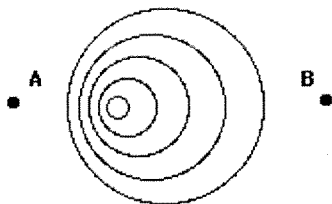


## Sound Review

1. Sound waves are best classified as
  - a. longitudinal, because the air molecules are vibrating perpendicular to the direction of wave motion
  - b. transverse, because the air molecules are vibrating perpendicular to the direction of wave motion
  - c. longitudinal, because the air molecules are vibrating parallel to the direction of wave motion
  - d. transverse, because the air molecules are vibrating parallel to the direction of wave motion
2. Bees which are not carrying honey fly with a flapping frequency of 440 Hz while those which are carrying honey fly with a flapping frequency of 300 Hz. The sound made by bees which are not carrying honey has
  - a. a lower pitch.
  - b. a higher pitch.
  - c. a smaller loudness.
  - d. a greater loudness.
3. Consider the diagram below of several circular waves created at various times and locations. At which point would you perceive a high Frequency and high pitch?



- a. Point A
  - b. Point B
  - c. Point A has a higher frequency while point B has a higher pitch
  - d. Point B has a higher frequency while point A has a higher pitch
4. If a sound seems to be getting louder, which of the following is probably increasing?
    - A. intensity
    - B. frequency
    - C. speed of sound
    - D. wavelength
  5. How does temperature of a medium affect the speed of sound waves?
    - a. As the temperature of a substance increases, sound waves in it move faster.
    - b. As the temperature of a substance decreases, sound waves in it move faster.
    - c. Temperature does not affect the speed of sound waves.

6. A sound that travels 343 m/s in air, and hits a canyon wall and bounces back. After 10-seconds you hear the echo. The canyon wall is how far away?

$$d = v \cdot t = (343 \text{ m/s})(5 \text{ sec}) = 1715 \text{ m}$$

$\frac{1}{2}$  the time to travel one way to canyon

7. In which of these does sound travel the fastest?

- a. gas
- b. liquid
- c. Solid
- d. The speed of sound would be the same in all of them

8. Which of the following is the region of a longitudinal wave in which the density and pressure are greater than normal?

- a. diffraction
- b. rarefaction
- c. compression
- d. amplitude

9. Resonance occurs when

- a. the amplitude of a sound wave is magnified.
- b. a sound wave changes speed as it moves into a new medium.
- c. a sound wave is reflected more than once.
- d. an object is forced to vibrate at its natural frequency by another vibrating object.

10. If a guitar string has a fundamental frequency of 250 Hz, what is the frequency of its second harmonic?

Fixed string - all harmonics  $2^{\text{nd}} \text{ Harm} = 2(250 \text{ Hz}) = 500 \text{ Hz}$

Sound Source	Level (dB)
Smashin' Pumpkins concert (front row)	110
Smashin' Pumpkins concert (15th row)	100
Average factory	90
Normal Speech	60
Library	40
Threshold of hearing	0

11. According to the table above, how many times more intense is the average factory than the threshold of hearing?

- a. 90 times
- b. 1,000,000,000 times
- c. 9000 times
- d. 1,000,000 times

$$0 - 90 = 9 \text{ changes} \\ \text{so } 10^9$$

How many times more intense is a front row at a concert to normal speech?

