1. A fire truck is moving at a fairly high speed, with its siren emitting sound at a specific pitch. As the fire truck recedes from you which of the following characteristics of the sound wave from the siren will have a smaller measured value for you than for a fireman in the truck? Choose two characteristics.

(A) frequency
(B) wavelength
(C) speed
(D) intensity

2. A student tunes her guitar by striking a 110-Hertz A-note on a tuning fork, and simultaneously playing the 5th string on her guitar. Listening closely, she hears the amplitude of the combined sound oscillating twice per second. Which of the following is most likely the current frequency of the 5th string on her guitar?

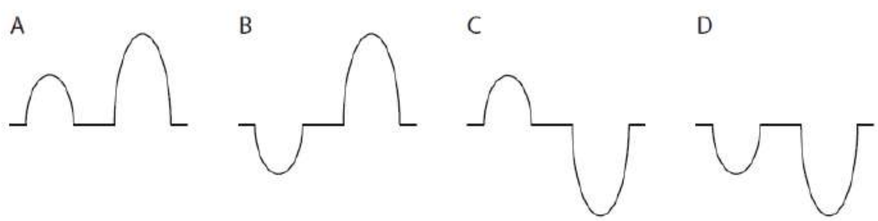
(A) 108 Hertz
(B) 114 Hertz
(C) 220 Hertz
(D) 440 Hertz

3. A transverse wave travels in medium X with a speed of 800 m/s and a wavelength of 4 m. The wave then moves into medium Y, traveling with a speed of 1600 m/s.

(a) Determine the frequency of the wave in medium Y.

(b) Determine the wavelength of the wave in medium Y.

4. Wave pulses travel toward each other along a string as shown below. Answer the following questions in terms of the resulting superposition of the pulses when their centers are aligned.



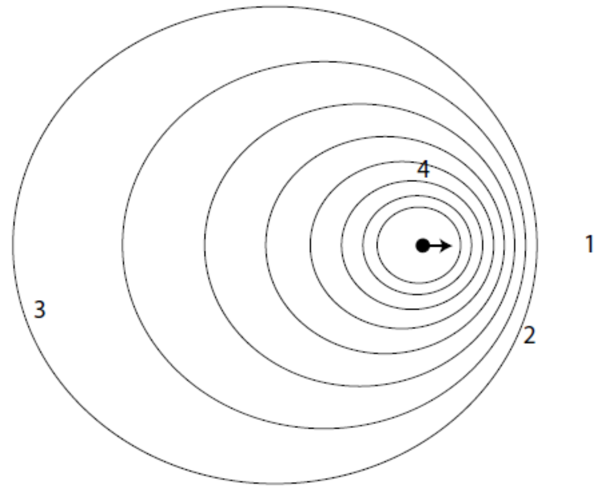
(a) Rank the maximum amplitude of the resulting superposition from smallest to largest.

(b) Rank the magnitude of the maximum amplitude of the resulting superposition from smallest to largest.

5. A string on a musical instrument is fixed at both ends. If the length of the string is 0.3 meters and waves travel through the string with a speed of 450 m/s, which of the following frequencies would you expect to hear from the string? Select two answers.

(A) 570 Hz
(B) 750 Hz
(C) 1125 Hz
(D) 1500 Hz

6. A baseball is moving to the right with a speed of v. At four different positions people have radar guns pointed at the ball to measure a Doppler shift in frequency in order to determine the baseball's speed, as shown in the diagram at right (note that wave fronts are NOT drawn to scale). Rank the measured shift in frequency of the radar beam from lowest to highest based on the position of the radar gun.

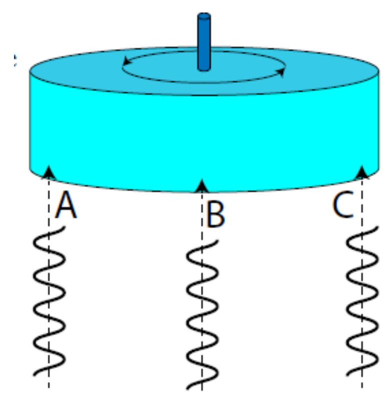


(A) 3 < 4 < 2 < 1
(B) 3 < 1 < 2 < 4
(C) 1 < 2 < 4 < 3
(D) 4 < 2 < 3 < 1

7. Sound waves are traveling through air when they encounter a steel barrier. Some of the sound waves are reflected and inverted, while the rest are transmitted through the steel barrier. The restoring forces within the steel are significantly higher than that of air. Which of the following changes occur to the sound waves at the air/steel boundary? Select two answers.

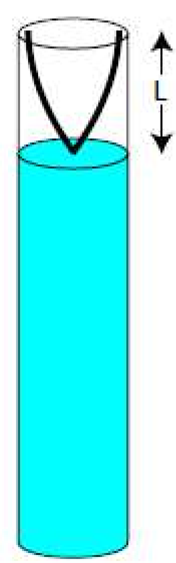
(A) their amplitude decreases in the steel because some of the waves are reflected.
(B) their speed increases in the steel because the restoring forces are higher.
(C) their frequency decreases in the air because the restoring forces are lower.
(D) their wavelength decreases in the air because the reflected waves are inverted.

8. Light waves A, B, and C all have the same frequency. They are sent through a vacuum into the plane of the page, striking a rotating cylinder at various points as shown in the diagram at right. When the waves strike the cylinder, they are reflected back toward their source by tiny mirrors on the surface of the cylinder kept perpendicular to the incoming waves. Rank the observed frequency of the reflected waves from highest frequency to lowest frequency.



(A) A, B, C
(B) C, B, A
(C) A, C, B
(D) C, A, B

9. Students are attempting to determine the speed of sound in air using tuning forks and tubes which are closed at one end. In this procedure, the tube is filled with water, and a tuning fork of known frequency is struck. The vibrating tuning fork is then held over the tube filled with water, and the water is slowly drained out of the tube while students listen for the loudest possible sound at the first resonant condition. Once the loudest possible sound is heard (the first harmonic), the distance from the top of the tube to the water's surface (L) is measured and recorded. This procedure is repeated for five tuning forks of varying frequencies. Data is recorded in the table below.



Trial	1	2	3	4	5	6
Freq (Hz)	128	256	288	384	426.6	512
Period (s)						
L (m)	.65	.33	.29	.23	.19	.17
λ (m)						

(a) Determine the period of oscillation (*T*) for each of the five trials and fill in the data table above.

(b) Write an equation for the wavelength of the sound wave (λ) as a function of *L*.

(c) Use the grid below to plot a linear graph of wavelength (λ) as a function of period (*T*). Use the empty boxes in the data table to record any calculated values you are graphing. Label the axes as appropriate.

(d) Draw a best-fit line on your graph. Using your best-fit line, determine the speed of the sound waves in air.

(e) Describe how your procedure and analysis would change if you used the third harmonic instead of the first harmonic to determine the speed of sound. Indicate specifically any changes in calculations.