



## Sound

### Sound

- Sound is a form of energy which produces a sensation of hearing in our ears.
- The matter or substance through which sound is transmitted is called a medium.

### Sound Waves

- A wave is a disturbance that moves through a medium when the particles of the medium set neighboring particles into motion.
- Sound waves are characterized by the motion of particles in the medium and are called mechanical waves.
- Compression : When a vibrating object moves forward, it pushes and compresses the air in front of it creating a region of high pressure. This region is called compression.
- Rarefaction : When a vibrating object moves backward, it creates a region of low pressure called rarefaction.

### Sound needs a medium to travel

- Sound needs a material medium for its propagation. It does not travel through vacuum.

### Types of Waves

- Longitudinal waves : In these waves, the individual particles of the medium move in a direction parallel to the direction of propagation of disturbance.
- Transverse Waves : In these waves, the individual particles oscillate up and down, perpendicular to the direction of disturbance.

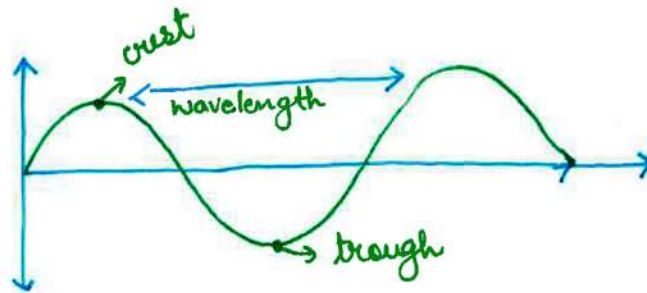


## Characteristics of Sound Waves

We describe a sound wave by its:

- ① Speed
- ② Amplitude
- ③ Frequency

- A peak is called the **crest** and valley is called the **trough**.
- The distance between two consecutive compressions (C) or two consecutive rarefactions (R) is called the **wavelength**.
- The number of such oscillations per unit time is the **frequency** of the sound wave.
- The time taken by two consecutive compressions and rarefactions to cross a fixed point is called the **time period** of the wave.



- The way in which brain interprets the frequency of sound is called **Pitch**.
- The faster the vibration of the source, the higher is the frequency and higher is the pitch.
- The magnitude of the maximum disturbance in the medium on either side of the mean value is called **amplitude**.
- The **quality or timber** of sound is that characteristic which enables us to distinguish one sound from another having same pitch and loudness.
- A sound of a single frequency is called a **tone**.
- The sound which is produced due to a mixture of several frequencies is called a **note**.





- The speed of sound is defined as the distance at which a point on a wave, such as a compression or a rarefaction travels per unit time.

### Intensity of Sound

- The amount of sound energy passing each second through the unit area is called the intensity of sound.

### Echo

- If we shout or clap near a suitable reflecting object such as a tall building or mountain, we will hear the same sound again a little later. This sound which we hear is called an echo.
- Echoes may be heard more than once due to successive or multiple reflections.

### Reverberation

- A sound created in a big hall or auditorium will persist by repeated reflections from the walls until it is reduced to a value where it is no longer audible. The repeated reflections that results in this persistence of sound is called reverberation.

### Range of hearing

- The audible range of hearing for human beings extends from about 20Hz to 20,000 Hz.
- Sounds of frequencies below 20Hz are called infrasonic sound or infrasounds.
- Frequencies higher than 20,000 Hz are called ultrasonic sound or ultrasound.



## SONAR

- Sound Navigation And Ranging also known as echo ranging.
- Uses Ultrasonic waves.
- Measures distance, speed and direction of underwater objects.
- Consists of transmitter and detector
- Used to locate underwater objects.
- Used to determine depth of sea.

## Human Ear

- Outer Ear is called Pinna. It extends into the auditory canal.
- Middle Ear consists of the ear drum and bone ossicles.
- Inner Ear consists of cochlea and three semi-circular canals.
- Sound waves are collected by Pinna. It passes through the auditory canal and reaches ear drum.
- Transmission of waves from middle ear to inner ear.
- Amplification of vibrations by three bones.
- Cochlea converts sound waves to electrical signals.
- Auditory nerve sends these signals to the brain.