Name _____ Class _____ Date _____

Exercises

26.1 The Origin of Sound (page 515)

Match each sound source with the part that vibrates.

	Sound Source	Vibrating Part
a	1. violin	a. strings
b	2. your voice	b. reed
d	3. saxophone	c. column of air at the mouthpiece
c	4. flute	d. vocal chords

5. Sound waves are a type of longitudinal wave.
6. What normally determines the frequency of sound waves?
   The frequency of sound waves produced normally have the same frequency as the vibrating source.
7. Define pitch.
   Pitch is our subjective impression about the frequency of sound.
8. As people grow older, they often have more trouble hearing sounds at the high end of the range of frequencies.
9. Sound waves with frequencies below the normal range are infrasonic waves.
10. Sound waves with frequencies above the normal range are ultrasonic waves.

26.2 Sound in Air (pages 515–517)

11. Is the following sentence true or false? Sound vibrates the air much like particles move back and forth along a stretched spring. true
12. A pulse of compressed air is called a compression, and a pulse of low-pressure air is called a rarefaction.
13. For all wave motion, it is not the medium that travels, but a pulse that travels.
14. Explain what happens when a tuning fork is struck against one end of an open tube.
    When the prong is struck, a compression enters the tube. When the prong swings away, a rarefaction follows the compression. A series of compressions and rarefactions is produced within the tube as the fork continues to vibrate.

26.3 Media That Transmit Sound (page 517)

15. What did Native Americans learn long ago when they put their ears to the ground?
    They could hear the hoofbeats of distant horses through the ground before they could hear them through the air.

16. Suppose a friend far away taps a metal fence. Circle the letter of the true statement.

a. The sound is softer and travels slower through the metal than through air.

b. The sound is louder and travels slower through the metal than through air.

c. The sound is softer and travels faster through the metal than through air.

(d.) The sound is louder and travels faster through the metal than through air.

17. Circle the letter of the best conductor of sound.

a. a gas b. a liquid

(c.) a solid d. a vacuum

18. Suppose a ringing bell is placed inside a sealed jar filled with air. The air is then removed from the jar, creating a vacuum. Describe the difference in what a person nearby hears before and after the air is removed from the jar.

The person will hear the bell ringing when the jar is filled with air. When the air is removed, the person will not be able to hear the sound because sound cannot travel through a vacuum.

26.4 Speed of Sound (page 518)

19. Is the following sentence true or false? During a thunderstorm, you hear the thunder before you see the lightning. false

20. The speed of sound in a gas depends primarily on the temperature of the gas and the mass of the particles in the gas.

21. Circle the letter of the speed of sound in dry air at 0°C.

a. 20 m/s (b.) 330 m/s

c. 60 m/s d. 1200 m/s

22. Water vapor in the air increases the speed of sound in air.

23. For each degree increase in air temperature above 0°C, the speed of sound in air increases about 0.60 m/s.

24. The speed of sound at normal room temperature is about 340 m/s.

25. Do lighter gas particles transmit sound faster or slower than heavier gases found in air? faster

26. Is the following sentence true or false? The speed of sound in a solid material depends not on the material's density, but on its elasticity. true

26.5 Loudness (page 519)

27. What is the intensity of sound proportional to?

the square of the amplitude of a sound wave

28. Is the following sentence true or false? Sound intensity is a physiological sensation, but loudness can be measured by instruments. false

Sound Levels	
Source of Sound	**Level (dB)**
Jet engine, at 30 m	140
Old subway train	100
Average factory	90
Normal speech	60
Library	40

29. Study the table above. Circle the letter beside the source of sound that is 100 times as intense as the normal sound of a library.

a. Jet engine, at 30 m
b. Old subway train
c. Average factory
(d.) Normal speech

30. Physiological hearing damage begins at exposure to 85 decibels.

31. Is the following sentence true or false? The cells of the receptor organ in the inner ear do not regenerate. true

26.6 Natural Frequency (page 520)

32. Define natural frequency.

The frequency at which an object vibrates when it is disturbed.

