Longitudinal Waves Exercise

3. A longitudinal wave has a compression to compression distance of 10 m. It takes the wave 5 s to pass a point.

a) What is the wavelength of the longitudinal wave?

b) What is the speed of the wave?

4. A flute produces a musical sound travelling at a speed of $320\ \mathrm{m \cdot s^{-1}}$. The frequency of the note is 256 Hz. Calculate:

a) the period of the note

b) the wavelength of the note

Do all calculations in the back of your Physics book and just fill in final answers.

Don't forget units! (For ms^{-1} type ms-1)

Sound Exercises

1. Choose a word from column B that best describes the concept in column A.

Column A	Column B
a) pitch of sound	amplitude
b) loudness of sound	frequency
c) quality of sound	speed
	waveform

a)

b)

c)

2. A tuning fork, a violin string and a loudspeaker are producing sounds. This is because they are all in a state of:

a) compression

b) rarefaction

c) rotation

d) tension

e) vibration

Just write a letter (a – e) for your answer.

3. What would a drummer do to make the sound of a drum give a note of lower pitch?

a) hit the drum harder
b) hit the drum less hard
c) hit the drum near the edge
d) loosen the drum skin
e) tighten the drum skin

4. What is the approximate range of audible frequencies for a healthy human?

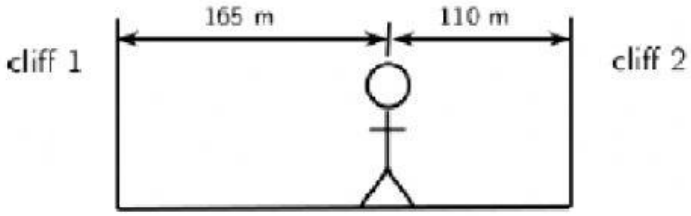
a) 0.2 Hz → 200 Hz
b) 2 Hz → 2 000 Hz
c) 20 Hz → 20 000 Hz
d) 2 000 Hz → 2 000 000 Hz
e) 200 Hz → 200 000 Hz

Hint: have another look at the notes on ultrasound…

6. Astronauts are in a spaceship orbiting the moon. They see an explosion on the surface of the moon. Why can they not hear the explosion?

a) explosions do not occur in space
b) sound cannot travel through a vacuum
c) sound travels too quickly in space to affect the ear drum
d) the spaceship would be moving at a supersonic speed
e) sound is reflected away from the spaceship

7. A man stands between two cliffs as shown in the diagram and claps his hands once.



Assuming that the velocity of sound is $330 m \cdot s^{-1}$, what will be the time interval between the two loudest echoes?

a) $\frac{1}{6}$ s
b) $\frac{5}{6}$ s
c) $\frac{2}{3}$ s
d) 1 s
e) $\frac{1}{3}S$

8. A dolphin emits an ultrasonic wave with frequency of 0,15 MHz. The speed of the ultrasonic wave in water is $1\ 500\ \mathrm{m \cdot s^{-1}}$. What is the wavelength of this wave in water?

a) 0,1 mm
b) 1 cm
c) 10 cm
d) 100 m
e) 10 m

10. A jet fighter travels slower than the speed of sound. Its speed is said to be:

a) Mach 1
b) supersonic
c)subsonic
d) hypersonic
e) infrasonic

11. A sound wave is different from a light wave in that a sound wave is:

a) produced by a vibrating object and a light wave is not.
b) not capable of travelling through a vacuum.
c) capable of existing with a variety of frequencies and a light wave has a single frequency.
d) not capable of diffracting and a light wave is.

12. At the same temperature, sound waves have the fastest speed in:

a) rock
b) oxygen
c) sand
d) milk

13. Two sound waves are travelling through a container of nitrogen gas. The first wave has a wavelength of 1,5 m, while the second wave has a wavelength of 4,5 m. The velocity of the second wave must be:

a) $\frac{1}{9}$ the velocity of the first wave.
b) $\frac{1}{3}$ the velocity of the first wave.
c) the same as the velocity of the first wave.
d) nine times larger than the velocity of the first wave.
e) three times larger than the velocity of the first wave.

Hint: speed of sound in air is $343 ms^{-1}$.

14. A lightning storm creates both lightning and thunder. You see the lightning almost immediately since light travels at $3 \times 10^8 \, m \cdot s^{-1}$. After seeing the lightning, you count 5 s and then you hear the thunder. Calculate the distance to the location of the storm.

15. A person is yelling from a second story window to another person standing at the garden gate, 50 m away. If the speed of sound is $344 \, m \cdot s^{-1}$, how long does it take the sound to reach the person standing at the gate?

16. Person 1 speaks to person 2. Explain how the sound is created by person 1 and how it is possible for person 2 to hear the conversation.

17. Sound cannot travel in space. Discuss what other modes of communication astronauts can use when they are outside the space shuttle?

18. An automatic focus camera uses an ultrasonic sound wave to focus on objects. The camera sends out sound waves which are reflected off distant objects and return to the camera. A sensor detects the time it takes for the waves to return and then determines the distance an object is from the camera. If a sound wave (speed = $344 \, m \cdot s^{-1}$) returns to the camera 0,150 s after leaving the camera, how far away is the object?

19. Calculate the frequency (in Hz) and wavelength of the annoying sound made by a mosquito when it beats its wings at the average rate of 600 wing beats per second. Assume the speed of the sound waves is $344 \, m \cdot s^{-1}$.

20. How does halving the frequency of a wave source affect the speed of the waves?

21. Humans can detect frequencies as high as 20 000 Hz. Assuming the speed of sound in air is $344 \, m \cdot s^{-1}$, calculate the wavelength of the sound corresponding to the upper range of audible hearing.

22. An elephant trumpets at 10 Hz. Assuming the speed of sound in air is $344 \, m \cdot s^{-1}$, calculate the wavelength of this infrasonic sound wave made by the elephant.

23. A ship sends a signal out to determine the depth of the ocean. The signal returns 2,5 seconds later. If sound travels at $1450 \, m.s^{-1}$ in sea water, how deep is the ocean at that point?

24. A person shouts at a cliff and hears an echo from the cliff 1 s later. If the speed of sound is $344 \, m \cdot s^{-1}$, how far away is the cliff?

Remember when there is an echo the wave has travelled THERE and BACK so you have to divide the distance by 2!