Chapter 24 Assessment

Vocabulary

Select the correct term to complete the sentences.

standing wave	cycle	decibels
wave	fundamental	diffraction
period	reflection	absorption
refraction	pendulum	harmonics
beats	Doppler effect	linear motion
frequency	constructive interference	harmonic motion
oscillator	amplitude	hertz
resonance	wavelength	natural frequency
transverse wave	longitudinal wave	pitch
periodic force	destructive interference	supersonic
sound		

Section 24.1

1. The harmonic motion of a boy on a swing is like the motion of a(n) ____.
2. An object with repeating cycles of motion is a(n) ____.
3. The note A in the musical scale has a(n) ____ of 220 Hz.
4. One unit of harmonic motion is called a(n) ____.
5. The motion of a girl running is called ____, and the motion of a girl riding a ferris wheel is called ____.
6. The formula for ____ is the inverse of the formula for frequency.
7. One ____ equals one cycle per second.
8. When the periodic force matches the natural frequency of an object, the object experiences ____.
9. To have a high ____ on a swing, your friend needs to push you with a(n) ____.
10. When you hit a drum, it will vibrate at its ____.

Section 24.2

11. A(n) ____ is a traveling oscillation.
12. The distance from one crest to the next is a wave's ____.
13. The process of a wave bouncing off a surface is called ____.
14. ____ is the process of the amplitude of a wave diminishing as it enters another material.
15. ____ is when waves bend when they enter another material, and ____ is when waves bend around an object or outward after exiting a hole.
16. The amplitude of two waves will cancel when ____ occurs.
17. The amplitude of two waves gets larger when ____ occurs.
18. Sound waves are an example of this type of wave: ____.
19. Water waves are an example of this type of wave: ____.

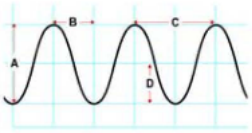
Section 24.3

20. Two sounds that are out of phase will cause you to hear ____.
21. Compared to a whistle, a vacuum cleaner produces sound with a low ____.
22. The threshold of human hearing is zero ____.
23. An oscillator in motion can produce the ____.
24. You can make a(n) ____ using a length of string.
25. The natural frequency of an object is called the ____, and additional natural frequencies are called ____.
26. A(n) ____ object moves faster than the speed of sound.
27. As ____ travels in a solid or liquid, neighboring atoms oscillate.

Concepts

Section 24.1

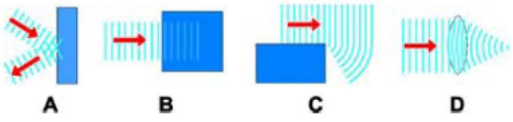
1. State whether the following are linear or harmonic motions.
   a. skiing downhill
   b. riding on a merry-go-round
   c. hiking uphill
   d. jumping on a trampoline
2. Describe how you find the amplitude of a pendulum and of a water wave.
3. For the wave in the diagram, which measurement shows the amplitude? Which measurement shows the wavelength?



4. What will happen to the period of a pendulum if you:
   a. increase its mass?
   b. increase its length?
   c. Challenge: increase the amplitude?

Section 24.2

5. Explain how you would make a transverse wave and a longitudinal wave with a long spring toy.
6. Below are diagrams representing interactions between waves and boundaries. Identify each interaction by name.



7. Can two waves interfere with each other so that the new wave formed by their combination has NO amplitude? Explain your answer.
8. Read the descriptions below and indicate which of the four types of wave interactions (*absorption*, *reflection*, *refraction*, or *diffraction*) has occurred for each.
   a. The distortion of your partially submerged arm makes it look "broken" when viewed from the air.
   b. You hear the music even though you are seated behind an obstruction at a concert.
   c. You see yourself when you look at a polished car hood.
   d. Heavy curtains are used to help keep a room quiet.

Section 24.3

9. Give an example of a sound with a high pitch and an example of a sound with a low pitch.
10. Do all frequencies of sounds at 40 decibels seem equally loud to your ears? Explain.
11. Why do sound waves travel faster in steel than in water?
12. Explain why the range of human hearing is limited to a particular range of frequencies.
13. A car honking its horn moves toward you. Does the horn's pitch sound higher or lower than it would if the car were parked? Explain.

Problems

Section 24.1

1. A bicycle wheel spins 25 times in 5 seconds. Calculate the period and frequency of the wheel.
2. The piston in a gasoline engine goes up and down 3,000 times per minute. For this engine, calculate the frequency and period of the piston.
3. Determine the period and frequency of the second hand on a clock. Here's a hint: how long does it take for the second hand to go around?

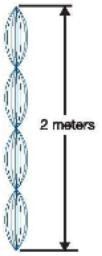
4. Make a harmonic-motion graph for a pendulum. Place time in seconds on the x-axis and position on the y-axis. The period of the pendulum is 0.5 second and the amplitude is 2 centimeters.
   a. What is the frequency of this pendulum?
   b. If you shortened the string of this pendulum, would the period get shorter or longer?

Section 24.2

5. A wave has a frequency of 10 hertz and a wavelength of 2 meters. What is the speed of the wave?
6. A sound wave has a speed of 400 m/s and a frequency of 200 Hz. What is its wavelength?
7. If the frequency of a wave is 30 hertz, how many wavelengths pass a certain point in 30 seconds?
8. Make a graph of two cycles of a transverse wave with an amplitude of 4 cm and a wavelength of 8 cm. If the frequency of this wave is 10 Hz, what is its speed?

Section 24.3

9. You hear the dishwasher with a loudness of 40 dB and a siren outside with a loudness of 60 dB. How much greater is the amplitude of the siren's sound than the amplitude of the dishwasher's sound?
10. A sound wave takes 0.2 seconds to travel 306 meters. What is the speed of sound in this material? Through which of the materials in Figure 24.23 is the wave traveling?
11. The diagram to the right shows a harmonic of a standing wave on a vibrating string.
    a. Which harmonic is shown?
    b. How many wavelengths are shown?
    c. What is the length of one wavelength?



12. A wave with a period of 1 second comes from the left. At the same time, a wave with a period of 2 seconds comes from the right. The amplitude of each wave is 5 centimeters. Draw a harmonic-motion graph for each of these waves with time on the x-axis and position on the y-axis. Overlay two wavelengths of the 1-second wave on one wavelength of the 2-second wave. Use the superposition principle to determine whether these two waves interfere by constructive interference, destructive interference, or both.

Applying Your Knowledge

Section 24.1

1. How are Newton's laws of motion helpful in understanding harmonic motion? Use a pendulum as an example.
2. The Tacoma Narrows Bridge in the state of Washington collapsed in 1940. Research this bridge to find out what caused "Galloping Gertie" to fall. Describe your findings in a paragraph.

Section 24.2

3. One of the four wave interactions is very important to how plants use light to grow. Guess which interaction this is, and write several sentences to justify your answer.

Section 24.3

4. When you watch fireworks, sometimes you see the explosion and then hear the sound. Why do you think this is?
5. People can usually hear sounds with frequencies from 20 to 20,000 hertz. Some animals can hear higher or lower frequencies than people can. Research to find out the hearing ranges of several different animals.