33. Circle the letter of the properties upon which an object's natural frequency depends.

(a.) elasticity and shape
b. mass and shape
c. volume and elasticity
d. volume and mass

34. Is the following sentence true or false? A natural frequency is one at which maximum energy is required to produce forced vibrations. false

26.7 Forced Vibration (page 520)

35. Why is the sound made by an unmounted tuning fork faint when compared to the sound of the fork when its base is on a tabletop?

The table is forced to vibrate, and its larger surface sets more air in motion, causing the loudness of the tuning fork to increase.

36. Define forced vibration.

A vibration that occurs when an object is made to vibrate by another vibrating object that is nearby.

37. The part of any stringed musical instrument that undergoes forced vibration and makes the sound you hear is a sounding board.

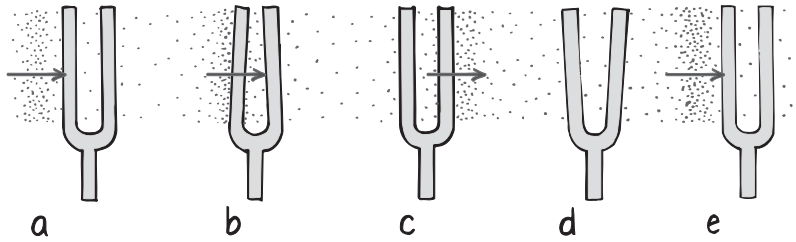
26.8 Resonance (pages 521–522)

38. Define resonance.

A phenomenon that occurs when the frequency of a vibration forced on an object matches the object's natural frequency, causing a dramatic increase in amplitude.

39. Describe how a child's swing illustrates resonance.

The child pumps the swing or is pushed in rhythm with the natural frequency of the swing, increasing the amplitude of the swing.



40. Describe what is happening to the tuning fork shown in the figure above.

a. A compression gives the fork a tiny push.

b. The fork bends in response to the push.

c. The fork returns to its initial position just as a rarefaction arrives.

d. The fork overshoots its original position.

e. The fork is at its original position when another compression arrives, and the cycle repeats.

41. Describe how resonance affects the way you listen to a radio.

When you tune the radio set, you are adjusting the natural frequency of the electronics to match one of many incoming signals.

26.9 Interference (pages 522–523)

42. A ___compression___ of a sound wave corresponds to a crest of a transverse wave.

43. A ___rarefaction___ of a sound wave corresponds to a trough of a transverse wave.

44. When the crests of one wave overlap the crests of another wave, there is ___constructive___ interference and an increase in ___amplitude___.

45. When the crests of one wave overlap the troughs of another wave, there is ___destructive___ interference and a decrease in ___amplitude___.

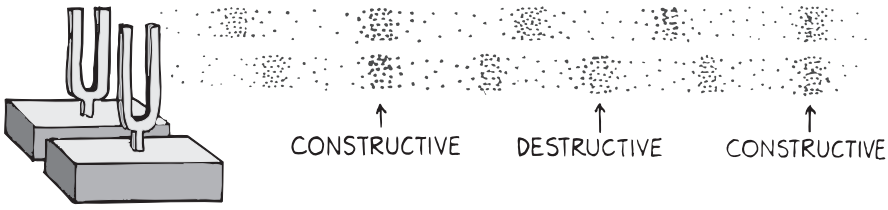
46. Is the following sentence true or false? Constructive sound interference is a useful property in antinoise technology. ___false___

47. Describe how antinoise technology is used to protect the hearing of jackhammer users.

Sound compressions (or rarefactions) from the hammer are neutralized by mirror-image rarefactions (or compressions) in the user's earphones.

26.10 Beats (pages 524–525)

Use the figure below to answer Questions 48 and 49.



48. Use the figure to explain how beats are formed.

The tuning forks emit sound waves at slightly different frequencies. When the forks are in step, sound is at a maximum. When the forks are out of step, the sound is at a minimum. Beats are the throbs you hear between maximum and minimum loudness.

49. Suppose one tuning fork in the figure vibrates 264 times per second, and the other vibrates 262 times per second.

a. How often are the forks in step? twice each second

b. What is the frequency of beats? 2 hertz

50. Is the following sentence true or false? If a piano tuner hears beats, the piano is out of tune. true