Physics Practice Test

The *Physics Practice Test* is provided as a *Blackline Master* on your *Teacher Resources CD*.

5b Blackline Master

Content Review

1. a

2. c

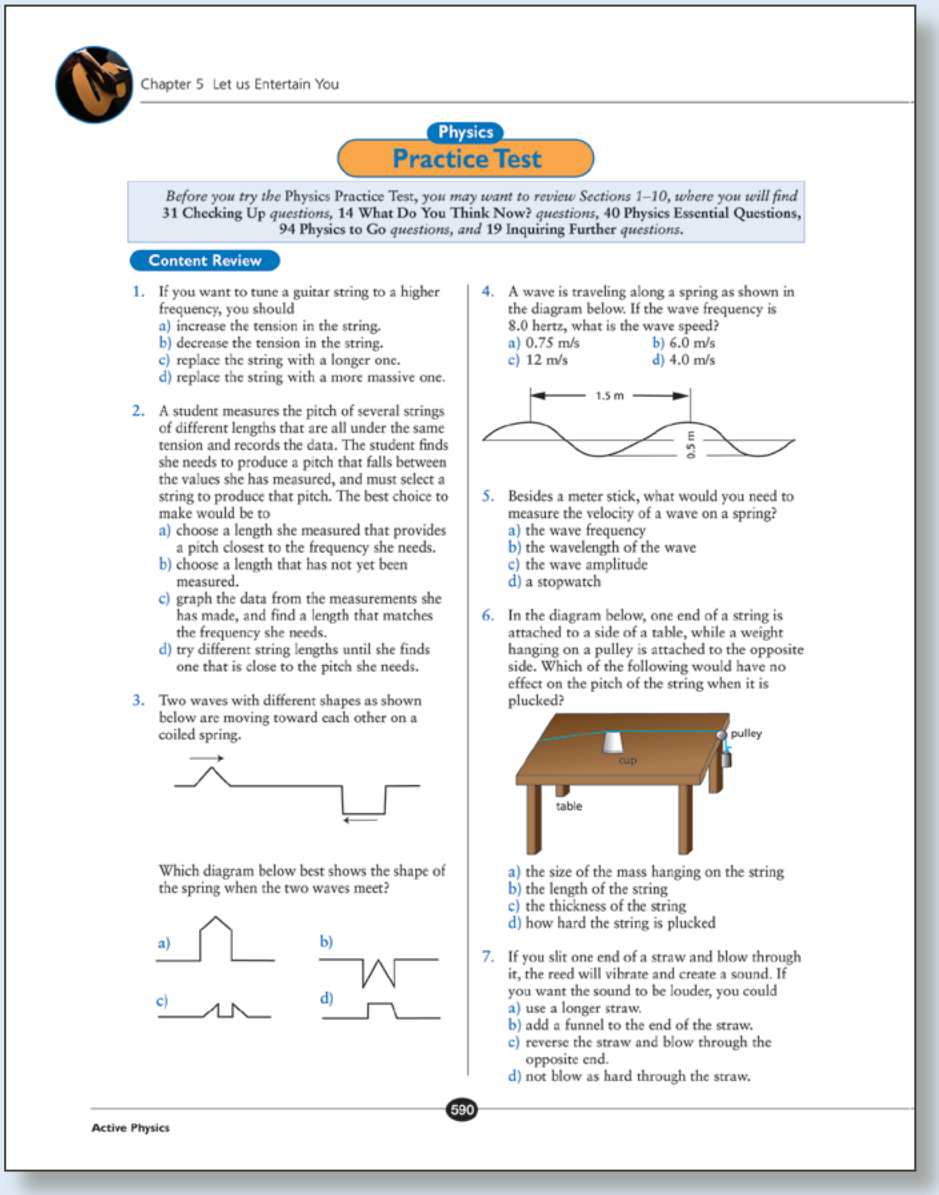
3. b

4. c

5. d

6. d

7. b



Chapter 5 Let us Entertain You

Physics

Practice Test

Before you try the Physics Practice Test, *you may want to review Sections 1–10, where you will find* **31 Checking Up** *questions,* **14 What Do You Think Now?** *questions,* **40 Physics Essential Questions, 94 Physics to Go** *questions, and* **19 Inquiring Further** *questions.*

Content Review

1. If you want to tune a guitar string to a higher frequency, you should
   a) increase the tension in the string.
   b) decrease the tension in the string.
   c) replace the string with a longer one.
   d) replace the string with a more massive one.

