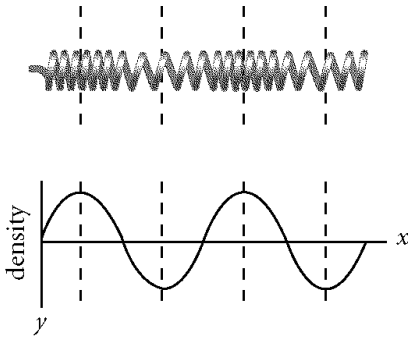
Sample Test - Waves and Sound

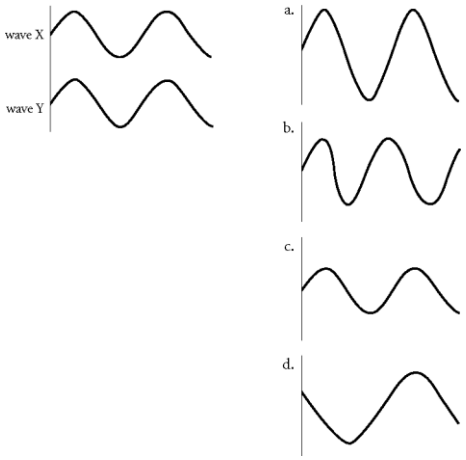
Multiple Choice

Identify the letter of the choice that best completes the statement or answers the question.



1. Each compression in the waveform of the longitudinal wave shown above corresponds to what feature of the transverse wave below it?
   a. wavelength b. crests c. troughs d. amplitude
2. Suppose that two sound waves passing through the same medium have different wavelengths. Which of the following is most likely to be the reason for the differing wavelengths?
   a. the nature of the medium
   b. differences in amplitude
   c. differences in frequency
   d. the type of wave
3. When two mechanical waves coincide, the amplitude of the resultant wave is always ____ the amplitudes of each wave alone.
   a. greater than b. less than c. the sum of d. the same as
4. Two mechanical waves meet and coincide. One wave has a positive displacement from the equilibrium position, and the other wave has a negative displacement. What kind of interference occurs?
   a. constructive b. destructive c. complete constructive d. none

5. Which of the following types of interference will occur when the pulses in the figure above meet?
   a. no interference
   b. constructive interference
   c. destructive interference
   d. total interference
6. Waves arriving at a free boundary are
   a. neither reflected nor inverted.
   b. reflected but not inverted.
   c. reflected and inverted.
   d. inverted but not reflected.
7. A student sends a pulse traveling on a taut rope with one end attached to a post. What will the student observe?
   a. The pulse will not be reflected if the rope is free to slide up and down on the post.
   b. The pulse will be reflected and inverted if the rope is free to slide up and down on the post.
   c. The pulse will be reflected and inverted if the rope is fixed to the post.
   d. The pulse will not be inverted if the rope is fixed to the post.
8. Standing waves are produced by periodic waves of
   a. any amplitude and wavelength traveling in the same direction.
   b. the same amplitude and wavelength traveling in the same direction.
   c. any amplitude and wavelength traveling in opposite directions.
   d. the same frequency, amplitude, and wavelength traveling in opposite directions.
9. A 2.0 m long stretched rope is fixed at both ends. Which wavelength would *not* produce standing waves on this rope?
   a. 2.0 m b. 3.0 m c. 4.0 m d. 6.0 m
10. What is the fewest number of nodes a standing wave can have?
    a. 1 b. 2 c. 3 d. 4

