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.

Intensity of Sound

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

Sounds needs a medium to travel

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

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.

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.

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.

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.

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 are 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.

SONAR

• Sound Navigation And Ranging is 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.