2. A student measures the pitch of several strings of different lengths that are all under the same tension and records the data. The student finds she needs to produce a pitch that falls between the values she has measured, and must select a string to produce that pitch. The best choice to make would be to
   a) choose a length she measured that provides a pitch closest to the frequency she needs.
   b) choose a length that has not yet been measured.
   c) graph the data from the measurements she has made, and find a length that matches the frequency she needs.
   d) try different string lengths until she finds one that is close to the pitch she needs.

3. Two waves with different shapes as shown below are moving toward each other on a coiled spring.

Which diagram below best shows the shape of the spring when the two waves meet?

a) b) c) d)

4. A wave is traveling along a spring as shown in the diagram below. If the wave frequency is 8.0 hertz, what is the wave speed?
   a) 0.75 m/s b) 6.0 m/s
   c) 12 m/s d) 4.0 m/s

1.5 m, 0.5 m

5. Besides a meter stick, what would you need to measure the velocity of a wave on a spring?
   a) the wave frequency
   b) the wavelength of the wave
   c) the wave amplitude
   d) a stopwatch

6. In the diagram below, one end of a string is attached to a side of a table, while a weight hanging on a pulley is attached to the opposite side. Which of the following would have no effect on the pitch of the string when it is plucked?

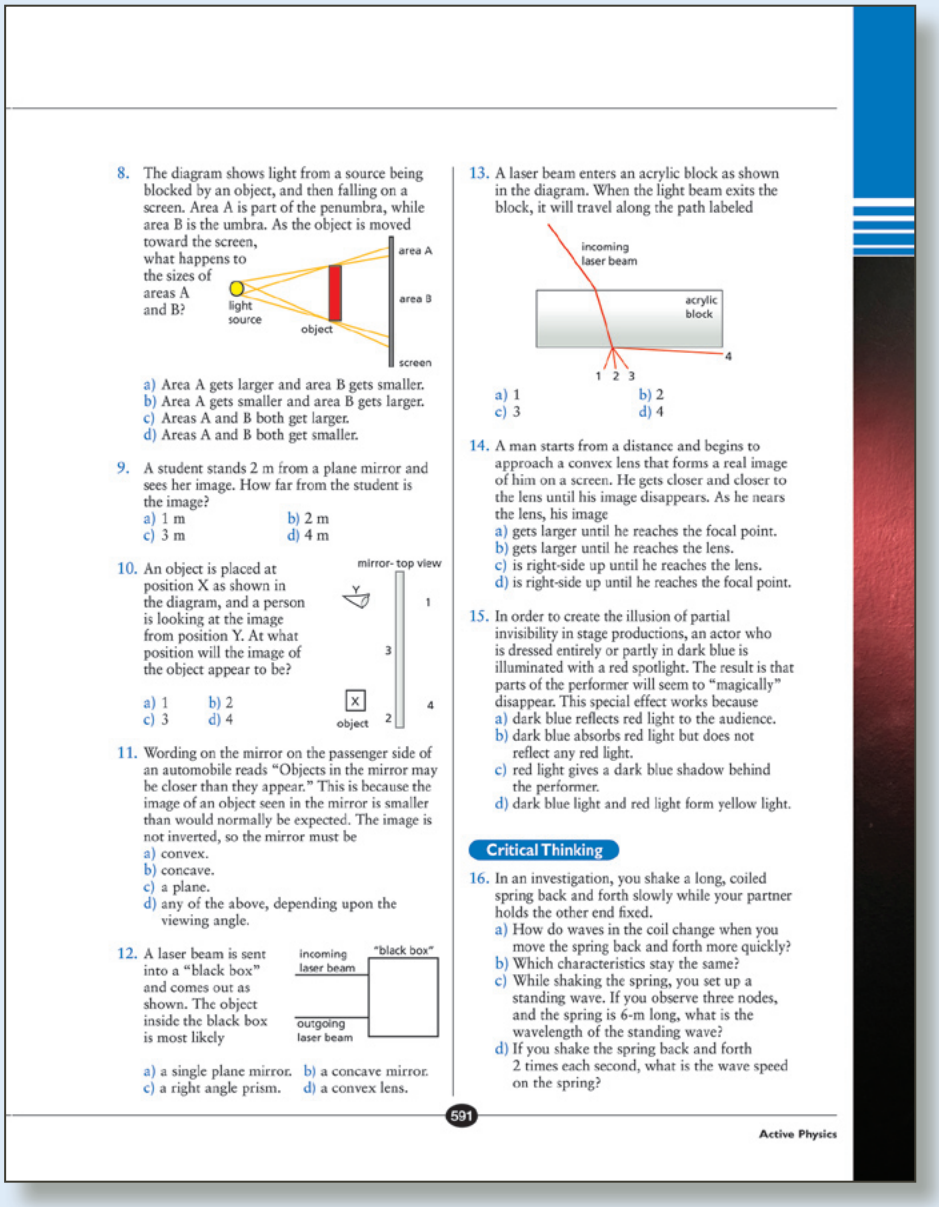
pulley, cup, table

   a) the size of the mass hanging on the string
   b) the length of the string
   c) the thickness of the string
   d) how hard the string is plucked

