

Chapter-5: SOUND

8th Class

Running Notes

Introduction:

Sound is a form of energy that produces a sensation of hearing in our ears.

It is produced by vibrating objects.

Example: The sound of a school bell, a whistle, a stretched rubber band when plucked, or a guitar string, all originate from vibrating objects.

How Sound is Produced?

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

Sound is produced when an object vibrates. The object could be a string, a membrane, a metal plate, or a column of air.

Experiment:

Strike a tuning fork on a rubber pad and bring its prongs near a suspended table tennis ball. The ball gets pushed away repeatedly, demonstrating that the prongs are vibrating.

Touch the vibrating tuning fork to your chin; you can feel the vibrations.

The vibrating object sets the surrounding medium (air, water, etc.) into vibration, which carries the sound to our ears.

Sound Needs a Medium to Travel

Sound cannot travel through a vacuum (an empty space without any matter).

It requires a material medium (solid, liquid, or gas) to travel from one place to another.

Experiment (Bell-Jar Experiment):

- An electric bell is suspended inside an airtight glass jar connected to a vacuum pump.
- When the bell is switched on, we can hear it.
- As the air is gradually pumped out, the sound becomes fainter.
- When a near-vacuum is created, no sound is heard, even though we can see the bell hammer moving. This proves sound needs a medium (like air) to travel.

Speed of Sound in Different Media:

Solids > Liquids > Gases

- Sound travels fastest in solids because the particles are closely packed, allowing vibrations to be transferred more quickly.
- Sound travels slowest in gases because the particles are far apart.

How Do We Hear Sound? (The Human Ear)

The ear is a complex organ designed to detect sound. The process involves:

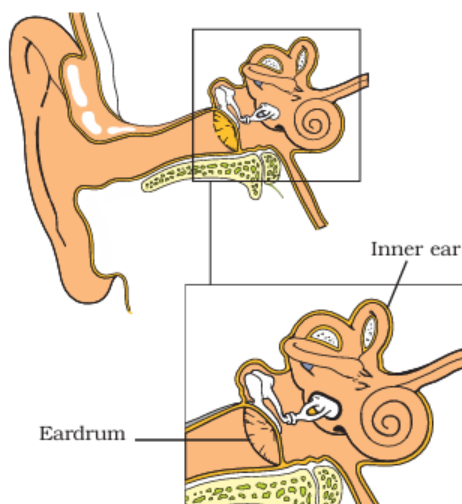


Fig. 5.16 : Human ear

1. Outer Ear (Pinna): Collects sound waves from the surroundings and directs them into the ear canal.
2. Eardrum (Tympanic Membrane): A thin, stretched membrane at the end of the ear canal. When sound waves hit it, it starts vibrating.
3. Middle Ear: The vibrations from the eardrum are amplified and transmitted by three tiny bones (hammer, anvil, stirrup) to the inner ear.
4. Inner Ear (Cochlea): The cochlea converts the vibrations into electrical signals.
5. Auditory Nerve: These electrical signals are sent to the brain via the auditory nerve, which interprets them as sound.

Characteristics of Sound

Sound is characterized by its Amplitude, Frequency, and Time Period.

A) Amplitude (A):

Definition: The magnitude of the maximum disturbance (vibration) in a medium from its rest position.

It is also the extent of displacement of a vibrating object from its mean position.

It determines the Loudness of sound.

Higher the amplitude, louder the sound. (Example: Beating a drum softly vs. strongly).

B) Frequency (v) and Time Period (T):

Frequency: The number of oscillations or vibrations per second.

Unit: Hertz (Hz)

1 Hz = 1 vibration per second.

Time Period (T): The time taken to complete one oscillation.

Unit: Seconds (s).

Relationship: Frequency (v) = $1 / \text{Time Period (T)}$

It determines the Pitch of sound.

Higher the frequency, higher the pitch (shrill sound).

Lower the frequency, lower the pitch (deep sound).

Example: A baby's voice has a high frequency (shrill), while a lion's roar has a low frequency (deep).

Audible and Inaudible Sound:

Audible Sound: The range of frequencies that the human ear can detect. Typically from 20 Hz to 20,000 Hz.

Inaudible Sound

Infrasonic Sound: Sounds with frequencies below 20 Hz. (Example: Rhinos and whales use infrasound to communicate).

Ultrasonic Sound: Sounds with frequencies above 20,000 Hz. (Example: Dolphins, bats, and dogs can hear ultrasound).

Noise vs. Music

Noise: Sound that is unpleasant to the ear. It is often irregular and discontinuous.

Example: Sound of construction, traffic, loudspeakers.

Music: Sound that is pleasant to the ear. It is produced by regular, periodic vibrations.

Example: Sound from a sitar, piano, or flute.

Noise Pollution

Definition: The presence of excessive or unwanted sound in the environment.

Sources of Noise Pollution:

- a) Industrial activities
- b) Automobiles and aircraft
- c) Construction sites
- d) Loudspeakers at festivals and weddings
- e) Bursting of crackers

Harmful Effects of Noise Pollution:

Health: Lack of sleep, hypertension (high blood pressure), anxiety, hearing loss.

Psychological: Stress, irritability.

Measures to Limit Noise Pollution:

- i) Silencing devices (mufflers) on vehicles and aircraft engines.
- ii) Using sound-absorbing materials in buildings.
- iii) Planting trees along roads and buildings, as trees act as sound barriers.
- iv) Strict laws against using loudspeakers in public places after certain hours.
- v) Personal protection like using earplugs in noisy areas.

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