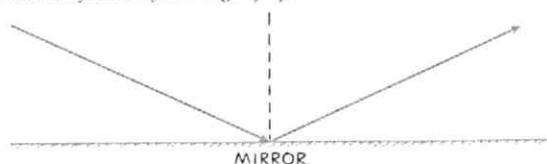# Exercises

29.1 Reflection (page 579)

1. What usually happens when a wave reaches a boundary between two media?

_____

_____

2. The return of a wave back to its original medium is called _____.

29.2 The Law of Reflection (page 580)

6. On the diagram below, label the following: *normal, incident ray, angle of incidence, reflected ray,* and *angle of reflection.*

MIRROR

Match each phrase with the correct term or terms.

Phrase	Terms
_____ 7. a line perpendicular to a surface	a. angle of reflection
_____ 8. the angle between the incident ray and the normal	b. angle of incidence
	c. law of reflection
_____ 9. the angle between the reflected ray and the normal	d. normal
_____ 10. the relationship between the angle of incidence and angle of reflection	

29.3 Mirrors (pages 580–581)

11. A _____ is an image that appears to be in a location where light does not really reach.

12. Can your eye tell the difference between an object and its virtual image? Explain.

_____

_____

_____

29.4 Diffuse Reflection (pages 582–583)

16. What is diffuse reflection? _____

17. Explain why light is reflected in many directions when striking a rough surface.

_____

_____

18. Is the following sentence true or false? If the differences in elevations in a surface are small (less than about one-eighth the wavelength of the light that falls on it), the surface is considered polished. _____

20. What determines whether a surface is a diffuse reflector or a polished reflector?

_____

29.6 Refraction (pages 584–585)

27. What is refraction?

_____

_____

28. Circle the letter of each statement that is true about refraction.

   a. When a wave that is traveling at an angle changes its speed upon crossing a boundary between two media, it continues in a straight line.

   b. Water waves bend, or refract, when one part of each wave is made to travel slower (or faster) than another part.

   c. Refraction is the same as reflection.

   d. Water waves are refracted as they move from deep water into shallow water.

29.7 Refraction of Sound (page 586)

31. Sound waves are refracted when parts of a wave front travel at _____

32. How does a sound wave become refracted?

_____

_____

33. How does a layer of warm air on top of a layer of colder air near the ground affect sounds waves?

_____

_____

_____

29.8 Refraction of Light (pages 587–588)

34. Changes in the speed of light as it passes from one medium to another, or variations in the temperatures and densities of the same medium, cause _____.

36. When light rays enter a medium in which their speed decreases, the rays bend toward the _____.

37. Circle the letter of each statement that is true.

   a. If a laser beam enters a container of water at the left and exits at the right, the path would be the same as if the light entered from the right and exited at the left.

   b. Light paths are reversible for reflection but not refraction.

   c. The apparent depth of a glass block is less than the real depth because of refraction.

   d. A full glass mug appears to hold more colored liquid than it actually does because of reflection.

29.9 Atmospheric Refraction (pages 588–590)

38. What is a mirage?

_____

39. Since molecules in hot air are farther apart, light travels _____ through it than through the cooler air above, resulting in a _____ of the light rays.

29.10 Dispersion in a Prism (page 590)

44. What is dispersion?

_____

_____

29.11 The Rainbow (pages 591–593)

45. What needs to happen in order for a person to see a rainbow?

_____

_____

46. Why aren't rainbows completely round?

_____

_____

47. Explain why, if each drop of water disperses a full spectrum of colors, an observer can only see a single color from any one drop.

_____

_____

_____

48. How does a secondary rainbow form?

_____

29.12 Total Internal Reflection (pages 593–595)

Match each phrase with the correct term or number.

Phrase	Terms and Numbers
_____ 49. the angle of incidence that results in light being refracted at an angle of 90° with respect to the normal	a. 24.6°
	b. critical angle
	c. 43°
_____ 50. the complete reflection of light back into its original medium	d. total internal reflection
_____ 51. critical angle for glass	
_____ 52. critical angle for diamond	

53. What are optical fibers?

_____

_____