10
Chapter

# Sound

**We'll cover the following key points:**

- Sound and Its Propagation
- Sound Produced by Animals
- Characteristics of sound

Hi, I'm EeeBee

**Do you Remember:**

**Fundamental concept in previous class.**

In class 5th we learnt

- Sound and Electrical Energy

**Still curious?** Talk to me by scanning the QR code.

## Learning Outcomes

**By the end of this chapter, students will be able to:**

- Understand the basic nature of sound and how it is generated.
- Explore the importance of a medium for sound propagation and examine how the speed of sound changes across different materials.
- Analyze the properties and characteristics of sound waves.
- Identify the harmful effects of noise pollution and explore strategies to prevent and reduce its impact.

## Guidelines for Teachers

To teach sound effectively, educators can use multisensory tools like visual aids and auditory demonstrations to simplify concepts. Encouraging curiosity with open-ended questions and promoting critical thinking helps students explore sound phenomena, understand its practical applications, and analyze its environmental impact.

## NCF Curricular Goals and Competencies

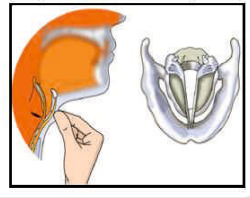
This chapter aligns with the following educational objectives CG-6 (C 6.1): Encourages students to understand scientific processes through exploration, experimentation, and critical thinking, fostering the ability to apply scientific knowledge to real-world scenarios.

Mind Map

# SOUND

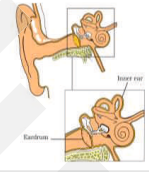
## Sound is Produced by a Vibrating Body & Humans

- Striking a pan, Plucking the rubber band, musical instruments etc.
- In humans, the sound is produced by the voice box or the larynx.



## Our Ears

- The shape of the outer part of the ear is like a funnel.
- The thin stretched membrane is called the eardrum.



## Audible and Inaudible Sounds

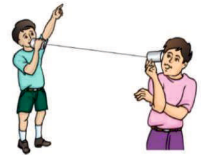
- **Audible Sound :-** Sounds with frequency from 20Hz to 20000Hz.
- **Inaudible Sound** :- Sounds with frequency less than 20Hz or more than 20000Hz

## Sound Needs a Medium for Propagation

- Sound can travel through solids, Liquids and Gas medium

Speed of sound.

Solids >Liquids > Gas



## Factors of a Vibration

**Frequency**

The number of oscillations per second is called frequency.

S.I. Unit: Hertz (Hz)

**Amplitude**

It is known as sound loudness or the maximum displacement of vibrating particles in a medium.

S.I. Unit :- Metre (m)

**Time Period**

Time taken to complete one ossilation.

S.I. unit :- Second (s)

**NOTE**:-1. Loudness of sound is proportional to the square of the amplitude of the vibration producing the sound.

2. The loudness is expressed in a unit called decibel (dB).

## Noise, Music& Noise Pollution

**NOISE**: Unpleasant sounds are called noise.

**Music**: Pleasant and enjoyful sounds are called music.

**Noise Pollution**

**Harms**: Lack of sleep, hypertension (high blood pressure), anxiety and Hearing Impairment.

**Limit Noise Pollution**:

1. Use silencing devices in vehicles and different machines.

2. All noisy operations must be conducted away from any residential area



Based on NCERT*

## Introduction

We are familiar with the different type of sounds that we hear daily from early morning to late night. These sounds may be:

