1. Which of the times below best estimate the time it takes for a sound wave to go from the stage of a concert hall, bounce from the back wall and get back to the stage

a) 10s
b) 0.2 s
c) 2 ms (milliseconds)
d) 1 minute
e) 0.001 s

2. What is the speed of sound in air ?

a) approximately 20 Hz
b) approximately 20 Km
c) approximately 344 Km/s
d) approximately 0.2 miles/second
e) approximately 20.000 Hz

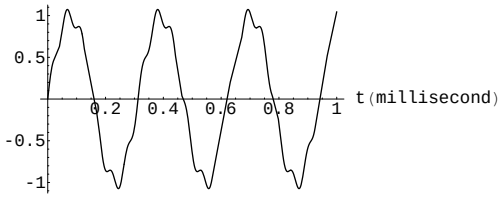
3. You are standing on a train platform and initially hear the siren of a train at rest, 1/2 a mile from you. The train then starts moving fast towards you and a ¼ mile away it sirens again. Compared to the first siren, the second one will sound to you

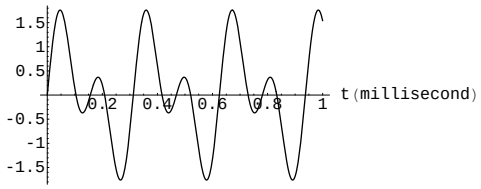
a) Louder and lower in pitch
b) Louder with the same pitch
c) Less loud with lower pitch
d) Louder with higher pitch
e) Same loudness and higher pitch

4. Two loudspeakers emit identical sounds in phase with each other. You will hear:

a) a louder sound since we now have two sound sources
b) a quieter sound since the sound from the two loudspeakers will interfere with each other
c) in some points of the room the sound will be louder, in others it will lower. The distance between two points of maximum volume will be about one wavelength apart
d) in between the loudspeaker the sound will be louder but it will be lower on the sides due to destructive interference.
e) there is a cancellation between the two sounds in most points in the room and they will be hard to hear

Questions 5 and 6 are based on the figures on the top of the next page:





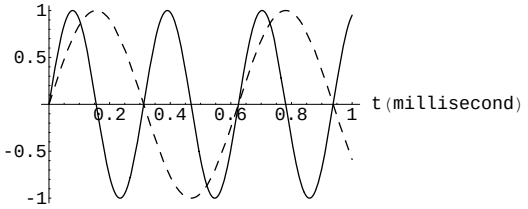
5. What are the period and frequency of the wave shown in the figure on the left ?

a) 1 ms and 100 Hz
b) 0.2 ms and 500 Hz
c) 1 s and 1 Hz
d) 0.3 s and 0.32 Hz
e) <u>0.3 ms and 3200 Hz</u>

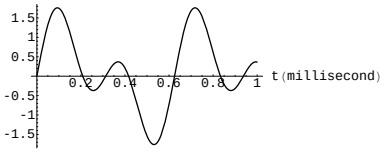
6. If the two waves represent sound waves:

a) They will have the same frequencies but different periods
b) They will have the same pitch but different wavelengths
c) <u>They will have the same pitch but different timbres</u>
d) They are completely different sounds
e) They are inaudible as their frequency is outside the range for human hearing

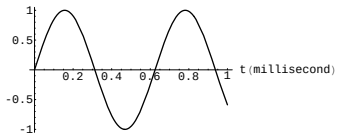
7. What is the result of combining the two waves shown in the figure below (solid and dashed lines) ?



