Board – CBSE	Class –9th	Topic – Sound

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

Ans. When an object vibrates, it forces the neighbouring particles of the medium to vibrate. These vibrating particles then force the particles adjacent to them to vibrate. In this way, vibrations produced by an object are transferred from one particle to another till it reaches the ear.

2. Explain how your school bell produces sound.

Ans. When the school bell vibrates, it forces the adjacent particles in the air to vibrate. This disturbance gives rise to a wave, and when the bell moves forward, it pushes the air in front of it. This creates a region of high pressures known as compression. When the bell moves backwards, it creates a region of low pressure known as rarefaction. As the bell continues to move forward and backwards, it produces a series of compressions and rarefactions. This makes the sound of a bell propagate through the air.

3. Why are sound waves called mechanical waves?

Ans. Sound waves force the medium particles to vibrate. Hence, these waves are known as mechanical waves. Sound waves propagate through a medium because of the interaction of the particles present in that medium.

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

Ans. Sound needs a medium to propagate. Since the moon is devoid of any atmosphere, you cannot hear any sound on the moon.

5. Distinguish between loudness and intensity of sound.

Ans. The intensity of a sound wave is defined as the amount of sound energy passing through a unit area per second. Loudness is a measure of the response of the ear to the sound. The loudness of a sound is defined by its amplitude. The amplitude of a sound decides its intensity, which is perceived by the ear as loudness.

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

Ans. The following equation relates the speed, wavelength, and frequency of a sound wave.

Speed (v) = wavelength (λ) × Frequency (υ)

$v = \lambda \times \upsilon$

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

Ans. Frequency of the sound wave, $\upsilon = 220$ Hz

Speed of the sound wave, $v = 440$ m s^{-1}

For a sound wave,

Speed = Wavelength × Frequency

$v = \lambda \times \upsilon$

$\therefore \lambda = \frac{v}{\upsilon} = \frac{440}{220} = 2m$

Hence, the wavelength of the sound wave is 2 m.

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

Ans. The time interval between two successive compressions is equal to the time period of the wave. This time period is reciprocal of the frequency of the wave and is given by the relation.

$T = \frac{1}{Frequency} = \frac{1}{500} = 0.002\ s$

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

Ans. The speed of sound depends on the nature of the medium. Sound travels the fastest in solids. Its speed decreases in liquids, and it is the slowest in gases.

Therefore, for a given temperature, sound travels fastest in iron.

10. 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, $v = 342$ m s^{-1}

Echo returns in time, $t = 3$ s

Distance travelled by sound $= v \times t = 342 \times 3 = 1026\ m$

In the given time interval, sound has to travel twice the distance between the reflecting surface and the source.

Hence, the distance of the reflecting surface from the source $= \frac{1026}{2} m = 513\ m$

11. Why are the ceilings of concert halls curved?

Ans. Ceilings of concert halls are curved, so sound after reflection (from the walls) spreads uniformly in all directions.

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

Ans. The audible range of an average human ear lies between 20 Hz to 20,000 Hz. Humans cannot hear sounds having a frequency less than 20 Hz and greater than 20,000 Hz.

13. What is the range of frequencies associated with

(a) Infrasound?

(b) Ultrasound?

Ans. (a) Infrasound has frequencies less than 20 Hz.

(b) Ultrasound has frequencies more than 20,000 Hz.

14. A submarine emits a sonar pulse, which returns from an underwater cliff in 1.02 s. If the speed of sound in saltwater is 1531 m/s, how far away is the cliff?

Ans. Time taken by the sonar pulse to return, t = 1.02 s

Speed of sound in saltwater, v = 1531 m s^{-1}

Total distance covered by the sonar pulse = Speed of sound × Time taken

Total distance covered by the sonar pulse = $1.02 \times 1531 = 1561.62m$ .....(i)

Let d be the distance of the cliff from the submarine.

Total distance covered by the sonar pulse = 2d

$\Rightarrow 2d = 1561.62$ [From (i)]

$\Rightarrow$ d = 780.81 m