Ch 12A

1) Seven seconds after a brilliant flash of lightning, thunder shakes the house. Approximately how far was the lightning strike from the house?
   A) about two kilometers away
   B) much farther away than two kilometers
   C) about one kilometer away
   D) much closer than one kilometer
   E) It is impossible to say.

   ID: ppa7g 12.1-1

2) Sound A has a high pitch and sound B has a low pitch. Which of the following statements about these two sounds are correct? (There could be more than one correct choice.)
   A) Sound B travels faster than sound B through air.
   B) The wavelength of A is longer than the wavelength of B.
   C) The frequency of A is greater than the frequency of B.
   D) The amplitude of A is larger than the amplitude of B.
   E) The period of A is shorter than the period of B.

   ID: ppa7g 12.1-3

3) Suppose that a sound source is emitting waves uniformly in all directions. If you move to a point twice as far away from the source, the frequency of the sound will be
   A) half as great.
   B) unchanged.
   C) twice as great.
   D) one–fourth as great.

   ID: ppa7g 12.1-5

4) Consider the standing wave on a guitar string and the sound wave generated by the string as a result of this vibration. What do these two waves have in common? (There may be more than one correct choice.)
   A) They have the same wavelength.
   B) They have the same frequency.
   C) They have the same amplitude.
   D) They have the same speed.
   E) They have the same period.

   ID: ppa7g 12.1-11

5) What is the ratio of the intensities of two sounds with intensity levels of 70 dB and 40 dB?

   ID: ppa7g 12.2-8+

6) A barking dog delivers about 1.0 mW of power, which is assumed to be uniformly distributed in all directions. What is the intensity level in decibels at a distance 5.00 m from the dog? The threshold of human hearing is 1.0×10^{-12} W/m^2.

   ID: ppa7g 12.2-12+

7) A certain siren radiates sound uniformly in all directions. At a distance of 17 m from the siren, the intensity level is 49 db. How many watts of power does this siren put out? The threshold of human hearing is 1.0×10^{-12} W/m^2.

   ID: ppa7g 12.2-16

8) A certain factory whistle can be heard up to a distance of 9.8 km. Assuming that the acoustic output of the whistle is uniform in all directions, at what distance from the factory is the intensity level of the whistle sound equal to 25 dB? The threshold of human hearing is 1.0×10^{-12} W/m^2.

ID: ppa7g 12.2-20+

9) A string that is 0.26 m long is vibrating in its $n = 6$ harmonic. The sound from this string excites a pipe that is 0.88 m long and open at both ends into its second overtone resonance. What is the common resonant frequency of the string and the pipe? The speed of sound in air is 345 m/s.

ID: ppa7g 12.2-40+

10) A certain glass window reduces the intensity level of the sound from 72 dB to 47 dB. By what factor is the acoustic *power* reduced by this glass window?

ID: ppa7g 12.2-24+

Ch 12B

11) An organ pipe that is 1.75 m long and open at both ends produces sound of frequency 303 Hz when resonating in its second overtone. What is the speed of sound in the room?

ID: ppa7g 12.2-28

12) An organ pipe of length L that is open at one end resonates in its third harmonic with a wavelength of $2L/3$. Is the other end of the pipe closed or open?

A) closed
B) open
C) We cannot tell from the information provided.

ID: ppa7g 12.1-6

13) In a resonating pipe that is open at one end and closed at the other end, there

A) is a displacement node at the closed end and a displacement antinode at the open end.
B) are displacement nodes at each end.
C) are displacement antinodes at each end.
D) is a displacement node at the open end and a displacement antinode at the closed end.

ID: ppa7g 12.1-8

14) The lowest tone to resonate in pipe of length L that is open at both ends is 200 Hz. Which one of the following frequencies will *not* resonate in the same pipe?

A) 600 Hz B) 900 Hz C) 800 Hz D) 200 Hz E) 400 Hz

ID: ppa7g 12.1-9

15) An organ pipe open at both ends has a length of 0.80 m. If the velocity of sound in air is 340 m/s, what is the frequency of the second harmonic of this pipe?

ID: ppa7g 12.2-32+

16) One of the harmonics of a column of air in a tube that is open at both ends has a frequency of 448 Hz, and the next higher harmonic has a frequency of 576 Hz. What is the fundamental frequency of the air column in this tube?

ID: ppa7g 12.2-36+

17) The wavelengths of the sounds produced by two horns are 6.0 m and 7.0 m, respectively. What beat frequency is heard when the horns are sounded on a day when the speed of sound is 340 m/s?

ID: ppa7g 12.2-44+

18) Consider a pipe of length L that is open at both ends. What are the wavelengths of the three lowest-pitch tones produced by this pipe?

A) $2L$, L, $2L/3$ B) $4L$, $4L/3$, $4L/5$ C) $2L$, L, $L/2$ D) $4L$, $2L$, L

ID: ppa7g 12.1-12

19) Consider a pipe of length L that is open at one end and closed at the other end. What are the wavelengths of the three lowest-pitch tones produced by this pipe?

A) $2L$, L, $2\,L/3$ B) $4L$, $4L/3$, $4L/5$ C) $4L$, $2L$, L D) $2L$, L, $L/2$

ID: ppa7g 12.1-15

20) A pipe of length L that is closed at one end and open at the other end is resonating at its fundamental frequency. Which statement about the sound is correct?