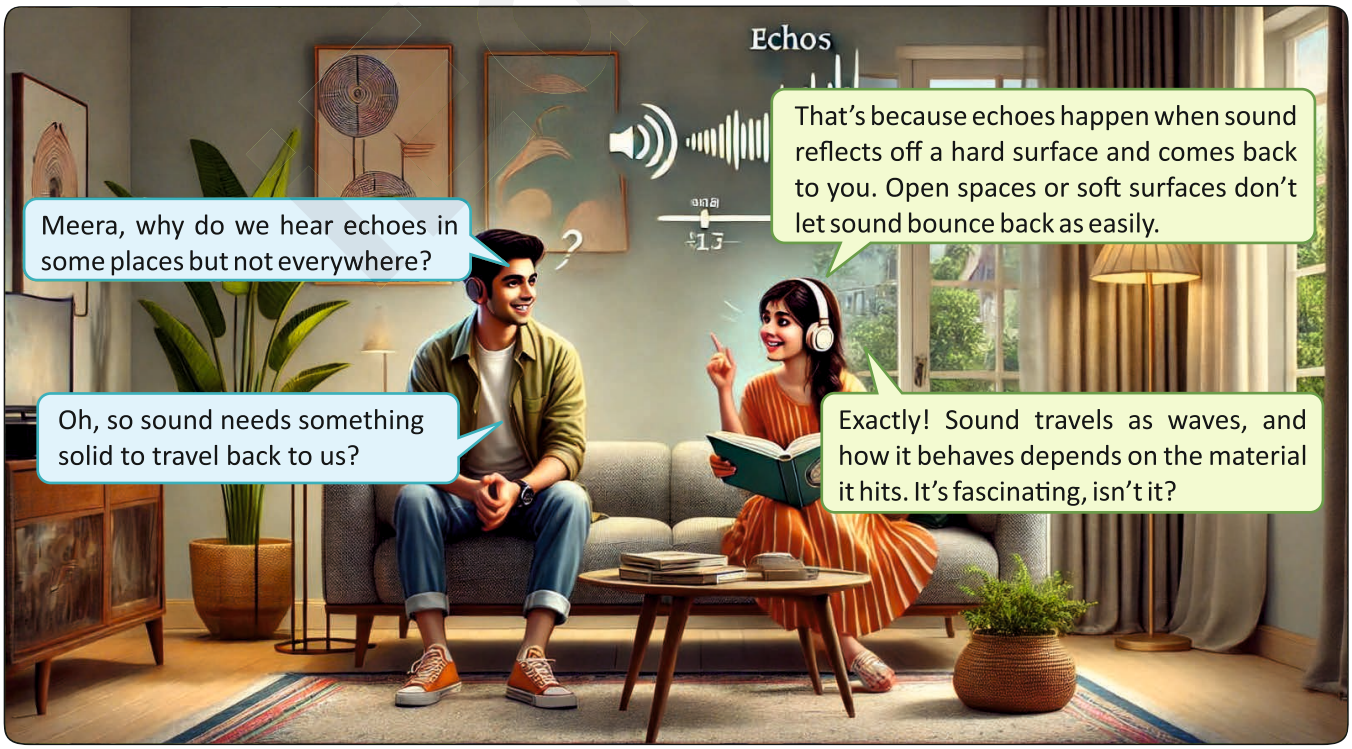
- Sound of chirping of birds on the tree.
- Sounds of different vehicles on the street.
- Sound of school bell.
- The sound of an alarm clock.
- Sound of whistle of our game teacher.
- Voice of our friends and teachers.
- Sound of your mobile phone and T.V.
- Sounds of ticking of a clock.
- Sounds of humming of insects and mosquitoes.
- Sounds produced by musical instruments like harmonium, tabla, guitar, sitar, flute, drum, manjira, etc.

Sound plays an important role in our lives. It helps us to communicate with one another. We hear sound with the help of our ears. Animals also have ears to hear the sound.

We can recognise the voices of our friends even if they are not visible to us. We can also distinguish different types of sounds because each sound has some definite character. For example, we can differentiate between the sounds produced by different musical instruments. Similarly, the sounds produced by different animals are different. Even the sounds produced by different humans differ from each other. We can recognise our friend or anybody else known to us only by hearing the sound.

## Sound and Its Propagation

Rohan is sitting in the living room when his cousin, Meera, walks in after reading a book.



## Sound : A form of Energy

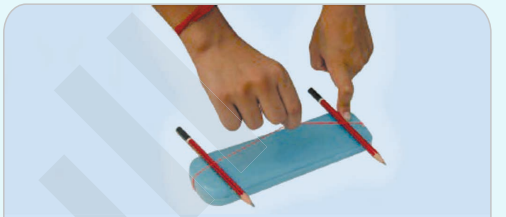
Sound is a form of energy which produces a sensation of hearing in our ears.

## Sound is produced by a vibrating body

To and from or back and forth motion of an object is called vibration. Sound is produced by the vibration of objects. Thus, sound is a vibration that is capable of being heard. Almost all objects produce sound on vibration. Let us verify this by collecting as many different kinds of objects as possible, for example, a pan, a rubber band, a metal dish, an earthen pot, glass tumblers, etc., and performing the following activities to produce vibration in them to produce sound:

### Activity

Take a rubber band. Put it around the longer side of a pencil box. Insert two pencils between the box and the stretched rubber. Now, pluck the rubber band somewhere in the middle. Do you hear any sound? Does the band vibrate?



