

Chapter 25 Vibrations and Waves

## Exercises

### 25.1 Vibration of a Pendulum (page 491)

- The time it takes for one back-and-forth motion of a pendulum is called the period.
- List the two things that determine the period of a pendulum.  
length of the pendulum and the acceleration of gravity
- Circle the letter of each statement about a pendulum that is true.
  - A longer pendulum has a longer period.
  - A shorter pendulum swings with a greater frequency.
  - Mass does not affect the period of the pendulum.
  - All pendulums swing at the same rate.

### 25.2 Wave Description (pages 491–493)

- What is simple harmonic motion?  
the back-and-forth vibratory motion of a swinging pendulum
- Is the following sentence true or false? A sine curve is a pictorial representation of a wave. true
- Circle the letter that describes the source of all waves.
  - a temperature change
  - a change in pressure
  - something that vibrates
  - an electrical current

Match each phrase with the correct word or words.

Term	Definition
<u>d</u> 7. crest	a. distance between successive identical parts of a wave
<u>b</u> 8. trough	b. low point on a wave
<u>e</u> 9. amplitude	c. vibrations per unit of time
<u>a</u> 10. wavelength	d. high point on a wave
<u>c</u> 11. frequency	e. distance from a midpoint to a crest
<u>f</u> 12. hertz	f. unit of frequency

- Is the following sentence true or false? As the frequency of a vibrating source increases, the period increases. false

### 25.3 Wave Motion (pages 493–494)

- Describe the wave that forms and what is transmitted when a stone is dropped in a pond.  
A wave is produced that moves out from the center in an expanding circle. The wave transmits energy but not matter.
- Sounds waves are a(n) disturbance that travels through the air.

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16. Circle the letter of each statement about sound waves in air that is true.

- a. They carry energy.
- b. Air is the medium they travel through.
- c. They are a disturbance that moves through the air.
- d. Air molecules are carried along with the wave.

**25.4 Wave Speed (pages 495–496)**

17. Is the following sentence true or false? The speed of a wave depends on the medium through which it travels. true

18. The speed of sound in air is about 330 m/s to 350 m/s.

19. Is the following sentence true or false? Sound travels faster in air than in water. false

20. Circle the letter of each wave property that is related.

- a. speed
- b. frequency
- c. direction
- d. wavelength

21. Describe how to calculate the speed of a wave.

You multiply the wave's wavelength by its frequency.

22. Circle the letter of the equation used to calculate a wave's speed.

- a.  $v = \lambda p$
- b.  $v = \lambda t$
- c.  $v = \lambda f$
- d.  $v = \lambda a$

23. The Greek letter lambda is often used to represent wavelength.

24. Is the following sentence true or false? The equation for calculating the speed of a wave does not apply to light waves. false

25. Describe how wavelength and frequency are related for sound waves.

They are inversely related.

**25.5 Transverse Waves (pages 497)**

26. Circle the letter that best describes a transverse wave.

- a. The medium does not vibrate.
- b. The medium vibrates at right angles to the direction the wave travels.
- c. The medium vibrates in the same direction the wave travels.
- d. A sound wave.

27. Circle the letter of each example of a transverse wave.

- a. waves in the strings of instruments
- b. radio waves
- c. light waves
- d. sound waves

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**25.6 Longitudinal Waves (page 497)**

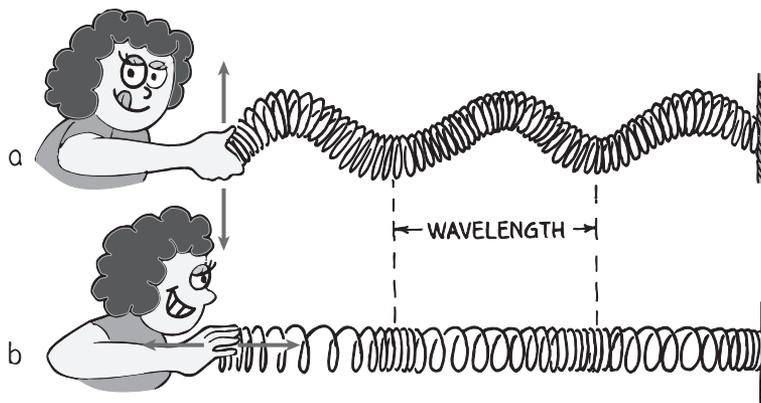
28. Describe the motion of the particles in a medium when a longitudinal wave passes through it.

