

CBSE 9th Science NCERT Solution - Chap - Sound

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Page 162 **How does the sound produced by a vibrating object in a medium reach your ear?**

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

Page 163 **Explain how sound is produced by your school bell.**

Ans: When the bell moves backwards, it creates a region of low pressure known as rarefaction. As the bell continues to move forward and backward, it creates a series of compressions and rarefactions. This produces the sound of a bell.

Why sound waves are called mechanical waves?

Ans: Sound waves need the material medium to vibrate and propagate. 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.

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

Sound needs a medium to propagate. Since there is no material medium on the moon due to the absence of atmosphere, you cannot hear any sound on the moon.

Page 166 **Which wave property determines (a) loudness, (b) pitch?**

(a) Amplitude of sound wave determines the loudness of a sound. The amplitude of a sound is directly proportional to the amplitude of the wave. If the amplitude of a sound is large, then the sound produced will also be loud.

(b) Frequency of sound wave **determines** the pitch of a sound. The pitch of a sound is proportional to its frequency. High pitched sounds have high frequency.

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

The frequency of the vibration of a sound produced by a guitar is greater than that produced by a car horn. As we know that the pitch of a sound is directly proportional to its frequency, the guitar has a higher pitch than a car horn.

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[CBSE PHYSICS](#) | [CBSE MATH STUDY](#) | [CHEMISTRY ADDA](#) | [CBSE ADDA](#) Page 1

CBSE 9th Science NCERT Solution - Chap - Sound

Page 166 What are wavelength, frequency, time period and amplitude of a sound wave?

Wavelength: The distance between two consecutive compressions or two consecutive rarefactions is known as the wavelength. Its SI unit is metre (m).

Frequency: The number of oscillations produced by vibrating body in one second is known as the frequency of a sound wave. It is measured in hertz (Hz).

Amplitude: The maximum height reached by the crest or trough of a sound wave is called its amplitude.

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

Speed of sound wave is product of wavelength and frequency of a sound wave

$$\text{Speed (} v \text{) = Wavelength } \times \text{ Frequency} = v \lambda$$

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

Frequency of the sound wave, $\nu = 220 \text{ Hz}$ Speed of the sound wave, $v = 440 \text{ m/s}$

$$\text{Speed} = \text{Wavelength} \times \text{Frequency}$$

\Rightarrow **Wavelength of a sound wave** = Speed of the sound wave/ Frequency of the sound wave

$$= 440 \text{ m/s} \div 220 \text{ Hz}$$

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

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?

You know that the time taken to complete two successive compressions or two consecutive rarefactions is called the time period of the wave.

Time period of the wave = $1/\text{Frequency}$ Hence, time period is reciprocal of the frequency of the wave

Now, Time period of the wave = $1/500 = 0.002$ second

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CBSE 9th Science NCERT Solution - Chap - Sound

Page 166 Distinguish between loudness and intensity of sound.

- Intensity of sound waves is defined as the average energy transported per second per unit area perpendicular to the direction of propagation.
 - It is measured in $\text{Js}^{-1}\text{m}^{-2}$ or Wm^{-2} .
 - The intensity of sound in air depends on the square of the frequency and the square of the amplitude.
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- The loudness of sound is defined as the degree of sensation of sound produced in the ear
 - The loudness of a sound depends on its amplitude.
 - The amplitude of a sound decides its intensity, which in turn is perceived by the ear as loudness.

Page 167 In which of the three media, air, water or iron, does sound travel the fastest at a particular temperature?

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.

Page 168 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 ?

Speed of sound, $v = 342 \text{ m/s}$ Echo returns in time, $t = 3 \text{ s}$

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

In the given time interval, sound has to travel a distance that is twice the distance of the reflecting surface and the source. Hence, the distance of the reflecting surface from the source = $1026/2 = 513 \text{ m}$

Page 169 Why are the ceilings of concert halls curved?

Ceilings of concert halls are curved so that sound after reflection (from the walls) spreads uniformly in all directions due to irregular reflection.

Page 170 What is the audible range of the average human ear?

The audible range of an average human ear lies between 20 Hz to 20,000 Hz.

Humans cannot hear sounds having frequency less than 20 Hz and greater than 20,000 Hz.

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[CBSE PHYSICS](#) | [CBSE MATH STUDY](#) | [CHEMISTRY ADDA](#) | [CBSE ADDA](#) Page 3