7. If you slit one end of a straw and blow through it, the reed will vibrate and create a sound. If you want the sound to be louder, you could
   a) use a longer straw.
   b) add a funnel to the end of the straw.
   c) reverse the straw and blow through the opposite end.
   d) not blow as hard through the straw.

590

Active Physics



8. The diagram shows light from a source being blocked by an object, and then falling on a screen. Area A is part of the penumbra, while area B is the umbra. As the object is moved toward the screen, what happens to the sizes of areas A and B?

a) Area A gets larger and area B gets smaller.
b) Area A gets smaller and area B gets larger.
c) Areas A and B both get larger.
d) Areas A and B both get smaller.

9. A student stands 2 m from a plane mirror and sees her image. How far from the student is the image?
a) 1 m b) 2 m
c) 3 m d) 4 m

10. An object is placed at position X as shown in the diagram, and a person is looking at the image from position Y. At what position will the image of the object appear to be?

a) 1 b) 2
c) 3 d) 4

11. Wording on the mirror on the passenger side of an automobile reads "Objects in the mirror may be closer than they appear." This is because the image of an object seen in the mirror is smaller than would normally be expected. The image is not inverted, so the mirror must be
a) convex.
b) concave.
c) a plane.
d) any of the above, depending upon the viewing angle.

12. A laser beam is sent into a "black box" and comes out as shown. The object inside the black box is most likely

a) a single plane mirror. b) a concave mirror.
c) a right angle prism. d) a convex lens.

13. A laser beam enters an acrylic block as shown in the diagram. When the light beam exits the block, it will travel along the path labeled

a) 1 b) 2
c) 3 d) 4

14. A man starts from a distance and begins to approach a convex lens that forms a real image of him on a screen. He gets closer and closer to the lens until his image disappears. As he nears the lens, his image
a) gets larger until he reaches the focal point.
b) gets larger until he reaches the lens.
c) is right-side up until he reaches the lens.
d) is right-side up until he reaches the focal point.

15. In order to create the illusion of partial invisibility in stage productions, an actor who is dressed entirely or partly in dark blue is illuminated with a red spotlight. The result is that parts of the performer will seem to "magically" disappear. This special effect works because
a) dark blue reflects red light to the audience.
b) dark blue absorbs red light but does not reflect any red light.
c) red light gives a dark blue shadow behind the performer.
d) dark blue light and red light form yellow light.

Critical Thinking

16. In an investigation, you shake a long, coiled spring back and forth slowly while your partner holds the other end fixed.
a) How do waves in the coil change when you move the spring back and forth more quickly?
b) Which characteristics stay the same?
c) While shaking the spring, you set up a standing wave. If you observe three nodes, and the spring is 6-m long, what is the wavelength of the standing wave?
d) If you shake the spring back and forth 2 times each second, what is the wave speed on the spring?

591

Active Physics

8. d

9. d

10. d

11. a

12. c

13. c

14. a

15. b

CHAPTER 5

Critical Thinking

16.a)

Moving the spring back and forth more quickly will decrease the distance between crests (decreased wavelength). The waves will travel with the same speed, but more of them will move past a point per unit time (increased frequency).

16.b)

The speed of the wave on the spring remains the same, as does the wave's amplitude if the shaking strength is the same.

16.c)

The wavelength would be 6 m, with a node at each end, and one at the center.

16.d)

