CBSE Class 9 Science
Important Questions
Chapter 12
Sound

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1 Marks Questions

1. Guess which sound has a higher pitch: guitar or car horn?

Ans. Sound of Guitar has a higher pitch.

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2. In which of the three media, air, water or iron, does sound travel the fastest at a particular temperature?

Ans. Sound will travel the fastest in iron at a particular temperature.

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3. What is the audible range of the average human ear?

Ans. 20 Hz to 20,000Hz.

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4. Which characteristic of the sound helps you to identify your friend by his voice while sitting with others in a dark room?

Ans. Pitch of the sound wave.

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5. A person has a hearing range from 20 Hz to 20 kHz. What are the typical wavelengths of sound waves in air corresponding to these two frequencies? Take the speed of sound in air as $344\ \text{m s}^{-1}$.

Ans. For 20 Hz sound waves the wavelength would be

$v = n \times \lambda$

λ = v/n = 344/20 = 17.2 m

For 20 kHz sound waves the wavelength would be

$v = n \times \lambda$

$\lambda = v / n = 344\ ms^{-1} / 20000\ Hz$ = 0.0172 m

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6. Two children are at opposite ends of an aluminium rod. One strikes the end of the rod with a stone. Find the ratio of times taken by the sound wave in air and in aluminium to reach the second child.

Ans. Since speed of sound in air = 344 m/s

And speed of sound in aluminium = 6420 m/s

we know that v = distance/time therefore time = d/v

time taken by sound wave in air/time taken by sound wave in aluminium

= d/344: d/6420 = 6420/344 = 18.66/1

the sound will take 18.66 times more time through air than in aluminum in reaching other boy.

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7. The frequency of a source of sound is 100 Hz. How many times does it vibrate in a minute?

Ans. Frequency of source of sound being 100 Hz means the sound source vibrates 100 times in one second. therefore vibrations made by sound source in 1min(60 sec)$= 100 \times 60$ = 6000

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8. Does sound follow the same laws of reflection as light does? Explain.

Ans. Yes.Sound follows the same laws of reflection as light does. We can say that because here the directions in which the sound is incident and is reflected make equal angles with the normal to the reflecting surface at the point of incidence, and the three are in the same plane.

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9. When a sound is reflected from a distant object, an echo is produced. Let the distance between the reflecting surface and the source of sound production remains the same. Do you hear echo sound on a hotter day?

Ans. As the sensation of sound persists in our brain for about 0.1 s. To hear a distinct echo the time interval between the original sound and the reflected one must be at least 0.1s. There for the total distance covered by the sound from the point of generation to the reflecting surface and back should be at least $(344\ m/s) \times 0.1\ s$ = 34.4 m. Thus, for hearing distinct echoes, the minimum distance of the obstacle from the source of sound must be half of this distance, that is, 17.2 m. Speed of sound will increase with increase in temperature. Therefore, on a hotter day speed of sound will be greater hence echoes may be

heard more than once because of multiple reflections of sound result will be no distinct echo will be heard by us.

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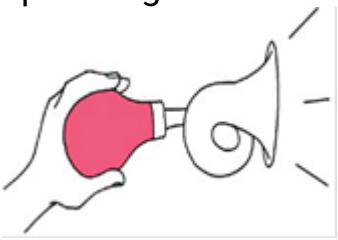
10. Give two practical applications of reflection of sound waves.

Ans. Two practical applications of reflection of sound waves

i. Megaphones or loudhailers, horns, musical instruments such as trumpets and *shehanais*, are all designed to send sound in a particular direction without spreading it in all directions.



ii. Stethoscope is a medical instrument used for listening to sounds produced within the body, chiefly in the heart or lungs. In stethoscopes the sound of the patient's heartbeat reaches the doctor's ears by multiple reflection of sound.

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11. A stone is dropped from the top of a tower 500 m high into a pond of water at the base of the tower. When is the splash heard at the top? Given, $g = 10\ \text{m s}^{-2}$ and speed of sound $= 340\ \text{m s}^{-1}$.

Ans. $v^2 = u^2 + 2gh$

$= 0 + 2 \times 10 \times 500$ = 10000

$v = \sqrt{10000}$ = 100 m/s

we also know that v = u + gt = 0 + 10t

100 = 10t or, Time taken by stone to reach the pond surface(t) = 100/10 = 10 sec

Therefore, time taken by soundto reach the top from pond surface = d/v = 500/340

= 1.47 sec

so the total time taken for splash being heard at the top = 10 + 1.47 = 11.47 s

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12. A sound wave travels at a speed of 339 m s^{-1}. If its wavelength is 1.5 cm, what is the frequency of the wave? Will it be audible?