Plucking the rubber band

## Name these musical instruments

1. _____

2. _____

3. _____

4. _____

**In History...**

The study of sound dates back to ancient Greece, where philosopher Pythagoras (6th century BCE) discovered that vibrating strings produced musical tones. He found that the pitch of a sound depended on the length and tension of the string.

Later, in the 17th century, scientist Robert Boyle demonstrated that sound cannot travel through a vacuum, proving the necessity of a medium (such as air) for sound to propagate. These early discoveries laid the foundation for modern acoustics and our understanding of sound today.

**KEYWORDS**

**Sensation of hearing:** The sensation of hearing is the ability to perceive sound through the ears, enabling the recognition of vibrations as distinct tones, pitches, and noises.

## Activity

Take a metal dish. Pour water in it. Strike it at its edge by a spoon. Do you hear a sound? Again strike the plate and then touch it. Can you feel the dish vibrating? Strike the dish again. Look at the surface of water. Do you see any waves there? Now hold the dish. What change do you observe on the surface of water? Can you explain the change? Is there a hint to connect sound with the vibrations of a body?

*Vibrating plate produces waves in water*

## Activity

Take 6-8 metal bowls or tumblers. Fill them with water up to different levels, increasing gradually from one end to the other. Now take a pencil and strike the bowls gently. Strike all of them in succession. You will hear a pleasant sound. This is your Jaltarang .

*Jaltarang*

In all the above activities, we see that a vibrating object produces sound. In some cases, the vibrations are easily visible to us. But in most cases, their amplitude is so small that we cannot see them. However, we can feel them.

## Let's recall what we know

### Apply Concept in Real-Life Context

Apply

1. Why do you hear the sound of thunder a few seconds after you see a lightning flash?
2. How does sound travel differently in air, water, and solids?

**Skills Practiced:** Critical and logical thinking, Identification, Application thinking

### Further Analysis

Analyse

1. Explain how vibrations produce sound, and describe how sound travels through different mediums.
2. Why is it that sound cannot travel in space?

**Skills Practiced:** Critical analysis, logical reasoning, brainstorming

### Self-Assessment Questions

Evaluate

1. What is sound, and how is it produced?
2. How does the speed of sound differ in solids, liquids, and gases?
3. What role do particles in a medium play in the propagation of sound?

SCAN TO ACCESS

Take a Task

Watch Remedial

Bloom's Taxonomy

## Creative Task

Create

Design a simple experiment to demonstrate how sound travels through solids:

1. Take a metal rod or a wooden stick.
2. Tap one end lightly and place your ear at the other end.
3. Compare the sound heard through the rod or stick with the sound heard directly through the air.

Write your observations and conclusions in your notebook, explaining how sound propagates through solids.

**Skills Practiced:** Brainstorming, research, digital literacy, creativity

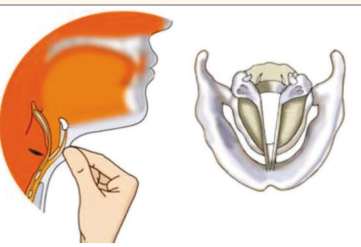
## Sound Produced by Animals

Rohan is sitting in the garden, observing birds, when his friend Kabir joins him.


### Sound produced by humans

In humans, the sound is produced by the voice box or the larynx. Put your fingers on the throat and find a hard bump that seems to move when you swallow. This part of the body is known as the voice box. It is at the upper end of the windpipe. Two ligaments, known as 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 voice is of high frequency and when the vocal cords are loose and thick, the sound is of low frequency.



Voice box in humans

## Sound produced by animals other than human

Bullfrog and its distended throat

Cows, cats, dogs and many other animals produce sound by means of vocal cords. But, all animals do not have vocal cords. Birds produce sound by means of a ring of cartilage, called syrinx, in their windpipe. Some birds have two parts in their voice box. Therefore two notes can be produced at the same time. Bees make a buzzing sound by vibrating their wings very rapidly. Bullfrog is a large-headed American frog, which produces sound with the help of vocal cords. But, to increase the loudness of its croaks (throaty frog cry), a bullfrog inflates its throat like a balloon, which amplifies the sound.

## Sound produced by different musical instruments

We are very much familiar with the different musical instruments. There are mainly three families of musical instruments. These are-

- Stringed instruments (tantu vadya)
- Wind or reed instruments (sushir vadya)
- Percussion or membrane instruments (avanaddhu vadya)

Stringed instruments have taut strings which vibrate when they are plucked, struck or played with a bow. The pitch of stringed instruments can be changed by altering the length of the strings. Sitar, veena, harp, santoor and violin are some of the stringed instruments .