- a. 50 times
- b. 100 000 times
- c. 5000 times

$$60 - 110 = 50 \text{ changes} \\ \text{so } 10^5$$

12. Why is a guitar string attached to a guitar so much louder than an identical guitar string with identical tension that is not attached to a guitar?
- The sound box of the guitar prevents destructive wave interference.
  - The sound box reflects the sound wave towards the listener.
  - The sound box of the guitar and the air inside are forced to vibrate along with the string.
13. Why does sound diffract more than light does?
- Because sound comes in many frequencies.
  - Because sound has a greater amplitude.
  - Because sound has a longer wavelength.
  - Because sound is a longitudinal wave.
14. The faster an object vibrates,
- the louder the sound it makes will be.
  - the higher the pitch will be.
  - the faster the sound wave will travel.
  - more than one of these will happen.
15. A source emits a sound with a frequency of 500 Hz, but the listener hears a frequency of 350 Hz. Therefore,
- the source is moving toward the listener.
  - the source is moving away from the listener.
  - the listener has defective ears.
16. Ultrasound refers to waves with
- very high amplitudes
  - very low amplitudes
  - very high frequencies
  - very low frequencies
17. In a demonstration, a vibrating tuning fork causes a nearby second tuning fork to begin to vibrate with the same frequency. Which wave phenomenon is illustrated by this demonstration?
- interference
  - refraction
  - resonance
  - diffraction
18. Compared to the speed of light, the speed of sound is
- much slower
  - about the same
  - slightly faster

20. Fill in the blank - fill in the correct unit (meters, meters per second, Hertz, decibel, Watts/meter<sup>2</sup>, seconds)

Frequency -- Hertz

Period -- second

Wavelength -- meters

Wave speed -- meters per second (m/s)

Sound Intensity -- Watts/meter<sup>2</sup>

Relative sound intensity -- decibel

21.

A sound wave is moving through air. The diagram below represents a snapshot of the air particles at a given instant in time. Several regions are labeled with a letter. Use the letters to identify the compressions and rarefactions.



Compressions: A C E G I K      Rarefactions: B D F H J

22. What is the intensity of sound waves produced by a trumpet at a distance of 1.6 m when the power output of the trumpet is 0.30 W?

$$I = \frac{0.30 \text{ W}}{(4)(3.14)(1.6)^2} = \frac{0.3}{32.15} = .009 \frac{\text{W}}{\text{m}^2}$$

$$I = \frac{P}{4\pi r^2}$$

23. If the intensity of a sound is  $8.0 \times 10^{-4} \text{ W/m}^2$  at a distance of 5.0 m, what is the power of the sound?

$$P = I(4)(\pi)(r^2) = (8 \times 10^{-4})(4)(3.14)(5^2) = .25 \text{ W}$$

$$P = I(4\pi r^2)$$

24. If both ends of a pipe are open,

- a. all harmonics are present.
- b. no harmonics are present.

- c. only odd harmonics are present.
- d. only even harmonics are present.

25. If one end of a pipe is closed,

- a. all harmonics are present.
- b. no harmonics are present.

- c. only odd harmonics are present.
- d. only even harmonics are present.

26. If a guitar string has a fundamental frequency of  $7.50 \times 10^2$  Hz, what is the frequency of its fifth harmonic?

- a. 3750 Hz
- b. 750 Hz

- c. 2000 Hz
- d. 1500 Hz

Fixed string - all harmonics  
 $5^{\text{th}} \text{ Har} = 5(750 \text{ Hz}) = 3750 \text{ Hz}$