Ans. Since we know that $v = \lambda\ \nu$

$339 = 0.015\ m \times \nu$

v = 339/0.015 = 22600 Hz

Since the resulting frequency is beyond the audible range of human beings(20Hz to 20kHz) therefore sound will not be audible to human ears.

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13. What is reverberation? How can it be reduced?

Ans. The repeated reflection of sound due to which sound persists for a long time is called reverberation.

To reduce reverberation, the roof and walls of the auditorium are generally covered with sound-absorbent materials like compressed fibreboard, rough plaster or draperies. The seat materials are also selected on the basis of their sound absorbing properties

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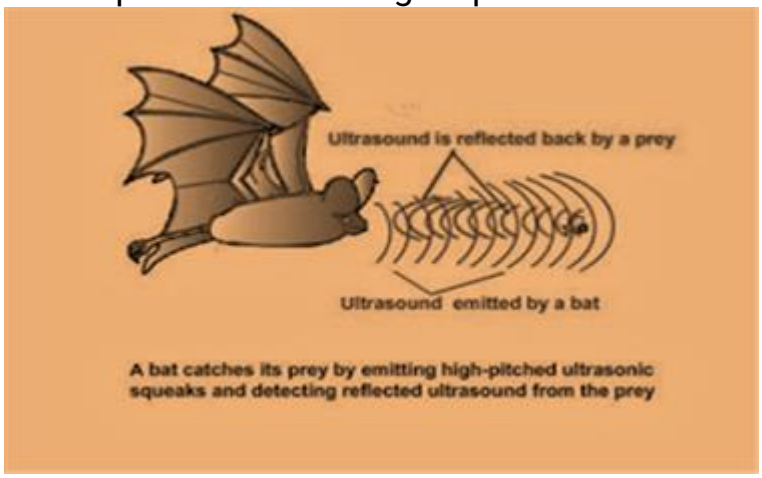
14. What is loudness of sound? What factors does it depend on?

Ans. Loudness is a measure of the response of the ear to the sound. Even when two sounds are of equal intensity, we may hear one as louder than the other simply because our ear detects it better.

Loudness of sound depends upon the amplitude of those sound waves. Higher is the amplitude of vibrating air particles louder will be the sound.



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15. Explain how bats use ultrasound to catch a prey.

Ans. Bats search out prey and fly in dark night by emitting and detecting reflections of ultrasonic waves. The high-pitched ultrasonic squeaks of the bat are reflected from the obstacles or prey and returned to bat's ear. The nature of reflections tells the bat where the obstacle or prey is and what it is like.

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16. How is ultrasound used for cleaning?

Ans. Ultrasound is generally used to clean parts located in hard-to-reach places, for example, spiral tube, odd shaped parts, electronic components etc. Objects to be cleaned are placed in a cleaning solution and ultrasonic waves are sent into the solution. Due to the high frequency, the particles of dust, grease and dirt get detached and drop out. The objects thus get thoroughly cleaned.

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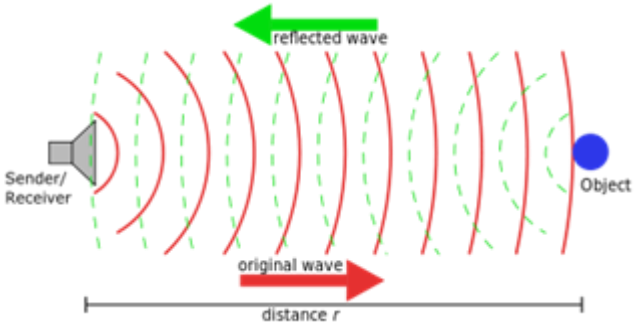
17. Explain the working and application of a sonar.

Ans. Sonar is a device that uses ultrasonic waves to measure the distance, direction and speed of underwater objects.

Sonar consists of a transmitter and a detector and is installed in a boat or a ship. The transmitter produces and transmits ultrasonic waves. These waves travel through water and after striking the object on the seabed, get reflected back and are sensed by the detector. The detector converts the ultrasonic waves into electrical signals which are appropriately interpreted. The distance of the object that reflected the sound wave can be calculated by knowing the speed of sound in water and the time interval between transmission and reception of the ultrasound. Let the time interval between transmission and reception of ultrasound signal be *t* and the speed of sound through sea water be *v*. The total distance, 2*d* travelled by the ultrasound is then, $2d = v \times t$.