A) The wavelength is L and there is a displacement antinode at the pipe's open end.
B) The wavelength is L and there is a displacement node at the pipe's open end.
C) The wavelength is $4L$ and there is a displacement node at the pipe's open end.
D) The wavelength is $4L$ and there is a displacement antinode at the pipe's open end.

ID: ppa7g 12.1-16

21) Two tuning forks have frequencies of 440 and 522 Hz. What is the beat frequency if both are sounding simultaneously?

A) 962 Hz B) 82 Hz C) 41 Hz D) 481 Hz E) 55 Hz

ID: ppa7g 12.1-17

22) A person stands between two speakers driven by the same source. Each speaker produces a tone with a frequency of 200 Hz on a day when the speed of sound is 330 m/s. The person is 1.65 m from one speaker and 4.95 m from the other. What type of interference does the person perceive?

A) constructive B) destructive
C) both constructive and destructive D) neither constructive nor destructive

ID: ppa7g 12.1-24+

23) Two motors in a factory are running at slightly different rates. One runs at 825.0 rpm and the other at 786.0 rpm. You hear the sound intensity increase and then decrease periodically due to wave interference. How long does it take between successive instances of the sound intensity increasing?

ID: ppa7g 12.2-4+

24) A music tuner uses a 554-Hz C# tuning fork to tune the frequency of a musical instrument. If the tuner hears a beat frequency of 2 Hz, what is the frequency of the instrument?

A) It must be 556 Hz.
B) It must be 552 Hz.
C) It could be either 553 Hz or 555 Hz.
D) It could be either 556 Hz or 552 Hz.
E) It is neither 556 Hz or 552 Hz.

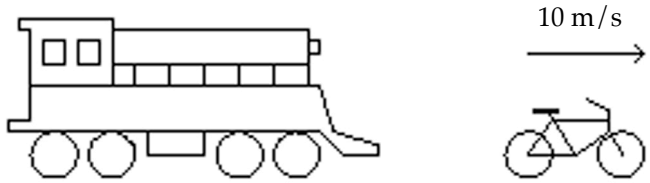
ID: ppa7g 12.1-20

25) In many cartoon shows, a character runs off a cliff, realizes his predicament, and lets out a scream. He continues to scream as he falls. If the physical situation is portrayed correctly, from the vantage point of an observer at the *foot* of the cliff, the pitch of the scream as he falls should be

A) lower than the original pitch and constant.
B) lower than the original pitch and decreasing as he falls.
C) higher than the original pitch and constant.
D) higher than the original pitch and increasing as he falls.
E) It is impossible to predict.

ID: ppa7g 12.1-23

26) As shown in the figure, a man is traveling on a bicycle along a straight road that runs parallel to and right next to some railroad tracks. While moving at 10 m/s, he hears the whistle of a train that is behind him, as shown in the figure. The frequency emitted by the train's whistle is 820 Hz, but the frequency the man hears is 774 Hz. The speed of sound is 340 m/s.
(a) What frequency is heard by a stationary observer located between the train and the bicycle?
(b) What is the speed of the train, and is the train traveling away from or toward the bicycle?



ID: ppa7g 12.2-48

27) You are driving along a highway at 35.0 m/s when you hear the siren of a police car approaching you from behind at constant speed and you perceive the frequency as 1340 Hz. You are relieved that he is in pursuit of a different driver when he continues past you, but now you perceive the frequency as 1300 Hz. What is the speed of the police car? The speed of sound in air is 343 m/s.

ID: ppa7g 12.2-52+

28) A whistle produces sound of frequency of 1.00 kHz. If a listener moves with a speed of 30 m/s away from the whistle, what frequency does this person hear if the sound speed is 340 m/s?

ID: ppa7g 12.2-56+

29) A train is traveling away from you at 120 km/h. It blows its whistle, and you hear a tone of 0.400 kHz. Take the speed of sound to be 340 m/s. What frequency does the whistle actually produce?

ID: ppa7g 12.2-60+

30) A siren emitting sound of frequency 1000 Hz approaches a stationary observer at one-half the speed of sound. The observer hears a frequency of

ID: ppa7g 12.2-64+

31) Two in-phase loudspeakers are placed along a wall and are separated by a distance of 4.00 m. They emit sound with a frequency of 514 Hz. A person is standing away from the wall, in front of one of the loudspeakers. What is the closest distance from the wall the person can stand and hear destructive interference? The speed of sound in air is 343 m/s.

ID: ppa7g 12.2-68+

32) Two loudspeakers placed 6.00 m apart are driven in phase by an audio oscillator having a frequency range from 1595 Hz to 2158 Hz. A point P is located 4.70 m from one loudspeaker and 3.60 m from the other speaker. The speed of sound in the room is 344 m/s. At what frequency (or frequencies) of the oscillator does the sound reaching point P interfere destructively? (There could be more than one correct choice.)

ID: ppa7g 12.2-72+

Answer Key
Testname: HW_CH12_SOUND

1) A
2) C, E
3) B
4) B, E
5) 1000:1
6) 65 dB
7) 2.9×10^{-4} W
8) 550 m
9) 590 Hz
10) 3.2×10^{-3}
11) 354 m/s
12) B
13) A
14) B
15) 425 Hz
16) 128 Hz
17) 8 Hz
18) A
19) B
20) D
21) B
22) A
23) 1.54 s
24) D
25) D
26) a) 797 Hz b) 9.8 m/s, away from the bicycle
27) 40.1 m/s
28) 912 Hz
29) 439 Hz
30) 2000 Hz.
31) 0.34 m
32) 1720 Hz