Revision Notes for Class 8 Science

Chapter 10 – Sound

What is Sound?

Sound is defined as the vibrations that can travel through any medium like air and can be heard when the vibrations reach an individual or an animal's ear. Musical sound is a sound which produces a pleasing effect to the ear while noise is defined as a sound that creates a jarring or an unpleasant effect.

Sound is Produced by a Vibrating Body

Sound is produced when an object vibrates. These vibrations cause the surrounding particles of the medium (air, water, or solids) to move back and forth, creating sound waves. As these sound waves travel through the medium, they reach our ears, and we perceive them as sound. For example, when you pluck a guitar string, it vibrates and creates sound that you can hear. In essence, all sounds originate from some form of vibration.

Sound Produced by Humans

- Humans produce sound through the vibration of the vocal cords located in the larynx.
- When air from the lungs passes through the vocal cords, they vibrate and create sound.
- The pitch of the sound changes depending on how tight or loose the vocal cords are.
- The sound produced is then modified by the mouth, tongue, and lips to form speech or different sounds.
- The volume of the sound depends on the force of the air expelled from the lungs.

Sound Needs a Medium for Propagation

Sound requires a medium, such as air, water, or solids, for its propagation because it travels in the form of mechanical waves. These waves are created by the vibration of particles in the medium, which transfer the sound energy from one particle to another. Without a medium, like in a vacuum where there are no particles to vibrate, sound cannot travel. This is why sound can be heard through air, water, or solids, but not in outer space, where there is no medium for the sound waves to move through. The speed of sound also varies depending on the medium, with sound travelling faster through solids due to the denser arrangement of particles.

We Hear Sound through Our Ears

- Sound waves enter the outer ear and travel through the ear canal.
- The sound waves cause the eardrum to vibrate.
- Vibrations are passed to three tiny bones in the middle ear (hammer, anvil, and stirrup), which amplify the sound.
- These vibrations are transmitted to the cochlea in the inner ear.
- The cochlea converts the vibrations into electrical signals.
- These signals are sent to the brain via the auditory nerve, allowing us to hear and interpret the sound.

Amplitude, Time Period and Frequency of a Vibration

- **Amplitude:** is defined as the maximum extent of vibrations produced by any vibrating body from its mean position. An example of amplitude is how much a radio wave moves back and forth.

- **Time Period:** One completed to and fro movement of the pendulum from its mean position is known as an oscillation. The total time taken by the vibrating particle to complete one oscillation is known as the Time Period.
- **Frequency**: Frequency is the number of vibrations or cycles that occur in one second. It is measured in Hertz (Hz). Higher frequency results in a higher-pitched sound, while lower frequency leads to a lower-pitched sound. The frequency is inversely related to the time period.

Audible and Inaudible Sounds

There are two distinct types of sound-

a. Inaudible Sound: Inaudible sounds have a frequency above 20,000 Hz or below 20 Hz. An average human ear cannot hear a sound within this frequency level.

- Low-frequency sounds that remain inaudible to the human ear are known as Infrasonics.
- High-frequency sounds that remain inaudible to the human ear are known as Ultrasonics.

b. Audible Sound: The audible sounds are vibrations whose frequency lies between 20 Hz and 20,000 Hz (20 kHz). The human ear can hear this frequency level.

Noise and Music

- **Noise:** Noise is an irregular and unpleasant sound produced by random vibrations. It lacks harmony and rhythm, making it uncomfortable to listen to. Examples of noise include traffic sounds, loud machinery, and construction sounds. Noise is generally unwanted and can cause stress or hearing damage with prolonged exposure.

- **Music:** Music is a pleasant, organised, and harmonious sound created by regular vibrations. It has rhythm, melody, and harmony, making it enjoyable to listen to. Examples include songs, instrumental tunes, and symphonies. Music is often used for relaxation, entertainment, and emotional expression.

Noise Pollution

Noise pollution refers to excessive or harmful levels of unwanted sound in the environment. It occurs when the level of noise exceeds the acceptable limit, leading to negative effects on human health and the environment.

- **Sources**: Common sources of noise pollution include traffic, industrial activities, construction work, loudspeakers, and household appliances.
- **Effects on Health**: Prolonged exposure to noise pollution can lead to various health issues such as hearing loss, stress, sleep disturbances, high blood pressure, and reduced concentration.
- **Environmental Impact**: Noise pollution can disrupt wildlife, causing changes in animal behavior and communication, and even affect ecosystems.
- **Prevention**: Noise pollution can be reduced by using soundproofing materials, planting trees, regulating noise levels in urban areas, and spreading awareness about its harmful effects.

What are the Harms of Noise Pollution?

The harms of Noise Pollution are Hearing Loss, Stress and Anxiety, Sleep Disturbances, High Blood Pressure, Reduced Concentration, Impact on Wildlife:

- **Hearing Loss**: Prolonged exposure to loud noise can cause permanent hearing damage or loss.
- **Stress and Anxiety**: Constant noise can lead to increased stress levels and anxiety, affecting mental health.
- **Sleep Disturbances**: Noise pollution can disrupt sleep patterns, leading to fatigue and reduced productivity.
- **High Blood Pressure**: Long-term exposure to high levels of noise can contribute to elevated blood pressure and cardiovascular issues.
- **Reduced Concentration**: Noise can hinder focus and concentration, affecting learning and work efficiency.
- **Impact on Wildlife**: Noise pollution can disturb animal behaviour, affecting their communication, reproduction, and survival.

Measures to Limit Noise Pollution

- Install soundproof materials in buildings and workplaces to reduce noise transmission.
- Restrict the use of loudspeakers and amplifiers in public areas, especially during night hours.
- Implement strict noise standards for vehicles and promote the use of quieter engines and mufflers.
- Plant trees as natural sound barriers to absorb and reduce noise levels in urban areas.
- Designate specific zones for industrial activities away from residential areas.
- Raise public awareness about the harmful effects of noise pollution and promote responsible noise-reducing behaviours.

Characteristics of Sound

There are three primary characteristics of sound:

a. Loudness: Loudness is a sensation produced in ears which enables individuals to distinguish between a faint and loud sound. If the amplitude of vibrations is larger, the sound produced will be more audible. Loudness is directly proportional to the square of the amplitude of a wave.

b. Pitch: Pitch is a characteristic of sound which enables individuals to distinguish a soft sound and a shrill sound. Higher the frequency of vibrations, higher would be the pitch and shrillness.

c. Quality: Quality is a characteristic of sound which enables individuals to distinguish the musical sounds emitted by different voices or musical instruments, even though they possess the same loudness and pitch.