The above method is called echo-ranging. The sonar technique is used to determine the depth of the sea and to locate underwater hills, valleys, submarine, icebergs, sunken ship etc.



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18. A sonar device on a submarine sends out a signal and receives an echo 5 s later. Calculate the speed of sound in water if the distance of the object from the submarine is 3625 m.

Ans. Distance of object from submarine = 3625 m

Therefore, distance travelled by sonar waves = 2×3625 = 7250 m

since, speed = distance/time= 7250/5 = 1450 m/s

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19. Explain how defects in a metal block can be detected using ultrasound.

Ans. Ultrasounds can be used to detect cracks and flaws in metal blocks. Metallic components are generally used in construction of big structures like buildings, bridges, machines and also scientific equipment. The cracks or holes inside the metal blocks, which are invisible from outside reduces the strength of the structure. Ultrasonic waves are allowed to pass through the metal block and detectors are used to detect the transmitted waves. If the reis even a small defect, the ultrasound gets reflected back indicating the presence of the flaw or defect.

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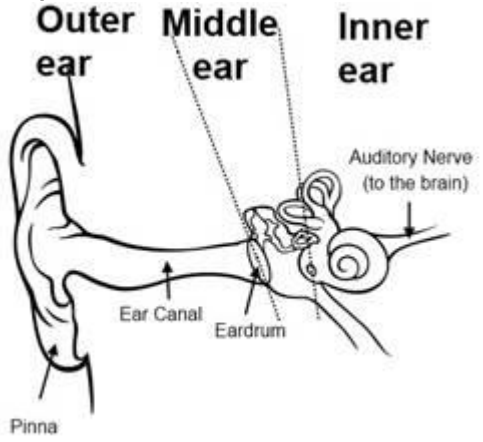
20. Explain how the human ear works.

Ans. The outer ear is called 'pinna'. It collects the sound from the surroundings. The collected sound passes through the auditory canal. At the end of the auditory canal there is a thin membrane called the ear drum or tympanic membrane. When a compression of the medium reaches the eardrum the pressure on the outside of the membrane increases and forces the eardrum inward. Similarly, the eardrum moves outward when a rarefaction reaches it. In this way the eardrum vibrates. The vibrations are amplified several times by three bones (the hammer, anvil and stirrup) in the middle ear. The middle ear transmits the amplified pressure variations received from the soundwave to the inner ear. In the inner ear, the pressure variations are turned into electrical signals by the cochlea. These electrical signals are sent to the brain via the auditory nerve, and the brain interprets them as sound.



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21. Wavelength of sound wave has units:

(a) metres

(b) metres/sound

(c) $(\text{metres})^2$

(d) $\text{meters}/\text{second}^2$

Ans. (a) metres

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22. Light is a

(a) Longitudinal wave

(b) Transverse wave

(c) Both

(d) None

Ans. (b) Transverse wave

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23. In compression, pressure density is

(a) High

(b) Less

(c) Remains same

(d) May be a) or b) depending upon disturbance

Ans. (a) High

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24. Frequency of ultrasonic sound wave is

(a) Greater than 20 HZ

(b) Greater than 20,000 HZ

(c) Greater than 2 HZ

(d) Greater than 2 MHZ

Ans. (b) Greater than 20,000 HZ

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25. S. I. units of frequency are:

(a) second

(b) $\mathbf{second^{-1}}$

(c) $\mathbf{(second)^{2}}$

(d) $\mathbf{decond^{-2}}$

Ans. (b) $second^{-1}$

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26. Stethoscope work on the principle of:

(a) Multiple reflection of sound

(b) Ultrasounds

(c) Both a and b

(d) None of the above

Ans. (a) Multiple reflection of sound

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27. Audible Range of human ear is:

(a) 20 HZ – 20 KHZ

(b) 20 HZ – 20 MHZ

(c) 20HZ – 20,000 HZ

(d) Both a) and b)

Ans. (d) Both a) and b)

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28. The order of bones is human area from outside to inside:

(a) Hammer, stirrup Anvil

(b) Hammer, Anvil and stirrup

(c) Anvil, Stirrup and Hammer

(d) Stirrup, Hammer and Anvil

Ans. (a) Hammer, stirrup Anvil

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29. Which of the following is used in echocardiography?

