

Chapter 27 Light

Exercises

27.1 Early Concepts of Light (page 533)

Match the scientist with his idea about the nature of light. An idea may be used more than once.

Scientist	Idea About Light
_____ 1. Einstein	a. Light is a wave.
_____ 2. Empedocles	b. Light consists of tiny particles.
_____ 3. Euclid	c. Vision results from streamers or filaments emitted by the eye making contact with an object.
_____ 4. Huygens	
_____ 5. Plato	
_____ 6. Socrates	

7. Is the following sentence true or false? The idea that light consists of tiny particles was first proposed in the early 1900s. _____

8. What characteristic of light did Huygens provide evidence of?

9. What phenomena did Einstein explain in the theory he published in 1905? _____

10. _____ are massless bundles of concentrated electromagnetic energy.

11. What is the modern theory of light?

27.2 The Speed of Light (pages 534–535)

12. Is the following sentence true or false? Roemer’s measurement of discrepancies in the position of Jupiter’s moon Io was the first demonstration showing that light travels at a finite speed. _____
13. How did Huygens interpret the discrepancy in Roemer’s measurement?

14. Circle the letter beside the correct speed of light.
 a. 300,000 m/s b. 300,000,000 m/s
 c. 300,000 km/s d. 300,000,000 km/s
15. Albert Michelson received the Nobel Prize for using a system of mirrors to measure _____.
16. How much time does it take light to travel from the sun to Earth?

17. What is a light-year? _____

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27.3 Electromagnetic Waves (page 536)

18. What is the source of the energy in light?

19. The energy in an electromagnetic wave is part _____ and part _____.
20. Name the different waves that make up the electromagnetic spectrum.
- | | |
|----------|----------|
| a. _____ | e. _____ |
| b. _____ | f. _____ |
| c. _____ | g. _____ |
| d. _____ | |
21. Electromagnetic waves of frequencies slightly lower than the red waves of visible light are called _____.
22. Electromagnetic waves of frequencies slightly higher than the violet waves of visible light are called _____.

27.4 Light and Transparent Materials (pages 537–538)

23. Is the following sentence true or false? How a receiving material responds when light is incident upon it depends only on the frequency of the light. _____
24. Is the following sentence true or false? Electrons are able to respond to the ultrafast vibrations of visible light because the electrons have a small enough mass to vibrate that fast. _____
25. How do the atoms in a transparent material interact with light?

26. The natural vibration frequencies of an electron depend on how strongly it is attached to _____.
27. What two things can happen to the energy received by an atom in glass when ultraviolet light shines on the glass?
- | |
|----------|
| a. _____ |
| b. _____ |
28. Why does resonance occur when ultraviolet light shines on glass?

29. What happens when electromagnetic waves with frequencies lower than ultraviolet light shine on glass?

30. Is the following sentence true or false? Infrared waves vibrate only the electrons in glass. _____

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27.5 Opaque Materials (page 539)

31. What are opaque materials?

32. Is the following sentence true or false? In opaque materials, any coordinated vibrations given by light to the atoms and molecules are turned into random kinetic energy, or internal energy. _____

33. Explain why metals reflect light and appear shiny.

34. Our atmosphere is transparent to _____ light and _____ light, but almost opaque to _____ light.

35. Why is it possible to get a sunburn on a cloudy day?

27.6 Shadows (pages 540–541)

36. What is a light ray? _____

37. Generally, shadows form where _____.

38. Would you position a light source close or far from an object in order to produce a sharp shadow? _____

39. Is the following sentence true or false? Most shadows have clearly defined edges. _____

40. A total shadow is called a(n) _____.

41. Where are two places a penumbra can form?

42. During a solar eclipse, the shadow of _____ falls on _____.

43. What will you observe if you stand in an umbra during a solar eclipse?

44. What will you observe if you stand in a penumbra during a solar eclipse?

45. What is a lunar eclipse?

46. Is the following sentence true or false? Shadows cannot occur when light is bent while passing through a transparent material. _____

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27.7 Polarization (pages 542–543)

47. Is the following sentence true or false? Polarization is a characteristic of transverse waves and not longitudinal waves. _____

48. Define polarization.

49. If you shake a rope up and down, it becomes _____ polarized.

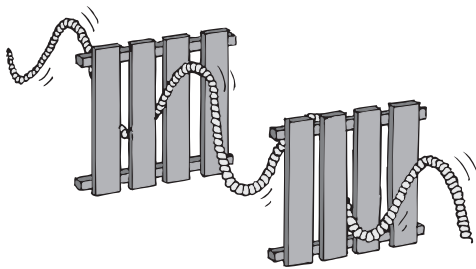
50. If you shake a rope from side to side, it becomes _____ polarized.

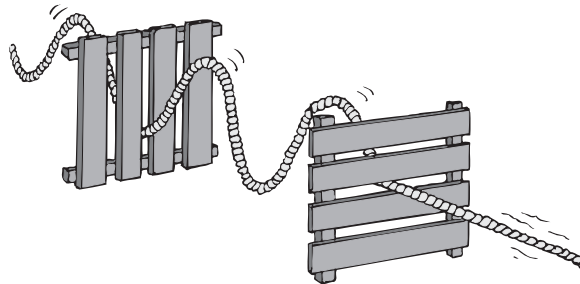
51. Write *P* if the source emits polarized light or *NP* if the source emits unpolarized light.

- | | |
|-----------------------------|-------------------------|
| _____ a. vibrating electron | _____ c. the sun |
| _____ b. incandescent bulb | _____ d. a candle flame |

52. Describe what happens to light from an unpolarized source that falls on a polarizing filter.

53. Each of the figures below is an analogy for the effect of crossed sheets of polarizing material. Explain what happens if the ropes are light and the picket fences are polarizing filters.





54. How are the axes of polarized sunglasses aligned in order to eliminate glare from horizontal surfaces? _____

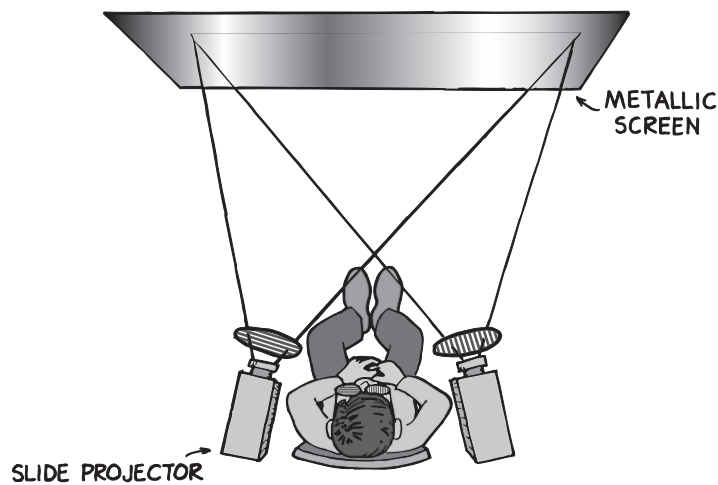
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27.8 Polarized Light and 3-D Viewing (pages 544–546)

55. How do your eyes perceive vision in three dimensions?

56. Is the following sentence true or false? The combination of views you see from both eyes gives depth to what you see. _____

57. Explain the effect that allows you to see a hidden message in a stereogram.



58. The figure above shows a person watching a 3-D slide show.

a. How are the photographs taken in order to be used in the 3-D slide show?

b. How are the photographs used in the slide show projected?

c. How is the viewer able to see the 3-D effect in the show?

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