The particles oscillate parallel to or along the direction of the wave.

29. What is an example of a longitudinal wave? sound

30. Identify the types of waves formed in part (a) and part (b) of the illustration below.

a. transverse                      b. longitudinal



**25.7 Interference (pages 498–499)**

31. A(n) interference pattern is a regular arrangement of places where wave effects are increased, decreased, or neutralized.

Match each term to its definition.

Term	Definition
<u>c</u> 32. constructive interference	a. when crests overlap troughs and effects are reduced
<u>a</u> 33. destructive interference	b. when crests of one wave overlap the crests of another wave
<u>d</u> 34. out of phase	c. when crests overlap and effects add together
<u>b</u> 35. in phase	d. when crests and troughs overlap to produce zero amplitude

36. Describe when wave interference occurs.

Interference occurs when waves from different sources arrive at the same place simultaneously.

37. Is the following sentence true or false? Wave interference only occurs with transverse waves. true

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### 25.8 Standing Waves (pages 500–501)

38. Is the following sentence true or false? A wave that appears not to move is likely to be a standing wave. false
39. The points on a standing wave where no motion occurs are called nodes.
40. Circle the letter of each statement about antinodes that is true.  
 a. They seem not to move.      **b.** They occur midway between nodes.  
**c.** location of largest amplitude      d. location of zero amplitude
41. Standing waves occur because of interference.
42. Describe the conditions necessary—in terms of wavelength—for a standing wave to form in a rope attached to a wall.  
They form when a half wavelength or a multiple of a half wavelength fits exactly into the length of the vibrating medium.
43. Is the following sentence true or false? Standing waves can form in both transverse and longitudinal waves. true

### 25.9 The Doppler Effect (pages 501–503)

44. Is the following sentence true or false? A moving wave source does not affect the frequency of the wave encountered by an observer. false
45. Describe the Doppler effect.  
the apparent change in frequency due to motion of the source (or receiver)
46. Circle the letter of each statement about the Doppler effect that is true.  
**a.** it occurs when a wave source moves toward an observer  
**b.** it occurs when an observer moves toward a wave source  
**c.** it occurs when a wave source moves away an observer  
**d.** it occurs when an observer moves away from a wave source
47. Is the following sentence true or false? A higher frequency results when a wave source moves toward an observer. true
48. Two fire trucks with sirens on speed toward and away from an observer as shown below. Identify which truck produces a higher than normal siren frequency and which produces a lower than normal siren frequency.  
higher: truck speeding toward listener; lower: truck speeding away



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49. The blue shift and red shift refer to how the Doppler effect affects \_\_\_\_\_ waves.

50. A(n) \_\_\_\_\_ in frequency is called a blue shift, while a(n) \_\_\_\_\_ is called a red shift.

**25.10 Bow Waves (pages 504–505)**

51. Is the following sentence true or false? Bow waves form a V-shaped wake in back of the moving source. \_\_\_\_\_

52. Bow waves form when the wave source moves \_\_\_\_\_ than the wave speed.

53. Is the following sentence true or false? The crests of bow waves overlap at their edges. \_\_\_\_\_

54. Circle the letter that describes how increasing the speed of the wave source above the wave speed affects the shape of the bow wave that is formed.

- a. The bow wave is unchanged.
- b. The bow wave has a narrower V shape.
- c. The bow wave has a wider V shape.
- d. The bow wave forms a straight line.

**25.11 Shock Waves (pages 505–506)**

55. A shock wave has the shape of a \_\_\_\_\_.

56. Circle the letter that describes the conditions needed for a shock wave to form.

- a. An object moves at the speed of sound.
- b. The wave speed exceeds the object's speed.
- c. The wave speed equals the object's speed.
- d. An object moves faster than the speed of sound.

57. What is a sonic boom?

A sonic boom is the sharp crack heard when the shock wave that sweeps behind a supersonic aircraft reaches the listener.

58. Why don't we hear a sonic boom from a subsonic aircraft?

Because the sound wave crests reach our ears one at a time and are perceived as a continuous tone.

59. Is the following sentence true or false? A sonic boom is formed only at the moment an object breaks through the sound barrier. \_\_\_\_\_