(a) Ultrasound waves

(b) Infrasound waves

(c) X-Ray waves

(d) Both a) and c)

Ans. (a) Ultrasound waves

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30. Infrasound is produced by:

(a) Bats

(b) Dogs

(c) Rhinoceros

(d) Rats

Ans. (c) Rhinoceros

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31. Speed of sound is maximum in:

(a) Solids

(b) Liquids

(c) Gases

(d) Plasma

Ans. (a) Solids

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32. Inner Ear is called as

(a) cochlea

(b) Pinna

(c) Hammer

(d) Anvil

Ans. Cochlea

2 Marks Questions

1. Explain how sound is produced by your school bell.

Ans. When the peon strikes the school bell with a hammer, the particles of bell metal start vibrating and those vibrations produce sound.

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2. Why are sound waves called mechanical waves?

Ans. Since sound waves need a medium for their propagation therefore we can say that sound waves are mechanical waves.

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3. Suppose you and your friend are on the moon. Will you be able to hear any sound produced by your friend?

Ans. There is no air on moon hence there is no medium for sound propagation on moon. As a result, me and my friend will not be able to hear any sound produced by my friend.

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4. Which wave property determines

(a) loudness,

(b) pitch?

Ans. (a) The amplitude of the wave determines loudness of sound.

(b) The frequency of the wave determines pitch of sound.

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5. How are the wavelength and frequency of a sound wave related to its speed?

Ans. From the equation: $v = n \times \lambda$

where v = velocity/speed

n = frequency of wave

λ = wavelength of wave

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6. Calculate the wavelength of a sound wave whose frequency is 220 Hz and speed is 440 m/s in a given medium.

Ans. The time interval between successive compressions from the source

T = 1/ν = 1/500 = 0.002 second.

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7. A person is listening to a tone of 500 Hz sitting at a distance of 450 m from the source of the sound. What is the time interval between successive compressions from the source?

Ans. The time interval between successive compressions from the source

T = 1/ν = 1/500 = 0.002 second.

8. Distinguish between loudness and intensity of sound.

Ans.

Loudness of sound	Intensity of sound
It is a subjective measurement of sound energy. It is a sensation as perceived by our ears. It depends upon intensity of sound near the ear.	It is an objective measurement of sound energy (amount of sound energy passing each second through unit area) and it determines the loudness of sound produced from any source.

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9. An echo returned in 3 s. What is the distance of the reflecting surface from the source, given that the speed of sound is $342\ m\ s^{-1}$?

Ans. Speed of sound = distance/time

Therefore, distance travelled by sound during echo $= speed \times time = 342 \times 3$ = 1026 m

so the distance of reflecting surface = 1026/2 =513 m

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10. Why are the ceilings of concert halls curved?

Ans. The ceilings of concert halls are curved because such architecture helps the sound to reach all the corners and places of concert hall.

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11. What is the range of frequencies associated with

(a) Infrasound?

(b) Ultrasound?

Ans. Infrasound = less than 20 Hz

Ultrasound = greater than 20 KHz

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12. A submarine emits a sonar pulse, which returns from an underwater cliff in 1.02 s. If the speed of sound in salt water is1531 m/s, how far away is the cliff?

Ans. Distance travelled by a sonar pulse = speed of sound in salt water × time

$= 1531 \times 1.02$ = 1561.62 m

Therefore, the distance of cliff from submarine = 1561.62/2 = 780.81 m

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13. What is sound and how is it produced?

Ans. Sound is a form of energy that produces a sensation of hearing in our ears. Sound gets produced when any object vibrates/oscillates.

