Sound Waves

Use this key to check answers and read the explanations.

1. What starts the sound you hear immediately after a tight drumhead is tapped?
   - A. The drumhead vibrates and disturbs nearby air.
   - B. The drumhead emits ultraviolet light.
   - C. The air pressure stops changing everywhere.
   - D. The drum replaces the air with water vapor.

   Correct answer: A. The drumhead vibrates and disturbs nearby air.
   The vibrating head makes the surrounding air pressure fluctuate. The disturbance spreads outward as sound.

2. Which measurable property is most directly associated with the pitch of a pure tone?
   - A. Speaker distance
   - B. Source mass
   - C. Frequency
   - D. Wave intensity alone

   Correct answer: C. Frequency
   A higher frequency is normally heard as a higher pitch for a pure tone.

3. Within a sound wave in air, what is a compression?
   - A. A pocket containing no molecules
   - B. A region of higher pressure than the undisturbed air
   - C. A region of lower pressure than the undisturbed air
   - D. A place where all molecules permanently stop

   Correct answer: B. A region of higher pressure than the undisturbed air
   Air molecules are crowded closer together in a compression, raising the local pressure.

4. Which process lets a shout return from a rock wall as an echo?
   - A. Polarization
   - B. Condensation
   - C. Melting
   - D. Reflection

   Correct answer: D. Reflection
   Part of the sound wave reflects from the wall and travels back to the listener.

5. If a tuning fork repeats its motion 440 times per second, how is its frequency written?

A. 440 m/s
B. 440 Hz
C. 440 dB
D. 440 m

Correct answer: B. 440 Hz
One hertz equals one cycle per second.

6. Two otherwise identical speakers play the same tone. At the same distance, which change typically makes one sound louder?

A. Increasing its sound pressure amplitude
B. Halving its sound pressure amplitude
C. Keeping the sound pressure amplitude unchanged
D. Reducing its sound pressure amplitude by one quarter

Correct answer: A. Increasing its sound pressure amplitude
At fixed frequency and distance, a greater pressure variation corresponds to greater intensity and is generally heard as louder.

7. A sensor sends out a 40,000 Hz sound pulse. Why is it called ultrasound?

A. It only exists in empty space.
B. It travels faster than visible light.
C. Its frequency is below all audible bass tones.
D. Its frequency is above the usual upper limit of human hearing.

Correct answer: D. Its frequency is above the usual upper limit of human hearing.
The pulse is above the usual human hearing limit of about 20,000 Hz.

8. In still air under otherwise comparable conditions, which path generally carries sound faster?

A. Both always give exactly the same speed.
B. A path through cooler air
C. A path through warmer air
D. Only the path with the louder sound

Correct answer: C. A path through warmer air
The speed of sound in an ideal gas increases with its absolute temperature when composition is fixed.

9. A 170 Hz tone travels through air at 340 m/s. What is its wavelength?

A. 2 m
B. 0.5 m
C. 170 m
D. 510 m

Correct answer: A. 2 m
Divide wave speed by frequency. The result is 340 ÷ 170 = 2 m.

10. If a speaker doubles the frequency while the speed of sound in the room stays the same, what happens to its wavelength?

A. It stays the same.
B. It doubles.
C. It quadruples.
D. It is halved.

Correct answer: D. It is halved.
Wavelength equals wave speed divided by frequency.

11. An ambulance moves toward a stationary listener while emitting a tone of fixed frequency. What change does the listener hear compared with a stationary ambulance?

A. A lower speed of sound in the surrounding air
B. A lower frequency
C. A higher frequency
D. No change in frequency

Correct answer: C. A higher frequency
Approaching motion brings successive wavefronts closer together in front of the source, increasing the observed frequency.

12. An echo comes back 0.20 s after a pulse. At 340 m/s, how far away is the reflecting wall?

A. 68 m
B. 34 m
C. 17 m
D. 170 m

Correct answer: B. 34 m
The pulse travels to the wall and back. Its round trip is 340 × 0.20 = 68 m, so the wall is 34 m away.

13. Sound A has ten times the intensity of Sound B. How much greater is its sound intensity level in decibels?

A. 100 dB
B. 1 dB
C. 20 dB
D. 10 dB

Correct answer: D. 10 dB
The difference in intensity level is ten times the base-ten logarithm of the intensity ratio.

14. Two notes heard together have frequencies of 440 Hz and 444 Hz. How many loudness beats occur each second?

A. 4
B. 2
C. 442
D. 884

Correct answer: A. 4
The beat frequency is the absolute difference between the two frequencies.

15. Two echoes reach a microphone 0.10 s apart. Sound travels at 340 m/s along each path straight out and back. How much farther away is the second reflector?

A. 3.4 m
B. 34 m
C. 17 m
D. 68 m

Correct answer: C. 17 m
The 0.10-second delay corresponds to a round-trip difference of 34 m. Divide by two to compare the one-way distances.