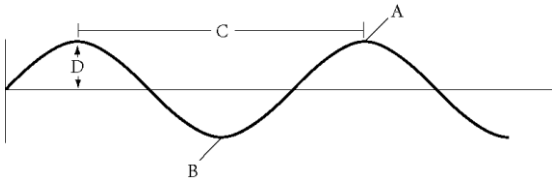


11. In the diagram above, use the superposition principle to find the resultant wave of waves X and Y.
    a. a b. b c. c d. d
12. Sound waves
    a. are a part of the electromagnetic spectrum.
    b. do not require a medium for transmission.
    c. are longitudinal waves.
    d. are transverse waves.
13. The highness or lowness of a sound is perceived as
    a. compression. c. ultrasound.
    b. wavelength. d. pitch.
14. In general, sound travels faster through
    a. solids than through gases. c. gases than through liquids.
    b. gases than through solids. d. empty space than through matter.
15. At a large distance from a sound source, spherical wave fronts are viewed as
    a. wavelengths. b. troughs. c. rays. d. plane waves.
16. The point at which a ray crosses a wave front corresponds to a ____ of a sound wave.
    a. wavelength b. compression c. trough d. source
17. A train moves down the track toward an observer. The sound from the train, as heard by the observer, is ____ the sound heard by a passenger on the train.
    a. the same as c. higher in pitch than
    b. a different timbre than d. lower in pitch than
18. The intensity of a sound at any distance from the source is directly proportional to the sound's
    a. wavelength. b. pitch. c. power. d. frequency.
19. If the intensity of a sound is increased by a factor of 100, the new decibel level will increase
    a. by two units. c. by a factor of 10.
    b. to twice the old one. d. by 20 units.
20. When the frequency of a force applied to a system matches the natural frequency of vibration of the system, ____ occurs.
    a. damped vibration b. random vibration c. timbre d. resonance
21. The Tacoma Narrows bridge collapsed in 1940 when winds caused ____ to build up in the bridge.
    a. a compression wave c. a standing wave
    b. a longitudinal wave d. friction
22. When an air column vibrates in a pipe that is open at both ends,
    a. all harmonics are present. c. only odd harmonics are present.
    b. no harmonics are present. d. only even harmonics are present.
23. The wavelength of the fundamental frequency of a vibrating string of length L is
    a. 1/2 L. b. L. c. 2L. d. 4L.
24. The quality of a musical tone of a certain pitch results from a combination of
    a. fundamental frequencies. c. transverse waves.
    b. harmonics. d. velocities.

25. Two violin players tuning their instruments together hear 8 beats in 2 s. What is the frequency difference between the two violins?
    a. 2 Hz b. 4 Hz c. 8 Hz d. 16 Hz

Short Answer

26. How is the relationship between period and frequency represented as an equation?



27. In the waveform shown above, which feature of a wave does letter D represent?
28. What feature of a wave increases when the source of vibration increases in energy?
29. In a mechanical wave, what is the relationship between the energy and the wave's amplitude?
30. A certain string that is 1.0 m long vibrates with a standing wave that has a wavelength of 2.0 m. How many nodes and antinodes will appear on the vibrating string?
31. A standing wave is produced by plucking a string. The points along the plucked string that appear not to be vibrating are produced by _____ interference.
32. The region of a sound wave in which air molecules are pushed closer together is called a(n) _____.
33. Unlike a transverse wave on a rope, sound travels as a(n) _____ wave.
34. Why is the number of possible standing waves in a pipe closed at one end limited compared to the number of possible standing waves in a pipe open at both ends?
35. It is possible for a highly amplified musical note to cause a crystal goblet to shatter. Explain how this might occur.
36. What is the wavelength of the third harmonic in a tube of length *L* that has a closed end?

Problem

37. A periodic wave has a wavelength of 0.50 m and a speed of 20 m/s. What is the wave frequency?
38. Radio waves from an FM station have a frequency of 103.1 MHz. If the waves travel with a speed of 3.00×10^8 m/s, what is the wavelength?
39. Bats chirp at high frequencies that humans cannot hear. They use the echoes to detect small objects, such as insects, as small as one wavelength. If a bat emits a chirp at a frequency of 60.0 kHz and the speed of sound waves in air is 340 m/s, what is the size in millimeters of the smallest insect that the bat can detect?
40. Waves propagate along a stretched string at a speed of 8.0 m/s. The end of the string vibrates up and down once every 1.5 s. What is the wavelength of the waves traveling along the string?
41. A wave on a guitar string has a velocity of 684 m/s. The guitar string is 62.5 cm long. What is the fundamental frequency of the vibrating string?
42. A resonating glass tube closed at one end is 4.0 cm wide and 47.0 cm long. What are the frequencies of the first two harmonics for the resonating tube? The speed of sound in air at this temperature is 346 m/s.