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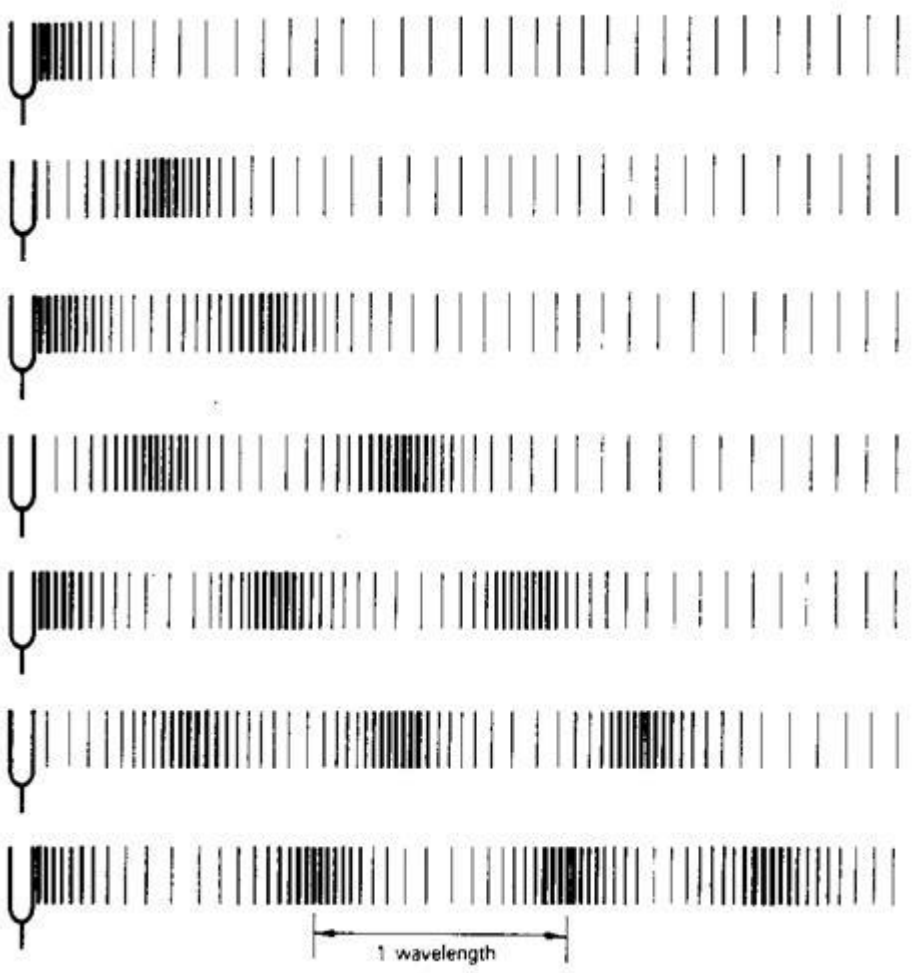
14. Describe with the help of a diagram, how compressions and rarefactions are produced in air near a source of sound.

Ans.



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15. Why is sound wave called a longitudinal wave?

Ans. Sound wave is called a longitudinal wave because sound waves travel in the air through compressions and rarefactions.

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16. Flash and thunder are produced simultaneously. But thunder is heard a few seconds after the flash is seen, why?

Ans. Since speed of thunder (sound) is much less (332 m/s) as compared to speed of flash (light) which is about $3\times10^{8} m/s$ therefore light travels faster than sound hence thunder is heard a few seconds after the flash is seen.

17. Differentiate between longitudinal and transverse wave?

Ans.

	Longitudinal wave	Transverse Wave
1.	In this, particles of the medium oscillate parallel to the direction of propagation of wave	In the, particles of the medium oscillate perpendicular to the direction of propagation of wave
2.	e.g. Sound waves	e.g. Light waves.

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18. Define the terms:

a) Wavelength

b) Frequency

Ans. a) The distance between two consecutive rest or two consecutive troughs is known as the wavelength of the wave.

b) The number of vibrations that particle covers in 1 second is called the frequency wave.

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19. An underwater device directs ultrasounds of frequency 75 KHZ towards water surface. What is the wavelength of sound in the air above the water surface and what is its frequency? Speed of sound in air = 340 m/s.

Ans. When sound wave travels from one medium to another, the frequency remain unchanged while the wavelength and velocity change

Frequency in air = 75,000 HZ

Wavelength, $\lambda = \frac{v}{f} = \frac{340}{75,000} = 4.53 \times 10^{-3} m$

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20. What is an echo? Name two areas of its application?

Ans. When sound waves strike a surface, they are reflected with the same velocity and the reflected sound wave are heard as echo. It is used in SONAR and detecting flaws in metal objects.

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21. Why are sound waves called as mechanical waves?

Ans. Mechanical waves are those which requires a medium for their propagation, since sound also requires medium for its Propagation, hence is a mechanical wave.

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22. Define a) Time Period b) Amplitude of a wave

Ans. a) Time Period of a wave: The time required by a wave to complete one vibration is called time Period.

b) Amplitude: The magnitude of the maximum disturbance in the medium on either side of mean value is called the amplitude of wave.

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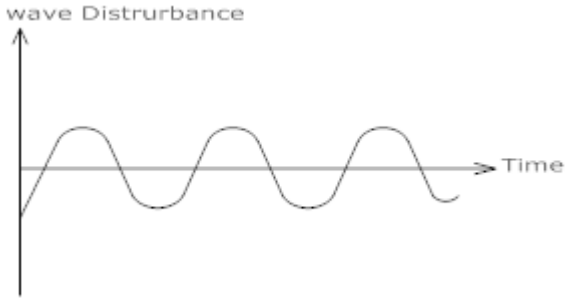
23. What do you understand by loud and soft sound?