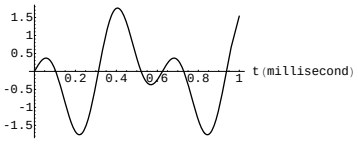
<u>a)</u>



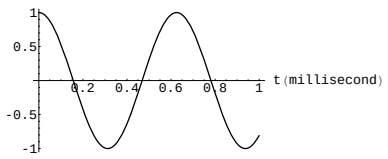
b)



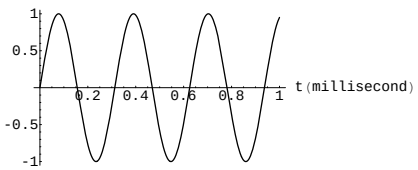
c)



d)



e)



8. Two different notes (and "C" and a "G") are played in the same violin.

a) The Fourier spectrum of the sounds will be nearly identical
b) The amplitude of the higher harmonics will be different but not of the fundamental
c) The "C" sound will have all harmonics shifted to higher frequencies
d) The "G" sound will have all harmonics shifted to lower frequencies
e) The fundamental frequency of the "C" sound is different than the one of the "G"

9. Two sound waves are represented mathematically by $\sin(2\pi\, f\, t) + 0.2 \sin(2\pi\, 2\, f\, t)$ and $\sin(2\pi\, f\, t) + 0.2 \sin(2\pi\, 2\, f\, t + \pi/4)$.

a) They will sound the same
b) The second will have a higher pitch
c) The second will have a lower pitch
d) The second will have a higher volume
e) The second will have a lower volume

10. Roughly speaking, volume, pitch and timbre are associated, respectively, with which characteristics of the sound waves?

a) Frequency, period and waveshape
b) Amplitude, frequency and air pressure
c) Frequency, waveshape and amplitude
d) Period, waveshape and amplitude
e) Amplitude, frequency and waveshape

11. Tuning bars of 400 Hz and 402 Hz are sounded simultaneously with the same intensity.

a) You hear a tone with about 400 Hz pitch and a volume going up and down every half second
b) You hear only the dominant 402 Hz sound
c) You hear a 802 Hz tone
d) You hear a 2 Hz tone
e) They interfere destructively and you do not hear anything

12. A loudspeaker inside a narrow cylinder with an open end emits a tone of variable frequency.

a) Spherical waves propagate poorly inside cylinders and there is no sound
b) At large wavelengths you can only hear the tone if your ear is aligned with the cylinder.
c) At high frequencies you can only hear the tone if your ear is aligned with the cylinder
d) At short wavelengths you can only hear the tone if your ear is **not** aligned with the cylinder.
e) At low frequencies you can only hear the tone if your ear is aligned with the cylinder.

13. A balloon filled with helium (a gas where the speed of sound is faster than in the air) is placed between your ear and a sound source

a) The large wavelengths will not propagate through the balloon because of the high sound speed in helium
b) The frequency of the sound will be lowered.
c) The frequency of the sound will be raised
d) The sound will diffract away from your ear and the sound will be less loud
e) The sound will diffract towards your ear and the sound will be louder

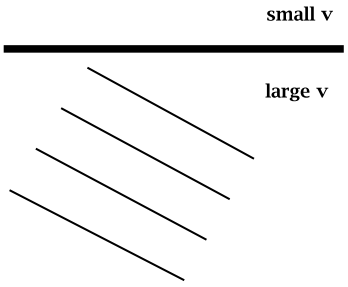
14. Knowing the Fourier amplitudes of a tone, what can one know about the sound ?

a) Know the pitch but not volume
b) Know the pitch and timbre
c) Know the frequency but not the pitch
d) Know the loudness and the speed of sound
e) Know the timbre but not the pitch

15. The following are examples of refraction:

a) The delay between the light and the sound of lightning
b) Echo
c) The sounds of two loudspeakers cancel each other if they are out of phase
d) Sound travels further during a nighttime temperature inversion
e) You can hear your mother in another room even though you cannot see her

16. Consider the waves approaching the boundary (thick line below) separating two media with different sound speeds (v). The waves arrive on an angle from the medium with higher sound speed.



a) The frequency of the wave will increase
b) The frequency of the wave will decrease
c) The wave will bend towards the right
d) The wave will bend towards the left
e) The wave will disappear

```
ERROR: invalidrestore
OFFENDING COMMAND: restore

STACK:

-savelevel-
-savelevel-
-dictionary-
-dictionary-
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