

AP physics B - Webreview Ch 14 Sound**Multiple Choice**

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

- _____ 1. Consider a vibrating string that makes a sound wave that moves through the air. As the guitar string moves up and down, the air molecules that are a certain horizontal distance from the string will move:
- up and down.
 - toward and away from the guitar string.
 - back and forth along the direction of the length of the string.
 - in circles around the guitar string.
 - none of the above.
- _____ 2. The speed of sound in air is a function of which one of the following?
- wavelength
 - frequency
 - temperature
 - amplitude
 - none of the above.
- _____ 3. The speed of sound at 0°C is 331 m/s. What is the speed of sound at 25°C ? ($0^{\circ}\text{C} = 273\text{ K}$)
- 346 m/s
 - 356 m/s
 - 343 m/s
 - 350 m/s
 - 340 m/s
- _____ 4. A sound wave in air has a frequency of 500 Hz and a wavelength of 0.68 m. What is the air temperature?
- -18°C
 - 0°C
 - 15°C
 - 27°C
 - 32°C
- _____ 5. Tripling the power output from a speaker emitting a single frequency will result in what increase in loudness?
- 0.33 dB
 - 3.0 dB
 - 4.8 dB
 - 9.0 dB
 - 11 dB
- _____ 6. What is the intensity level of a sound with intensity of $5.0 \times 10^{-10}\text{ W/m}^2$? ($I_0 = 10^{-12}\text{ W/m}^2$)
- 74 dB
 - 54 dB
 - 2.7 dB
 - 27 dB
 - 32 dB

- _____ 7. What is the intensity of a sound with a measured intensity level of 84 dB? ($I_0 = 10^{-12} \text{ W/m}^2$)
- $8.4 \times 10^{-3} \text{ W/m}^2$
 - $2.5 \times 10^{-4} \text{ W/m}^2$
 - $1.2 \times 10^{-5} \text{ W/m}^2$
 - $7.4 \times 10^{-4} \text{ W/m}^2$
 - $2.3 \times 10^{-3} \text{ W/m}^2$
- _____ 8. If the intensity of a sound is increased by a factor of 100, how is the decibel level changed? The new decibel level will be:
- two units greater.
 - double the old one.
 - ten times greater.
 - twenty units greater.
 - ten units greater.
- _____ 9. Tripling the distance between sound source and a listener will change the intensity, as detected by the listener, by what factor?
- 1/9
 - 0.33
 - 3.0
 - 9.0
 - 12
- _____ 10. A very loud train whistle has an acoustic power output of 100 W. If the sound energy spreads out spherically, what is the intensity level in dB at a distance of 100 meters from the train? ($I_0 = 10^{-12} \text{ W/m}^2$)
- 78.3 dB
 - 81.6 dB
 - 89.0 dB
 - 95.0 dB
 - 112 dB
- _____ 11. A sound source of frequency 1 000 Hz moves at 50.0 m/s toward a listener who is at rest. What is the apparent frequency heard by the listener? (speed of sound = 340 m/s)
- 853 Hz
 - 872 Hz
 - 1 150 Hz
 - 1 170 Hz
 - 1 220 Hz
- _____ 12. A 500-Hz whistle is moved toward a listener at a speed of 10.0 m/s. At the same time, the listener moves at a speed of 20.0 m/s in a direction away from the whistle. What is the apparent frequency heard by the listener? (The speed of sound is 340 m/s.)
- 473 Hz
 - 485 Hz
 - 533 Hz
 - 547 Hz
 - 568 Hz

- _____ 13. As a train starts from rest and then accelerates down the track, coming toward me faster and faster, the speed of the sound waves coming toward me will be:
- slower than the normal speed of sound in air.
 - equal to the normal speed of sound in air.
 - some constant speed faster than the normal speed of sound in air.
 - faster and faster.
 - slower and slower.
- _____ 14. An airplane flying with a constant speed flies from a warm air mass into a cold air mass. The Mach number will:
- increase.
 - decrease.
 - stay the same.
 - become unstable.
 - No conclusion can be made with the information given.
- _____ 15. A bat, flying at 5.00 m/s toward a wall, emits a chirp at 50.0 kHz. If the wall reflects this sound pulse, what is the frequency of the echo received by the bat? ($v_{\text{sound}} = 340$ m/s)
- 51.5 kHz
 - 51.2 kHz
 - 40.8 kHz
 - 50.5 kHz
 - 52.4 kHz
- _____ 16. The Doppler shift of ultrasonic waves can measure the speed of blood in an artery. If the frequency of the stationary source is 100 kHz and the reflected sound has a Doppler shift of 200 Hz, what is the blood flow speed? (The speed of sound inside the body is 1 500 m/s.)
- 1.0 m/s
 - 1.5 m/s
 - 2.2 m/s
 - 3.3 m/s
 - 4.5 m/s
- _____ 17. A phase difference of 270° corresponds to what wavelength difference?
- 3λ
 - $3\lambda/2$
 - $3\lambda/4$
 - $4\lambda/3$
 - $2\lambda/3$
- _____ 18. When two sound waves are out of phase by _____, destructive interference will occur.
- 90°
 - 270°
 - 540°
 - 720°
 - 810°