Ans. Louder sound: Sound which have higher amplitude and high energy are called louder sound.
Softer sound: Sound which have lesser amplitude and less energy are called soft sound.



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24. A sound wave travels at a speed of 340 m/s. If the wavelength of wave is 1.4 m, what is the frequency of wave?

Ans. Speed of sound wave = 340 m/s

Wavelength of sound wave = 1.4 m

Frequency = ?

Since, velocity = Frequency × Wavelength

$V = \gamma \lambda$

$340 = \gamma \times 1.4$

$\frac{340 \times 10}{1.4} = \gamma$

$\frac{1700}{7} = \gamma$

$242.85 / s = \gamma \ (frequency)$

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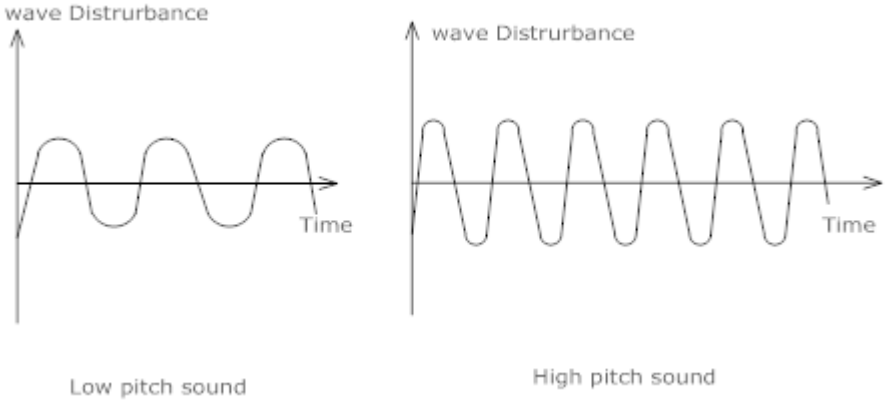
25. What do you understand by low pitched and high pitched sound?

Ans. High pitch sound are those sound which have higher frequency that is in 1 second they complete large number of vibrations.

Low pitch sound are those sound which have lesser frequency that is in 1 second they complete less number of vibrations



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26. Why do we see light first and hear the sound later during thunderstorm?

Ans. Since speed of light is greater than the speed of sound hence it travels faster and is seen first during a thunderstorm.

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27. What are laws of reflection of sound?

Ans. Laws of reflection of sound:

a) The incident, normal and reflected all lie in the same plane

b) Angle of incidence of sound is equal to angle of reflection of sound.

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28. Why are the ceilings of concert halls curved?

Ans. Ceilings of concert halls are corned so that sound after reflection from the curved surface which have greater surface area, can reach to all places of halls.

3 Marks Questions

1. How does the sound produced by a vibrating object in a medium reach your ear?

Ans. As we speak, the particles of air near our mouth are pushed forward so they get compressed. Then they compress the other particles of air. As the compression proceeds the particles of air near our mouth expand again and thus rarefaction occurs. This process is repeated further and as a result sound wave propagates in the form of compressions and rarefactions to the listener's ear.

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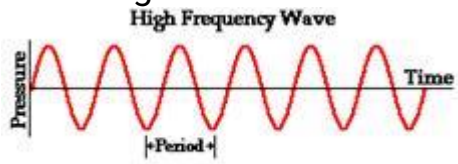
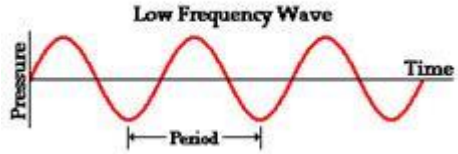
2. What are wavelength, frequency, time period and amplitude of a sound wave?

Ans. wavelength: For a sound wave, the combined length of a compression and an adjacent rarefaction is called its wavelength even the distance between centres of two consecutive compressions or two consecutive rarefactions is also equal to its wavelength.





frequency: The number of vibrations or oscillations per second is called frequency i.e. it is the number of complete waves or cycles produced in one second.

Time period: The time taken to complete one vibration/oscillation/complete wave is called time period. It is measured in seconds.

Amplitude: It is the maximum displacement of the particles of the medium from their mean/original position at rest.

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3. Cite an experiment to show that sound needs a material medium for its propagation.

Ans. Take an electric bell and an airtight glass bell jar. The electric bell is suspended inside the airtight bell jar. The bell jar is connected to a vacuum pump If you press the switch you will be able to hear the bell. Now start the vacuum pump. When the air in the jar is pumped out gradually, the sound becomes fainter, although the same current is passing through the bell.

