Chapter – 10
Sound

The sensation felt by our ears is called sound. Sound is a form of energy. Sound is that form of energy which makes us hear.

Each sound is special to the object which produces it. For example, the ticking of a clock, the click of an electric switch and the whirr (sound of rotation) of a ceiling fan are the characteristic sounds produced by a clock, an electric switch and a ceiling fan, respectively.

SOUND IS PRODUCED BY VIBRATING OBJECTS

When an object moves backwards and forwards (to-and-fro) rapidly we say that the object "vibrates or that the object is vibrating. In other words, sound produced by vibrating objects. So, whenever we hear a sound, then some object must be vibrating object to produce that sound.

SOUND PRODUCED BY HUMANS

In humans, the sound is produced by the voice box or the larynx. It is at the upper end of the windpipe. Two vocal cords, are stretched across the voice box or larynx in such a way that it leaves a narrow slit between them for the passage of air. When the lungs force air through the slit, the vocal cords vibrate, producing sound. Muscles attached to the vocal cords can make the cords tight or loose. When the vocal cords are tight and thin, the type or quality of voice is different from that when they are loose and thick.

SOUND NEEDS A MEDIUM FOR PROPAGATION

Sound needs a medium to travel. When air has been removed completely from a vessel, it is said that there is a vacuum in the vessel. The sound cannot travel through a vacuum.

WE HEAR SOUND THROUGH OUR EARS

The shape of the outer part of the ear is like a funnel. When sound enters it, it travels down a canal at the end of which there is a thin stretched membrane. It is called the eardrum. It performs an important function.

The eardrum is like a stretched rubber sheet. Sound vibrations make the eardrum vibrate. The eardrum sends vibrations to the inner ear. From there, the signal goes to the brain. That is how we hear.

AMPLITUDE, TIME PERIOD AND FREQUENCY OF A VIBRATION

The to and fro motion of an object is known as vibration. This motion is also called oscillatory motion.

Amplitude of Sound

The amplitude of a sound can be defined as the maximum displacement of the particles from their mean position due to the vibrations or when sound is made.

Time period of Vibration

Time-period is the time required to make 1 vibration' and 'frequency is the number of vibrations made in 1 second. This means that time-period is equal to the reciprocal (or inverse) of frequency.

$$\text{Time Period} = \frac{1}{Frequency}$$

Frequency of Vibrations

The number of vibrations made per second by a vibrating body is called the frequency of vibration. The number of vibrations made in

one second is called the frequency of vibration. The unit of frequency of vibrations (or oscillations) of a vibrating object is hertz.

CHARACTERISTICS OF SOUND: LOUDNESS, PITCH AND QUALITY

A sound has three characteristic properties by which it can be recognised. These are loudness, pitch and quality. Two musical sounds may differ from one another in one or more of these properties.

1. Loudness

Sounds are produced by vibrating objects. If more energy is supplied to an object by plucking it or hitting it more strongly, then the object will vibrate with a greater amplitude and produce a louder sound. Thus, the loudness of sound depends on the amplitude of vibrations of the vibrating object. Greater the amplitude of vibrations, louder the sound will be.

2. Pitch

It is the frequency of vibration of the sound producing object which determines the pitch (or shrillness) of a sound. As the frequency of vibration of an object increases, the pitch (or shrillness) of sound produced by it also increases.

3. Quality

Quality is that characteristic of sound which enables us to distinguish between the sounds produced by different sound producing objects (like different musical instruments or different singers) even if they are of same loudness and pitch.

AUDIBLE AND INAUDIBLE SOUNDS

Sounds of frequencies less than about 20 vibrations per second (20 Hz) cannot be detected by the human ear. Such sounds are called inaudible. Sounds of frequencies higher than about 20,000 vibrations per second (20 kHz) are also not audible to the human ear.

Thus, for human ear, the range of audible frequencies is roughly from 20 to 20,000 Hz.

Noise and Music

We hear different types of sounds around us. Some sounds are pleasant to the ear, whereas some are not. Unpleasant sounds are called noise. On the other hand you enjoy sounds from musical instruments. Musical sound is one which is pleasing to the ear. Sound produced by a harmonium is a musical sound.

Noise Pollution

Presence of unwanted gases and particles in air is called air pollution. Similarly, presence of excessive or unwanted sounds in the environment is called noise pollution.
Major causes of noise pollution are sounds of vehicles, explosions including bursting of crackers, machines, loudspeakers etc. Television and transistor radio at high volumes, some kitchen appliances, desert coolers, air conditioners, all contribute to noise pollution.

What are the Harms of Noise Pollution?

Presence of excessive noise in the surroundings may cause many health related problems. Lack of sleep, hypertension (high blood pressure), anxiety and many more health disorders may be caused by noise pollution. A person who is exposed to a loud sound continuously may get temporary or even permanent impairment of hearing.

Measures to Limit Noise Pollution

To control noise, we must control the sources of noise. For this, silencing devices must be installed in air craft engines, transport vehicles, industrial machines and home appliances.

All noisy operations must be conducted away from any residential area. Noise producing industries should be set up away from such areas. Use of automobile horns should be minimised.

TV and music systems should be run at low volumes.

Trees must be planted along the roads and around buildings to cut down on the sounds reaching the residents, thus reducing the harmful effects of noise pollution.

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