



Sound: We think of the word 'sound' whenever we have a sense of hearing in our ears. We, therefore, say that sound is a form of energy which produces the sensation of hearing in our ears. The sound can be produced by striking, shaking, blowing, rubbing or plucking, different objects. A close look at these situations shows that we actually set one or another object/s, into vibrations. It is these vibrations that produce sound. Whenever a source produces a sound, there are always some vibrations linked with it. We can, therefore think of vibrations as the basic cause of all sounds.

Vibration: The to and fro or back and forth motion of an object is called vibration.

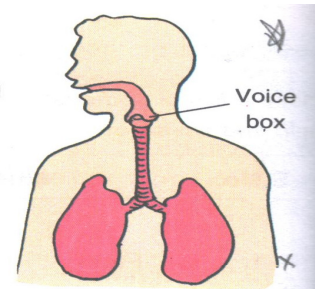
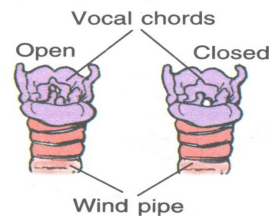
How sound is produced: A sound is produced because of a vibration. Thus, sound is a vibration that is capable of being heard. The organ in human beings that is involved in the production of sound is the larynx (commonly called the voice box). The voice box is situated in the neck at the upper end of wind pipe. The sound produced is controlled by vocal cords, which are thin membranes stretched across the voice box. There are muscles attached to the vocal cords.

These muscles can vary the tension in the vocal cords (i.e., make them tight or loose). With the help of these muscles, we can make different sounds.

Sound produced by animals

Our earth has an amazingly large variety of birds and animals living on it. There are endless varieties of sound produced by them.

1. Like human beings, there are quite a few animals that produce sound by means of vocal chords.
2. Birds have a ring of cartilage, called **syrix**, in their wind pipe. They use it (instead of the vocal chords) in their voice box to produce their characteristics sounds.
3. Insects like mosquitoes and bees, make their characteristic sounds by vibrating their wings rapidly.



DO YOU KNOW ?

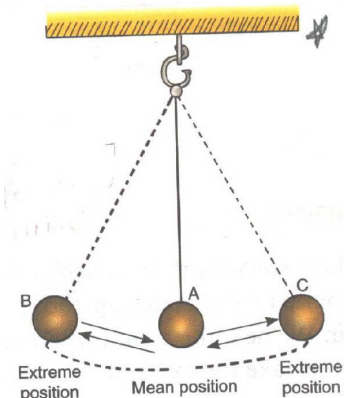
The vibrations, produced by our vocal cords, get converted into speech with the help of the tongue, the nose and the lips. Speech is a production of sound (vibrations) that has a definite and clear meaning for us!

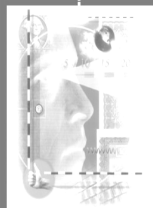
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Characteristics of Sound Sound travels in the form of a wave. Waves are characterized by three basic quantities. They are frequency, speed, and amplitude. Two of the main characteristics of sound are pitch and loudness, which in turn are determined by the frequency and amplitude of the wave, respectively. Therefore, to understand what pitch and loudness mean, we will first need to study the characteristics of waves.

Amplitude: the maximum displacement of the bob from the mean position during oscillation is called the amplitude of the oscillation. The maximum displacement occurs when the bob is at positions B and C. the position where it comes to stoop is called mean position.

Time period: when the bob moves from one position and comes back to the same position (moving in the same direction), it is said to complete one oscillation. The time taken to complete one





oscillation is called the time period of the oscillation. It is measured in seconds.
Frequency: the number of oscillations per second is called the frequency of oscillation.

The amplitude of a vibration is measured in units of distance/length. Therefore, its SI units are meter. Likewise, the time period of a vibrating body is measured in unit of time. Therefore, its SI unit is the second.

The SI unit of frequency is hertz.

Since frequency = $\frac{\text{no of vibrations completed}}{\text{time taken}}$

We can say that hertz = $\frac{1}{\text{second}}$

Loudness and pitch of a sound

The amplitude of a sound determines its loudness. More the amplitude of vibration, the louder is the sound produced. It can be easily checked by using a drum. If we strike the drum lightly with its stick, we get only a faint sound. However, if we strike the stick with a force, we get a loud sound.

The frequency of a sound determines its shrillness or flatness. The word pitch is used to describe the shrillness or flatness of a sound. A higher pitch (i.e. a higher frequency) means shriller sound while a lower pitch (i.e. a lower frequency) means a flatter sound. Sound travels in the form of waves. When pebble is dropped in pond water it produces ripples in water. The ripple is called wave. The distance between normal to peak in called amplitude.

Propagation of sound The travelling of sound is called propagation of sound. Sound cannot propagate in absence of medium (vacuum). Sound needs a medium to propagate (travels) Sound travels through solid liquid and gas

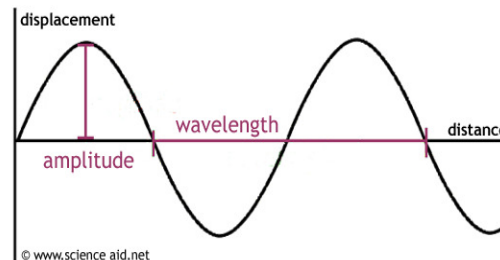
- The distance between molecules in solids is very small. The molecules of solids are colliding very quickly because they are so hence sound travels faster in solid.
- The distance between molecules in liquid are longer than solids, so sound travels second fast in liquid.
- The distance between molecules in gases is large. So sound travels very slow in gases.

Speed of sound : Sound waves travel at different speeds in different substances. The speed of sound depends on various factors like temperature, nature and physical state of the substance, etc. for example, the speed of sound in air is about 3.30m/s at 0°C and 346m/s at room temperature.

Also notice from table that sound waves travel fastest in solids and slowest in gases.

Substance	Speed (m/s)	Substance	Speed (m/s)
Air	346	Aluminum	5000
Water	1498	Iron	5000
Mercury	1452	Diamond	12,000
Glass	5000		

Light, propagates faster than sound All of us have, at one time or the other, been shaken and frightened by the roaring thunder sounds that follow





flashes of lightning. The thundering sounds are always heard a little after seeing the flash of lightning. Why?

In early stages, people thought that we hear the thunder a little after seeing the lightning simply because the thunder perhaps occurred a little later. We now know that this is not the reason. Both lightning and thunder really occur together. The reason for the delay, in hearing the thunder, is due to the difference in the speeds of sound and light.

Measurement of the speed of light and sound tell us that light propagates very fast as compared to sound. The speed of sound in air is nearly 30 ms^{-1} (or 0.33 km per second) whereas speed of light is as high as 3 lakh kilometers per second. Light, thus, propagates nearly a million times faster than the sound. Hence, when lightning and thunder occur together, the flash of lightning (i.e. light) reaches us in practically zero time. The sound of the thunder however, takes a few seconds to reach us.