After some time when less air is left inside the bell jar you will hear a very feeble sound. Now if we evacuate the bell jar no sound is heard.

Result: The above mentioned activity shows that sound needs a medium to propagate.

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4. What happens when sound travels in air?

Ans. When sound wave travels through air then the pressure and density of air changes. As the disturbance propagates through a medium, then alternate regions of pressure variations are created.

The region where particle come closer to each other (high density) and pressure of air is high is called as compression. The region where particles far apart from each other (low density) and pressure of air is less is called as rarefaction compression and rarefactions always occur together.

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5. Establish the relation for a wave that velocity = frequency × wavelength.

Ans. Since, velocity = $\frac{\text{Distance Travelled}}{\text{Time Taken}}$

For a wave, for one vibration, the distance b/w two consecutive crest or trough is called its wavelength (λ).
Time required to complete one vibration is called its Time Period (T).

$so, v = \frac{\lambda}{T}$

$Now, v = \lambda \times \frac{1}{T}$

$\frac{1}{T} = \gamma(\text{frequency of wave})$

$v = \lambda\gamma$

γ (Frequency) is defined as the no. of vibrations particle covers in 1 second.

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6. When a wave travels from one medium to another, the wavelength changes but not the frequency. The wavelength of sound disturbance 30 cm in air and of the wave velocity is 340 m/s. What will be the wavelength of this disturbance in Helium & water? The speed of sound in helium is 970 m/s and 1450 m/s in water?

Ans. Wavelength of sound disturbance (λ) = 30 cm

Wave velocity of sound (γ) = 340 m/s

$v = \gamma\lambda$ (velocity = frequency × wavelength)

$340 = \gamma \times \frac{30}{100} m$

$\frac{340 \times 10\cancel{0}}{3\cancel{0}} = \gamma$

$\Rightarrow \frac{3400/s}{3} = \gamma$

a) Helium: → speed of sound = 970 m/s

$v = \gamma\lambda$

$970 = \frac{3400}{3} \times \lambda$

$$\frac{970\times3}{3400}=\lambda$$
$$0.856m=\lambda$$

b) Water: → speed of sound = 1450 m/s
$$v=\gamma\,\lambda$$
$$1450=\frac{3400}{3}\times\lambda$$
$$\frac{1450\times3}{3400}=\lambda$$
$$1.28m=\lambda$$

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7. Sound waves of wavelength λ travel from a medium in which its velocity is v m/s into another medium in which if velocity is 3 v m/s. What is the wavelength of the sound λ in the second medium?

Ans. Since velocity = wavelength × frequency
$$v=\lambda f$$
$$f=\frac{v}{\lambda}$$
Now, when waves moves from one medium to another, the frequency remains the same
$$\frac{v_1}{\lambda_1}=\frac{v_2}{\lambda_2}$$
Now, when velocity in first Medium = $\sqrt{1}=\sqrt{}$
velocity in Second Medium = 3v
$$\frac{v}{\lambda_1}=\frac{3v}{\lambda_2}$$
$$\frac{\lambda_1}{\lambda_2}=\frac{1}{3}$$
$$\lambda_2=\frac{\lambda_1}{3}$$
The wavelength of the sound in the second medium is one – third of the wavelength in the first Medium.

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8. Sound requires a medium to travel? Justify experimentally.

Ans. Sound requires medium for propagation and it can be proved by following experiment:
1) Take a bell jar and suspend an electric bell in it,
2) The bell jar is connected to a vacuum pump. Till the air is in the bell jar, the sound of the electric bell is louder.
3) Now, with the help of vacuum pump, pump out the air gradually
4) Now as air is pumped out, the sound of the bell gets fainter and fainter.
5) Now, when the bell jar is completely vacuumed no sound is heard.
6) This shows that air is required for propagation of sound.

9. A cork on the surface of water moves up down completing five vibrations in 4s. The waves travel from a cork to the shore which is 20 m away in 10 s calculate

(a) the speed
(b) frequency
(c) wavelength

Ans. a) required to complete 1 vibrations $\frac{4}{5}$ sec.
Time required to complete 1 vibration = Time Period

Time Period (T) = $\frac{4}{5}$ second

$\gamma(\text{frequency}) = \frac{1}{T} = \frac{5}{4}./\text{ second}$

$\lambda = 1.25 / \text{second}$

Distance Travelled = 20 m
Time taken = 10 second

Velocity = $\frac{Distance}{Time} = \frac{20}{10} = 2m/s$

Now, $V = \gamma\lambda$

Velocity = Frequency × Wavelength

$2 = 1.25 \times \lambda$

$\frac{2 \times 100}{125} = \lambda$

$\frac{200}{125} = \lambda$

1.6 m = λ

So, **a)** Speed = 2 m/s
b) wavelength = 1.6 m
c) Frequency = 1.25/second

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10. An observer far away from a railway station hears the train starting. The sound arrives both from the steel rails and through air with a time difference of 3.5 s. How far is the railway station from the observer? The speed of sound in air and steal is 340m/s and 5130 m/s respectively?

