Name: _____ **Class:** _____ **Date:** _____ **ID: A**

Cp physics - Webreview : Sound

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

____ 1. Which of the following is the region of a sound wave in which the density and pressure are greater than normal?
a. rarefaction
b. compression
c. amplitude
d. wavelength

____ 2. The highness or lowness of a sound is perceived as
a. compression.
b. wavelength.
c. ultrasound.
d. pitch.

____ 3. At a large distance from a sound source, spherical wave fronts are viewed as
a. wavelengths.
b. troughs.
c. rays.
d. plane waves.

____ 4. 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

____ 5. The property of sound called *intensity* is proportional to the rate at which energy flows through
a. an area perpendicular to the direction of propagation.
b. an area parallel to the direction of propagation.
c. a cylindrical tube.
d. a sound wave of a certain frequency.

____ 6. 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.

____ 7. 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

____ 8. The Tacoma Narrows bridge collapsed in 1940 when winds caused ____ to build up in the bridge.
a. a compression wave
b. a longitudinal wave
c. a standing wave
d. friction

____ 9. When an air column vibrates in a pipe that is open at both ends,
a. all harmonics are present.
b. no harmonics are present.
c. only odd harmonics are present.
d. only even harmonics are present.

____ 10. When an air column vibrates in a pipe that is closed at one end,
a. all harmonics are present.
b. no harmonics are present.
c. only odd harmonics are present.
d. only even harmonics are present.

____ 11. The quality of a musical tone of a certain pitch results from a combination of
a. fundamental frequencies.
b. harmonics.
c. transverse waves.
d. velocities.

____ 12. How many beats per second are heard when two vibrating tuning forks having frequencies of 342 Hz and 345 Hz are held side by side?
a. 687 Hz
b. 343.5 Hz
c. 5 Hz
d. 3 Hz

____ 13. How many beats per second are heard when two vibrating tuning forks having frequencies of 216 Hz and 224 Hz are held side by side?
a. 6 Hz
b. 8 Hz
c. 9 Hz
d. 3 Hz

____ 14. A vibrating guitar string emits a tone just as a 5.00×10^2 Hz tuning fork is struck. If five beats per second are heard, which of the following is a possible frequency of vibration of the string?
a. 2500 Hz
b. 1500 Hz
c. 605 Hz
d. 495 Hz

Short Answer

15. The region of a sound wave in which air molecules are pushed closer together is called a(n) _____.

16. Unlike a transverse wave on a rope, sound travels as a(n) _____ wave.

17. Each trough of a sine wave used to represent a sound wave corresponds to a(n) _____ of the sound wave.

18. The _____ of a musical sound determines its pitch.

19. What happens to pitch when the frequency of a sound wave increases?

20. In general, does sound travel faster in a gas or in a solid? Explain.

21. How is the speed of sound in air affected when the temperature increases?

22. At a long distance from the source, spherical wave fronts can be treated as _____ waves.

23. Describe any changes in pitch of the sound a stationary observer hears from the siren of an ambulance as the ambulance passes the observer.

24. Compare the pitch of a sound source moving toward a stationary observer with the pitch of the sound the observer hears. Explain how this phenomenon occurs.

25. Under what conditions does sound resonance occur?

26. What is the wavelength of the fundamental frequency of a tube with open ends and length L?

Problem

27. An organ tuner is comparing the fundamental pitch from a certain closed-end organ pipe that is 53.3 cm long to the sound from an electronic signal generator set to a pitch of 165 Hz. The pipe is located in an environment in which the speed of sound is 343 m/s. How many beats per second will the organ tuner hear?

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Answer Section

MULTIPLE CHOICE

1. B
2. D
3. D
4. B
5. A
6. C
7. D
8. C
9. A
10. C
11. B
12. D
13. B
14. D

SHORT ANSWER

15. compression
16. longitudinal
17. rarefaction
18. frequency
19. The pitch rises.
20. Sound travels faster in a solid than in a gas because the particles of a solid are closer together than those of a gas.
21. The speed of sound in air increases as temperature increases.
22. plane
23. The apparent pitch of the sound drops as the ambulance passes.
24. The stationary observer hears a sound with a higher pitch than the sound source is emitting. As the source moves, the wave fronts ahead of the source are pushed closer together than they would be if the source were stationary. Because the perceived wavelength is less while the wave speed is constant, the perceived frequency is greater, and thus the observed pitch is higher.
25. Resonance occurs when the frequency of a force applied to an object is the same as the natural frequency of an object.
26. $2L$

PROBLEM

27. 4 beats/s

Given
$v = 343$ m/s
$L = 53.3$ cm $= 0.533$ m
$f_{signal} = 165$ Hz

Solution
For a resonating tube closed at one end,
$f_n = n\dfrac{v}{4L}$
At the fundamental frequency, $n = 1$, so
$f_1 = \dfrac{v}{4L} = \dfrac{343\text{ m/s}}{4(0.533\text{ m})} = 161\text{ Hz}$
$f_{signal} = 165$ Hz
Beat frequency $= f_{signal} - f_1 = 165$ Hz -161 Hz $= 4$ beats/s