

## Chapter 19 Optics

**Section 19.2 Lenses****(pages 574–578)**

*This section defines index of refraction and discusses how it is related to the way light behaves upon entering different materials. It also presents image formation in concave and convex lenses.*

**Reading Strategy (page 574)**

**Building Vocabulary** As you read the section, define in your own words each vocabulary word listed in the table. For more information on this Reading Strategy, see the **Reading and Study Skills** in the **Skills and Reference Handbook** at the end of your textbook.

Refraction and Reflection	
Vocabulary Term	Definition
Index of refraction	Ratio of the speed of light in a vacuum to the speed of light in the material
Critical angle	Angle of incidence that produces an angle of refraction of 90 degrees
Total internal reflection	The complete reflection of a light ray back into its original medium

**Index of Refraction of Light (pages 574–575)**

- Circle the letter of each sentence that is true about the speed of light through media.
  - Once light passes from a vacuum into any medium, it speeds up.
  - Compared to other media, air slows the speed of light only slightly.
  - The speed of light is greater in water than in air.
- The ratio of the speed of light in a vacuum to the speed of light in a particular material is known as the index of refraction of that material.

**Concave and Convex Lenses (pages 576–577)**

- An object made of transparent material that has one or two curved surfaces that can refract light is called a(n) lens.
- Circle the properties of a lens that affect the way it refracts light.
 

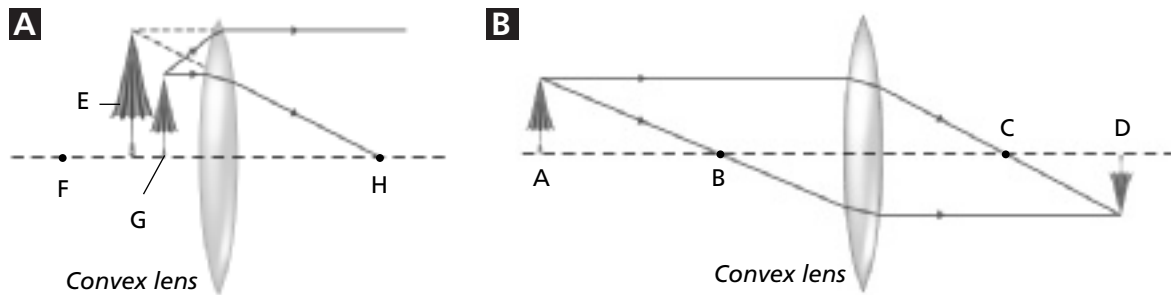
curvature      focal point      thickness
- A lens that is curved inward at the center and is thickest at the outside edges is called a(n) \_\_\_\_\_ lens. Circle the correct answer.
 

concave      convex      plane

**Chapter 19 Optics**

6. Circle the letter of each sentence that is true about convex lenses.
- a. Convex lenses are diverging lenses.
  - b.** Convex lenses can form either real or virtual images.
  - c. Convex lenses are shaped like the inside of a bowl.

For questions 7 and 8, refer to the diagrams below.



7. In each diagram, identify the labeled items as the object, focal point, or image. Also, identify the image as virtual or real.

- |                         |                       |
|-------------------------|-----------------------|
| A. <u>Object</u>        | B. <u>Focal point</u> |
| C. <u>Focal point</u>   | D. <u>Real image</u>  |
| E. <u>Virtual image</u> | F. <u>Focal point</u> |
| G. <u>Object</u>        | H. <u>Focal point</u> |

8. Which diagram shows the formation of a virtual image?

Diagram A

**Total Internal Reflection (page 578)**

9. Circle the letter of each sentence that is true about the critical angle.
- a.** At the critical angle, light refracts along the surface between two media.
  - b. Only concave lenses have critical angles.
  - c.** All the light is reflected back into the second, denser medium when the critical angle is exceeded.
10. Is the following sentence true or false? Materials that have small critical angles, such as the glass used in fiber optics, cause most of the light entering them to be totally internally reflected. true