Class 9th

PHYSICS

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 a **compression (C).**
- Rarefaction : When the vibrating object moves backwards, it creates a region of low pressure called **rarefaction.**

Sounds 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 the disturbance.
- **TRANSVERSE WAVES** : In a transverse wave particles do not oscillate along the line of wave propagation but oscillate up and down about their mean position as the wave travels.

Characteristics of Sound Waves

- We describe a sound wave by its :
  1. SPEED
  2. AMPLITUDE
  3. FREQUENCY

- A peak is called the **crest** and a valley is called the **trough** of a wave.
- 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 or rarefactions to cross a fixed point is called the **time period** of the wave.
- The way in which the brain interprets the frequency of a sound is called **Pitch**.
- The faster the vibration of the source, the higher is the frequency and the higher is the pitch.
- The magnitude of the maximum disturbance in the medium on either side of the mean value is called the **amplitude** of the wave.
- The loudness or softness of a sound is determined basically by its **amplitude.**
- The **quality or timber** of sound is that characteristic which enables us to distinguish one sound from another having the 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 a 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 will persist by repeated reflection from the walls until it is reduced to a value where it is no longer audible. The repeated reflection that results in this persistence of sound is called **reverberation**.

Range of Hearing

- The audible range of sound for human beings extends from about **20Hz to 20000Hz**.
- Sounds of frequencies below 20 Hz are called **infrasonic sound or infrasound.**
- Frequencies higher than 20 kHz 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 objects under water.
- Consists of a transmitter and detector.
- Used to locate underwater objects.
- Used to determine the depth of the sea.

Human Ear

- **Outer Ear** is called Pinna. It extends into the auditory canal.
- **Middle Ear** consists of the eardrum and bone ossicles.
- **Inner Ear** consists of the cochlea and three semicircular canals.
- Sound waves collected by the pinna. It passes through the auditory canal and reaches the eardrum.
- Transmission of waves by middle ear to inner ear.
- Amplification of vibrations by 3 bones.
- Cochlea converts sound waves to electrical signals.
- Auditory nerve sends these signals to the brain.