Ans. Let distance between railway station and observer = d
Speed of sound in air = 340 m/s

Time taken by sound in air = $\frac{\text{Distance}}{speed}$

= $\frac{d}{340} m$

Speed of sound in steel = 5130 m/s

Time taken by sound in steel = $\frac{d}{5130} m$

Time difference between sound in steel and air

$$3.5 = \frac{d}{340} - \frac{d}{5130}$$
$$3.5 = \frac{5130d - 340d}{340 \times 5130}$$
$$3.5 \times 340 \times 5130 = 4790d$$
$$\frac{3.5 \times 340 \times 5130}{4790 \times 10} = d$$
1274.46 m = d

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11. How can ultrasound be used to detect the defect in metal block?

Ans. Ultrasound are those waves which have frequency greater than 20 KHZ. Now, metal blocks are subjected to ultrasound at one end and at the other end, detectors are placed. If the metal block does not contain any defect then ultrasound travel through and are detected by detectors. If the metal block has any defect, than from that region ultrasounds are not detected and gets reflected back indicating the presence of defect in the block.

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12. What is reverberation? What is done to reduce it?

Ans. The repeated reflection of sound that results in the persistence of sound is celled as reverberation. We can reduce reverberation by:-
1) Covering roofs and walls of auditorium with sound absorbing materials
2) seat materials is also selected on the basis of sound absorbing property

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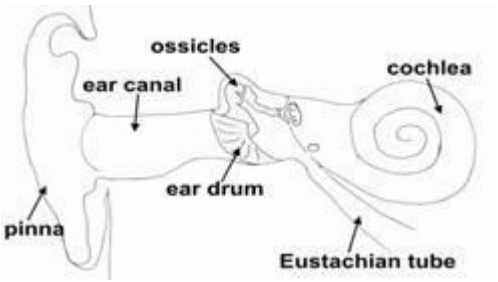
13. Discuss briefly the structure and working of human ear?

Ans. Structure of human ear:



Outer ear is called pinna followed by an auditory canal in which ends in a tympanic membrane. The tympanic membrane is then connected to three bones, hammer, anvil and stirrup. Then there is cochlea connected to an auditory nerve.

Working of human ear →
The pinna collects the sound and collected sound passes through reaches auditory nerve. After which it forces the ear drum (tympanic membrane) to vibrate. The vibrations are than amplified by 3 bones and the pressure variations reaches the inner ear after which cochlea converts them to electrical signal. Auditory nerve carries the electrical signal to brain and brain interprets them as sound.

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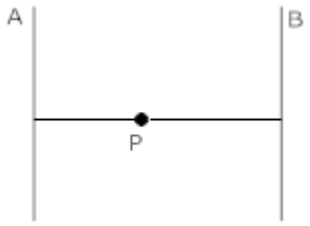
14. A man standing in a valley between two parallel mountains fires a gun and hears echo at an interval of 2 s and 3.5 s. what is

a) the distance between two mountains
b) the location of the man with respect to the mountain.

Ans. The speed of sound is air = 340 m/s



The two mountains are marked as A & B and man is at P.
The first echo comes from mountain A.
Time taken by echo to reach man = 2s
Time taken by sound to trammel from P to A = 1s
Distance travelled by sound in 1S = 340m
The Distance of A from P = 340m
The second Echo comes from mountain B.
Time taken by echo to reach Thomas = 3.5s
Time taken by sound to trend from P to A = 1.75s
Distance travelled by sound in 1.75 sec $= 340 \times 1.75$ = 595m
Distance of B from P = 595m
Distance between mountains = 340 + 595 = 935m

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15. What is SONAR? Write its working?

Ans. SONAR stands for sound Navigation and Ranging. It uses ultrasonic waves. It consists of a transmitter which produces and transmits ultrasonic waves. These waves travel though water and after striking the object on the sea bed gets reflected back and are sensed by detector. The waves are then converted to electrical signals by detector. The time taken by wave to reach detector is recorded. Now, distance of the object from the ship is calculated by wring formula $speed = \frac{\text{distance}}{time}$.