects that reflect light.

2. Light is a form of energy, and it has specific properties. In your notebook, complete each sentence with a word from the box.

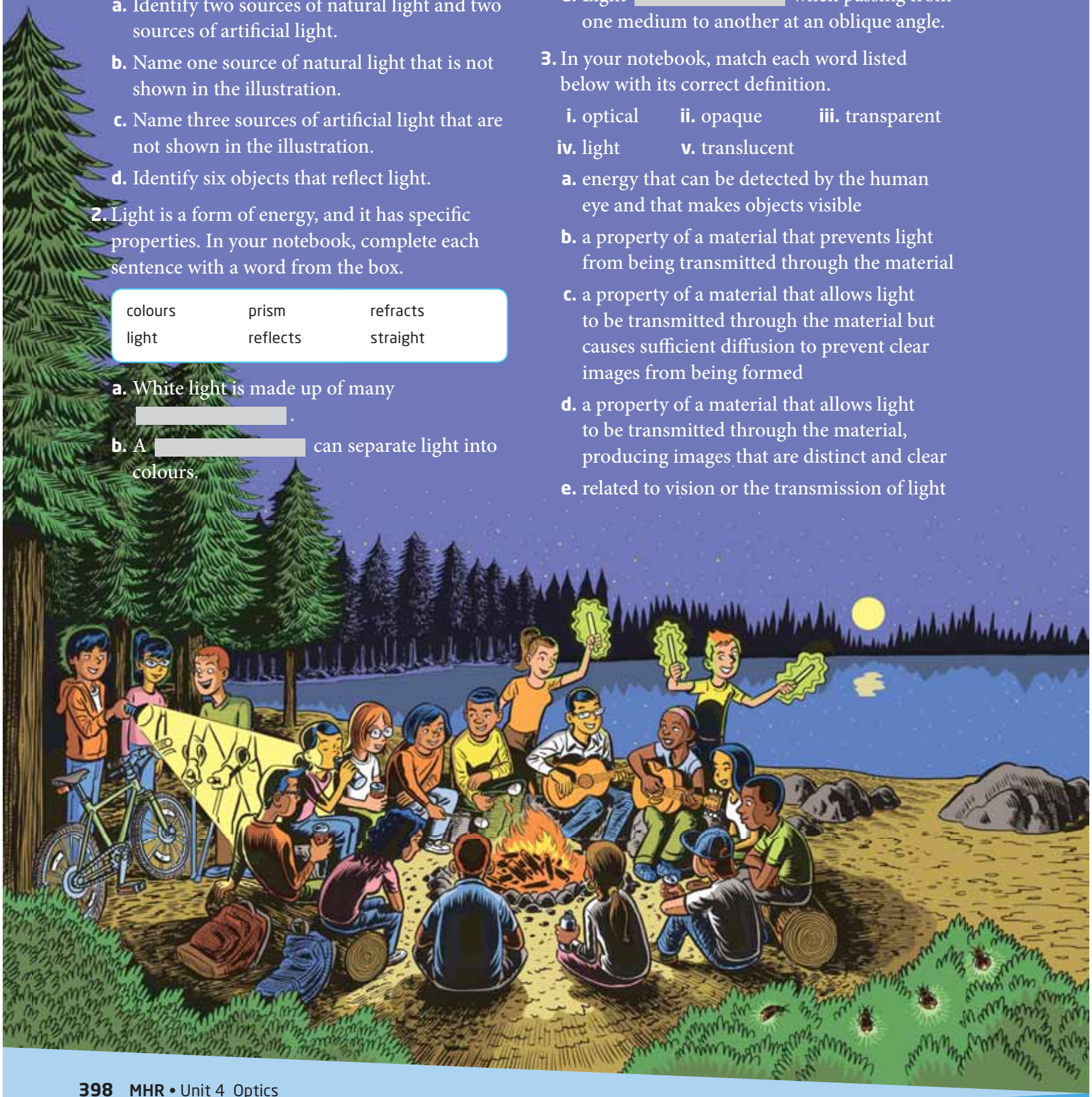
colours	prism	refracts
light	reflects	straight

   - **a.** White light is made up of many _____.
   - **b.** A _____ can separate light into colours.
   - **c.** Light travels in a _____ path in one medium.
   - **d.** Light _____ off shiny surfaces.
   - **e.** Light _____ when passing from one medium to another at an oblique angle.

3. In your notebook, match each word listed below with its correct definition.

i. optical **ii.** opaque **iii.** transparent
iv. light **v.** translucent

   - **a.** energy that can be detected by the human eye and that makes objects visible
   - **b.** a property of a material that prevents light from being transmitted through the material
   - **c.** a property of a material that allows light to be transmitted through the material but causes sufficient diffusion to prevent clear images from being formed
   - **d.** a property of a material that allows light to be transmitted through the material, producing images that are distinct and clear
   - **e.** related to vision or the transmission of light



Inquiry Check

4. Interpret Study the images shown below, which have different types of symmetry.

vertical symmetry

horizontal symmetry

vertical and horizontal symmetry

a. Print the letters of the alphabet, in capitals, in your notebook. Identify all the letters that are

i. vertically symmetrical

ii. horizontally symmetrical

iii. both vertically and horizontally symmetrical

b. Explain how your method for determining vertical symmetry differed from your method for determining horizontal symmetry.

5. Predict and Perform Examine the following words:

MOM DAD

a. Will these words read correctly from left to right in a mirror? Test your prediction.

b. What are the distinguishing features of words that read the same in a mirror reflection as they read from left to right on a piece of paper?

Numeracy and Literacy Check

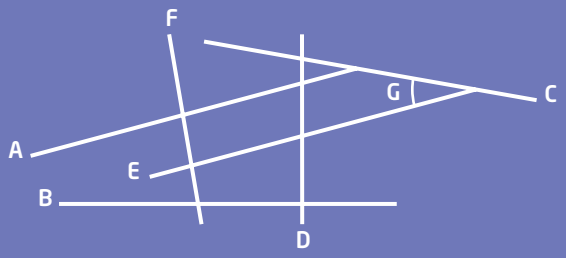
6. Identify In the diagram below, identify two lines that

a. are parallel to each other

b. are perpendicular to each other

c. intersect each other

Write your answers in your notebook.



7. Measure Angles Use a protractor and a ruler to answer these questions.

a. What is the measure of ∠G in the diagram?

b. Draw two lines that have an interior angle of 75°. Label the angle ∠A.

8. Categorize Words Put these words into three categories: *image, kaleidoscope, microscope, mirror, reflection, speed, straight, telescope*, and *beam*. Give each category a title, and explain your reasoning.

Looking Ahead to the Unit 4 Projects

At the end of this unit, you will have an opportunity to apply what you have learned in an inquiry or research project. Read the Unit 4 Projects on pages 522–523. Start a project folder now (either paper or electronic). Store ideas, notes, news clippings, website addresses, and lists of materials that might help you to complete your project.

Unit Project
Design a light tunnel to bring natural light to a windowless room.

An Issue to Analyze
Analyze the costs and benefits of LED lighting technology.