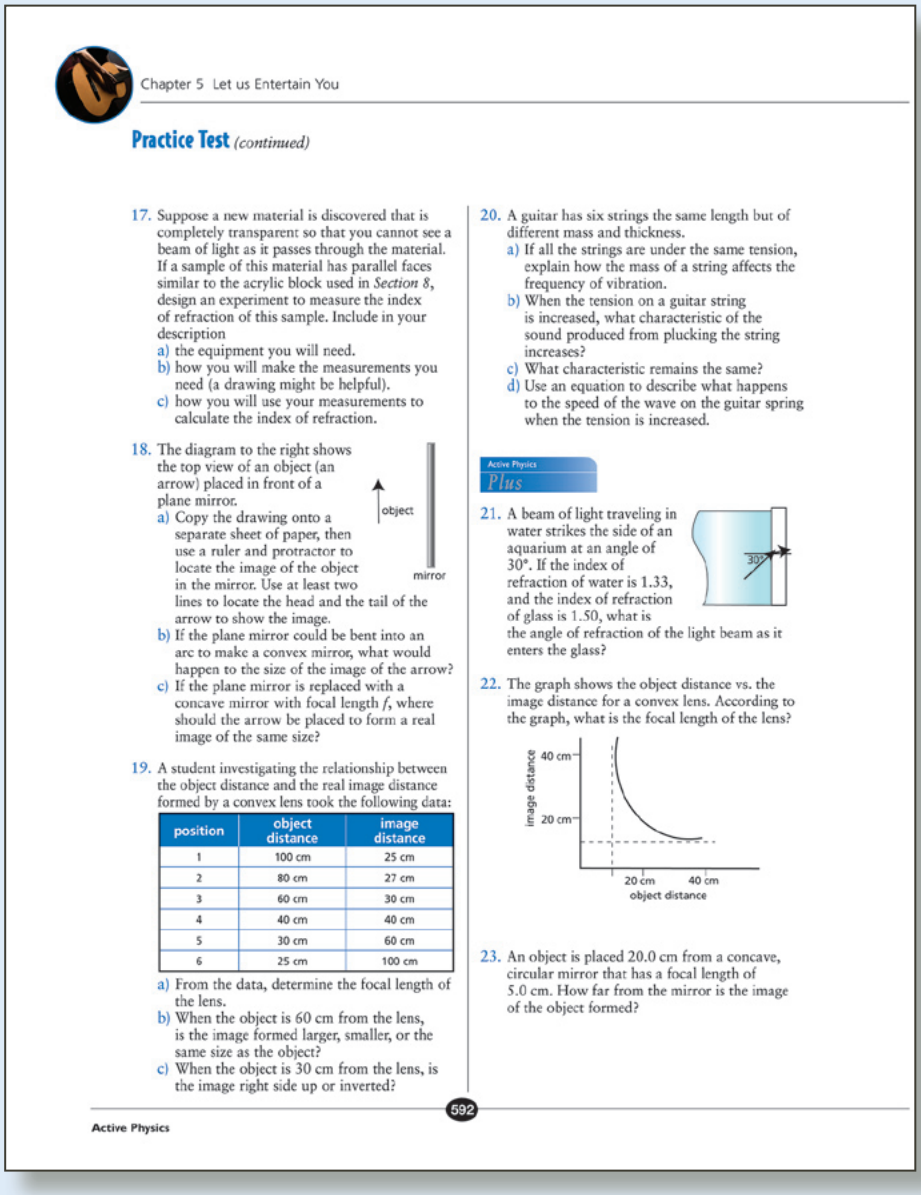
Using
$v = f\lambda = (2\text{ Hz})(6\text{ m}) = 12\text{ m/s}$.

17.a)

The equipment needed to measure the index of refraction includes a narrow beam of light source such as a laser, a ruler, and a protractor to measure angles. A glass rod to spread the laser beam would be useful, but is not required.

17.b)

Outline the parallel surfaces of the material with a pencil. Shine a laser with a glass rod inserted in the beam on one of the parallel faces at an angle to the perpendicular. Mark the path of the incoming beam, and the path of the emergent beam as the laser light leaves the material. Extend both lines back to surface lines, and then connect the surfaces where the laser lines struck with a pencil line. Add a normal line using the protractor to the point where the incoming laser line struck the first parallel surface, and then measure the angle of incidence in air and the angle of refraction in the material, still using the protractor.



Chapter 5 Let us Entertain You

Practice Test *(continued)*

17. Suppose a new material is discovered that is completely transparent so that you cannot see a beam of light as it passes through the material. If a sample of this material has parallel faces similar to the acrylic block used in *Section 8*, design an experiment to measure the index of refraction of this sample. Include in your description
    a) the equipment you will need.
    b) how you will make the measurements you need (a drawing might be helpful).
    c) how you will use your measurements to calculate the index of refraction.

18. The diagram to the right shows the top view of an object (an arrow) placed in front of a plane mirror.
    a) Copy the drawing onto a separate sheet of paper, then use a ruler and protractor to locate the image of the object in the mirror. Use at least two lines to locate the head and the tail of the arrow to show the image.
    b) If the plane mirror could be bent into an arc to make a convex mirror, what would happen to the size of the image of the arrow?
    c) If the plane mirror is replaced with a concave mirror with focal length *f*, where should the arrow be placed to form a real image of the same size?