- _____ 19. Two loudspeakers are placed next to each other and driven by the same source at 500 Hz. A listener is positioned in front of the two speakers and on the line separating them, thus creating a constructive interference at the listener's ear. What minimum distance would one of the speakers be moved back away from the listener to produce destructive interference at the listener's ear? (The speed of sound = 340 m/s.)
- 1.36 m
 - 0.68 m
 - 0.34 m
 - 0.17 m
 - 0.12 m
- _____ 20. When I stand halfway between two speakers, with one on my left and one on my right, a musical note from the speakers gives me constructive interference. How far to my left should I move to obtain destructive interference?
- one-fourth of a wavelength
 - half a wavelength
 - one wavelength
 - one and a half wavelengths
 - two wavelengths
- _____ 21. If the tension on a guitar string is increased by a factor of 3, the fundamental frequency at which it vibrates is changed by what factor?
- 9
 - 3
 - $\sqrt{3}$
 - $1/\sqrt{3}$
 - 1/3
- _____ 22. If I triple the mass per unit length of guitar string, its natural frequency changes by what factor?
- 0.58
 - 1.0
 - 1.7
 - 3.0
 - 9.0
- _____ 23. If a guitar string has a fundamental frequency of 500 Hz, what is the frequency of its second overtone?
- 250 Hz
 - 750 Hz
 - 1 000 Hz
 - 1 500 Hz
 - 1 700 Hz
- _____ 24. A standing wave is set up in a 200-cm string fixed at both ends. The string vibrates in 5 distinct segments when driven by a 120-Hz source. What is the wavelength?
- 10 cm
 - 20 cm
 - 40 cm
 - 80 cm
 - 100 cm

- _____ 25. A 1.5-m string is held fixed at both ends. When driven by a 180-Hz source, the string vibrates in 4 distinct segments. What is the natural fundamental frequency of the string?
- 45 Hz
 - 90 Hz
 - 240 Hz
 - 600 Hz
 - 630 Hz
- _____ 26. For a standing wave on a string the wavelength must equal:
- the distance between adjacent nodes.
 - the distance between adjacent antinodes.
 - twice the distance between adjacent nodes.
 - the distance between supports.
 - both choices C and D are valid.
- _____ 27. A 2.50-m-long organ pipe is open at one end and closed at the other. Its fundamental tone has wavelength:
- 1.25 m.
 - 5.00 m.
 - 10.0 m.
 - 16.25 m.
 - 19.0 m.
- _____ 28. What is the first overtone frequency for an organ pipe 2.00 m in length, closed at one end? The speed of sound in air is 340 m/s.
- 42.5 Hz
 - 85.0 Hz
 - 128 Hz
 - 680 Hz
 - 760 Hz
- _____ 29. A tuning fork is sounded above a resonating tube (one end closed), which resonates at a length of 0.200 m and again at 0.600 m. What is the frequency of the fork when the speed of sound is taken to be 340 m/s?
- 567 Hz
 - 425 Hz
 - 1 700 Hz
 - 950 Hz
 - 1 500 Hz
- _____ 30. For a standing wave in an air column in a pipe that is open at both ends, there must be at least:
- one node and one antinode.
 - two nodes and one antinode.
 - two antinodes and one node.
 - two nodes and two antinodes.
 - none of the above.
- _____ 31. If two adjacent frequencies of an organ pipe closed at one end are 550 Hz and 650 Hz, what is the length of the organ pipe? ($v_{\text{sound}} = 340$ m/s)
- 0.85 m
 - 1.25 m
 - 1.50 m
 - 1.70 m
 - 1.90 m

- _____ 32. The air in a tube open at both ends is sent into its fundamental resonance. One end of the tube is then closed and the air column is again set into its fundamental resonance. The resonant frequency _____ after the end is closed.
- halves
 - stays the same
 - doubles
 - increases by a factor of 1.4
 - increases by a factor of 4.0
- _____ 33. What phenomenon is created by two tuning forks, side by side, emitting frequencies, which differ by only a small amount?
- resonance
 - interference
 - the Doppler effect
 - beats
 - none of the above.
- _____ 34. The number of overtones, and their relative intensities, is associated with what property of the tone generated by a musical instrument?
- quality
 - interference pattern
 - range
 - attack pattern
 - both choices A and C are valid.
- _____ 35. The term "timbre" refers to which of the following?
- Any musical instrument made primarily of wood.
 - The quality of sound from instruments due to the mixture of harmonics.
 - Instruments that have valves.
 - An instrument made in France.
 - None of the above.
- _____ 36. Of the frequencies listed below, to which one is the human ear most sensitive?
- 33 Hz
 - 330 Hz
 - 3 300 Hz
 - 33 000 Hz
 - 330 000 Hz
- _____ 37. In which part of the ear is the cochlea?
- outer ear
 - middle ear
 - inner ear
 - ear canal
 - semicircular canal

**AP physics B - Webreview Ch 14 Sound
Answer Section**

MULTIPLE CHOICE

1. B
2. C
3. A
4. C
5. C
6. D
7. B
8. D
9. A
10. C
11. D
12. B
13. B
14. A
15. A
16. B
17. C
18. C
19. C
20. A
21. C
22. A
23. D
24. D
25. A
26. C
27. C
28. C
29. B
30. C
31. D
32. A
33. D
34. A
35. B
36. C
37. C