Extended Response

14.1 Speed of Sound, Frequency, and Wavelength 80.

How is a human able to hear sounds?

a. Sound waves cause the eardrum to vibrate. A complicated mechanism converts the vibrations to nerve impulses, which are perceived by the person as sound.
b. Sound waves cause the ear canal to vibrate. A complicated mechanism converts the vibrations to nerve impulses, which are perceived by the person as sound.
c. Sound waves transfer electrical impulses to the eardrum. A complicated mechanism converts the electrical impulses to sound.
d. Sound waves transfer mechanical vibrations to the ear canal, and the eardrum converts them to electrical impulses.

81.

Why does sound travel faster in iron than in air even though iron is denser than air?

a. The density of iron is greater than that of air. However, the rigidity of iron is much greater than that of air. Hence, sound travels faster in it.
b. The density of iron is greater than that of air. However, the rigidity of iron is much less than that of air. Hence, sound travels faster in it.
c. The density of iron is greater than that of air. However, the rigidity of iron is equal to that of air. Hence, sound travels faster in it.
d. The mass of iron is much less than that of air and the rigidity of iron is much greater than that of air. Hence, sound travels faster in it.

82.

Is the speed of sound dependent on its frequency?

a. No
b. Yes

14.2 Sound Intensity and Sound Level 83.

Why is the sound from a tire burst louder than that from a finger snap?

a. The sound from the tire burst has higher pressure amplitudes, hence it can exert smaller force on the eardrum.
b. The sound from the tire burst has lower pressure amplitudes, hence it can exert smaller force on the eardrum.
c. The sound from the tire burst has lower pressure amplitudes, hence it can exert larger force on the ear drum.
d. The sound from the tire burst has higher pressure amplitudes, hence it can exert larger force on the eardrum.

84.

Sound A is 1000 times more intense than Sound B. What will be the difference in decibels in their sound intensity levels?

a. 5\,\text{dB}
b. 10\,\text{dB}
c. 3\,\text{dB}
d. 30\,\text{dB}

85.

The ratio of the pressure amplitudes of two sound waves traveling through water at 0^{\circ}\text{C} is 4.0. What will be the difference in their sound intensity levels in dB?

a. 1.2\,\text{dB}
b. 6.0\,\text{dB}
c. 0.60\,\text{dB}
d. 12\,\text{dB}

86.

Which of the following most closely models how sound is produced by the vocal cords?

a. A person plucks a string.
b. A person blows over the mouth of a half-filled glass bottle.
c. A person strikes a hammer against a hard surface.
d. A person blows through a small slit in a wide, stretched rubber band.

14.3 Doppler Effect and Sonic Booms 87.

True or false—The Doppler effect occurs only when the sound source is moving.

a. False
b. True

88.

True or false—The observed frequency becomes infinite when the source is moving at the speed of sound.

a. False
b. True

89.

You are driving alongside a train. You hear its horn at a pitch that is lower than the actual frequency. What should you do to match the speed of the train? Why?

a. In order to match the speed of the train, one would need to increase or decrease the speed of his/her car because a lower pitch means that either the train (the source) is moving away or that you (the observer) are moving away.
b. In order to match the speed of the train, one would need to drive at a constant speed because a lower pitch means that the train and the car are at the same speed.

14.4 Sound Interference and Resonance 90.

How are the beat frequency and the regular frequency of a wave resulting from superposition of two waves different?

a. Beat frequency is the sum of two frequencies and regular frequency is the difference between frequencies of two original waves.
b. Beat frequency is the difference between the constituent frequencies, but the regular frequency is the average of the frequencies of the two original waves.
c. Beat frequency is the sum of two frequencies and regular frequency is the average of frequencies of two original waves.
d. Beat frequency is the average of frequencies of two original waves and regular frequency is the sum of two original frequencies.

91.

In the tuning fork and tube experiment, if resonance is formed for L = \lambda /4, where L is the length of the tube and \lambda is the wavelength of the sound wave, can resonance also be formed for a wavelength \lambda = 4L/9? Why?

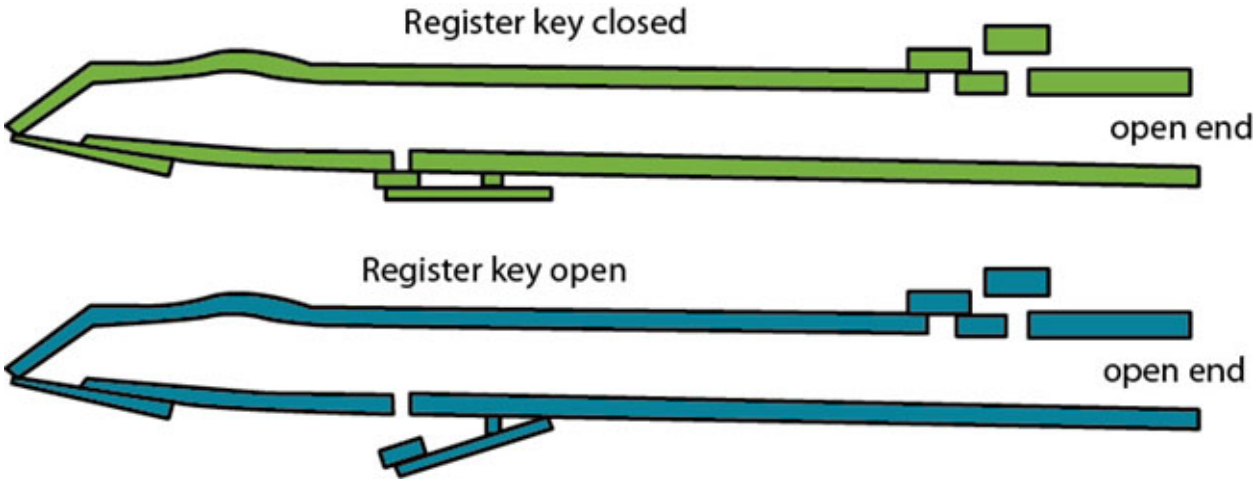
a. The frequency formed is a harmonic and first overtone so resonance will occur.
b. The frequency formed is a harmonic and second overtone so resonance will occur.
c. The frequency formed is a harmonic and third overtone so resonance will occur.
d. The frequency formed is a harmonic and fourth overtone so resonance will occur.

92.

True or false—An open-pipe resonator has more overtones than a closed-pipe resonator.

a. False
b. True

93.



(credit: modification of work by HyperPhysics)

In a clarinet, the mouthpiece is an antinode. This means the clarinet is acoustically a pipe closed at one end.

The clarinet has a key (the register key) near the mouthpiece. When this this key is pressed, a hole opens at the side. The hole adds a node on the air column.

Make a claim about the effect of this key.

a. The air column cannot move down this hole.
b. The instrument can no longer play its fundemental note.
c. All the notes played by the instrument become higher.
d. All the notes played by the instrument become lower.