19. A student investigating the relationship between the object distance and the real image distance formed by a convex lens took the following data:

position	object distance	image distance
1	100 cm	25 cm
2	80 cm	27 cm
3	60 cm	30 cm
4	40 cm	40 cm
5	30 cm	60 cm
6	25 cm	100 cm

    a) From the data, determine the focal length of the lens.
    b) When the object is 60 cm from the lens, is the image formed larger, smaller, or the same size as the object?
    c) When the object is 30 cm from the lens, is the image right side up or inverted?

20. A guitar has six strings the same length but of different mass and thickness.
    a) If all the strings are under the same tension, explain how the mass of a string affects the frequency of vibration.
    b) When the tension on a guitar string is increased, what characteristic of the sound produced from plucking the string increases?
    c) What characteristic remains the same?
    d) Use an equation to describe what happens to the speed of the wave on the guitar spring when the tension is increased.

Active Physics *Plus*

21. A beam of light traveling in water strikes the side of an aquarium at an angle of 30°. If the index of refraction of water is 1.33, and the index of refraction of glass is 1.50, what is the angle of refraction of the light beam as it enters the glass?

22. The graph shows the object distance vs. the image distance for a convex lens. According to the graph, what is the focal length of the lens?

23. An object is placed 20.0 cm from a concave, circular mirror that has a focal length of 5.0 cm. How far from the mirror is the image of the object formed?

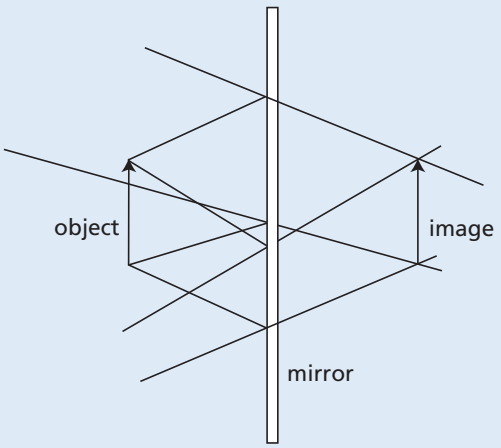
592

Active Physics

17.c)

The index of refraction can be calculated by using the equation $n = \sin\theta_i / \sin\theta_r$.

18.a)



18.b)

Bending the mirror into a convex mirror will decrease the size of the image being formed, since the image in a convex mirror is always smaller than the object, while in a plane mirror the image size is equal to the object size.

18.c)

To form an image the same size as the object in a concave mirror, the object must be placed on the principal axis outside the focal length, much further away from the concave mirror.

19.a)

The position where object size is equal to image size is at the $2f$ position for a lens. Looking at the data, the $2f$ position is 40 cm, so the focal length must be 20 cm. Students could also use the formula $1/d_o + 1/d_i = 1/f$ to find the focal length.

19.b)

When the object is 60 cm from the lens, it is beyond $2f$, so the image must be smaller than the object.

19.c)

When the object is 30 cm from the lens, the image is still outside the focal point, so the image will be inverted.

20.a)

The reason guitar strings with more mass vibrate more slowly under the same tension as lighter strings is given by Newton's second law or $a = F/m$. The acceleration of the string is less because the mass is greater, so the string cannot vibrate as quickly.

20.b)

The frequency of vibration is increased, so the pitch increases.

20.c)

The wavelength remains the same, since the wave has the same nodal points on the ends.

20.d)

Using the equation $v = f\lambda$, if the frequency increases, and the wavelength remains the same, the wave speed on the string must have increased.

21. Active Physics Plus

Given:
$n_i = 1.33;\ \theta_i = 30°;\ n_r = 1.5$

$n_i \sin\theta_i = n_r \sin\theta_r$
because $\sin 30° = 0.5$
$1.33(0.5) = 1.5 \sin\theta_r$
$\sin\theta_r = 0.444$
$\theta_r = 26°$.

22. Active Physics Plus

From the graph, the object distance and image distance are equal when they each are 20 cm. The object distance is equal to the image distance when the object is at $2f$, thus, the focal length must be 10 cm.

23. Active Physics Plus

Given:
$d_o = 20$ cm; $f = 5$ cm

$1/d_o + 1/d_i = 1/f$
$1/20\,\text{cm} + 1/d_i = 1/5$ cm
solving for $d_i = 20/3$ cm.

Therefore, the image is $20/3$ cm from the mirror.

CHAPTER 5