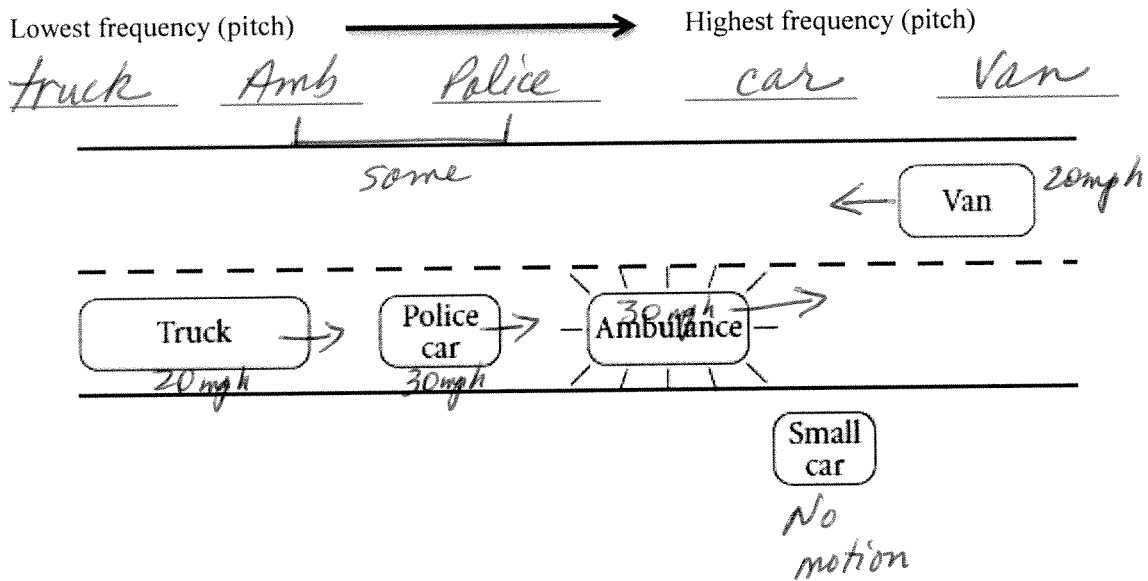
27. The effects of sound on the ear are loudness, pitch, and quality. Loudness is an effect of \_\_\_\_, pitch is an effect of \_\_\_\_, and timbre is an effect of \_\_\_\_.

- a. intensity; harmonic content; frequency
- b. harmonic content; frequency; intensity

- c. frequency; intensity; harmonic content
- d. intensity; frequency; harmonic content

28. The driver of an ambulance turns on its siren as the ambulance heads east at 30 mph. A police car is following the ambulance at 30 mph. A truck behind the police car is moving at 20 mph. A van is traveling west in the opposite lane at 20 mph. A small car is stopped at the side of the road. The vehicles are positioned as shown.

Rank the sounds perceived by the passengers in each of the vehicles in order of **decreasing** frequency.



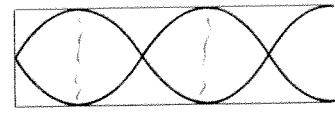
Ambulance & police - same velocity - no change  
 truck - slowest - lower freq  
 car - not moving - medium change  
 van - moving fastest going toward ambulance  
 greatest change

A. Open pipe, closed pipe or fixed string? closed

b. Which harmonic is shown? 5<sup>th</sup>

c. Which overtone is shown? 2<sup>nd</sup>

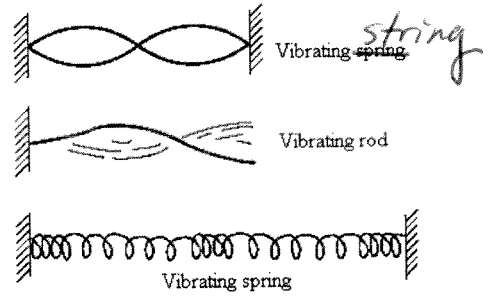
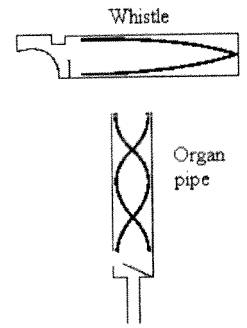
d. If the fundamental frequency is 125 Hz, what is the frequency shown? (5) 125 = 625 Hz



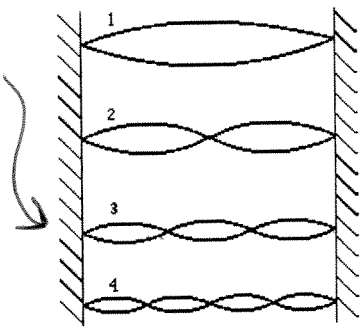
5 1/2 antinodes

E. Which object(s) indicates a fundamental frequency? whistle

F. Which object(s) shows the 2<sup>nd</sup> harmonic? organ pipe and string



G. Which diagram indicates the 3rd harmonic? 3  
 How many nodes are shown? 4  
 How many antinodes are shown? 3



H. If the fundamental frequency for this string is 252 Hz, what is the frequency shown?

(4) 252 = 1008 Hz



4<sup>th</sup> harmonic