Violin | Sitar | Santoor | Harp | Veena

*Some stringed instruments*

Wind instruments make use of vibrating air column. In these instruments, air is blown into the instrument either directly or through reeds. Flute, shehnai and the nadaswaram are some of the wind instruments.


Flute


Nadaswaram


Shehnai

*Some wind instruments*

Percussion instruments have a taut skin or a membrane. Drums, tabla, dholak and mridangam are some of the percussion instruments.


Drum

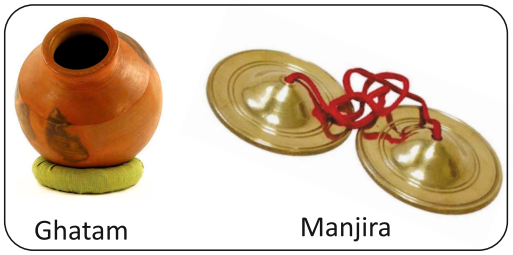

Tabla


Dholak


Mridangam

*Some percussion instruments*

Many of you might have seen the manjira (cymbals), the ghatam and the noot (mudpots). These instruments are commonly used in all parts of our country. They form the fourth class of musical instruments, known as ghana vadya, which are simply beaten or struck. The jal tarang and bells are also examples of such instruments.


Ghatam Manjira

*A few more musical instruments*

Every musical instrument has a vibrating part. For example, the vibrating part of veena is the stretched string, while that of tabla is the stretched membrane and that of flute is the air-column.

When we pluck the string of an instrument, like the sitar, the sound that we hear is not only that of the string. The whole instrument is forced to vibrate, and it is the sound of the vibration of the instrument that we hear. Similarly, when we strike the membrane of a mridangam, the sound that we hear is not only that of the membrane but of the whole body of the instrument.

## Sound Needs a Medium For Propagation

When sound is produced, it propagates like a wave which needs medium to propagate. It can propagate through solids, liquids or gases. But it cannot propagate in vacuum. Let us investigate the propagation of sound through these mediums by performing the following activities.

## Activity

Take a metal glass tumbler. Make sure that it is dry. Place a cell phone in it. (Remember that the cell phone must not be kept in water.) Ask your friend to give a ring on this cell phone from another cell phone. Listen to the ring carefully.

Now, surround the rim of the tumbler with your hands. Put your mouth on the opening between your hands. Indicate to your friend to give a ring again. Listen to the ring while sucking air from the tumbler. Does the sound become fainter as you suck? Remove the tumbler from your mouth. Does the sound become loud again?

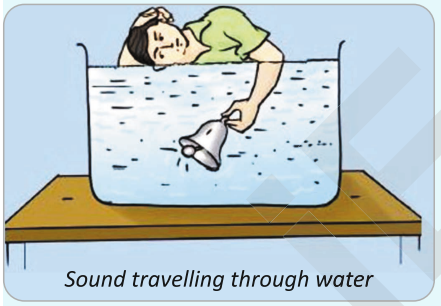
Sound needs a medium to travel

Can you think of an explanation? Is it possible that the decreasing amount of air in the tumbler had something to do with decreasing loudness of the ring? Indeed, if you had been able to suck all the air in the tumbler, the sound would stop completely. Actually, sound needs a medium to travel. When air has been removed completely from a vessel, it is said that there is vacuum in the vessel. The sound cannot travel through vacuum.

**Does sound travel in liquids? Let us find out.**

## Activity

Take a bucket or a bathtub. Fill it with clean water. Take a small bell in one hand. Shake this bell inside the water to produce sound. Make sure that the bell does not touch the body of the bucket or the tub. Place your ear gently on the water surface. Can you hear the sound of the bell? Does it indicate that sound can travel through liquids?



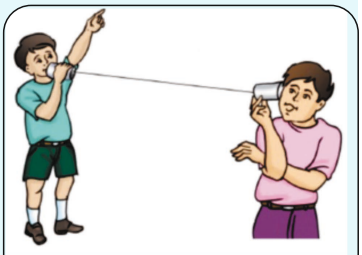
*Sound travelling through water*

That is how whales and dolphins might be communicating under water.

**Let us find out if sound can travel through solids also.**

## Activity

You can also perform the above activity by placing your ear at one end of a long wooden or metallic table and asking your friend to gently scratch the other end of the table We find that sound can travel through wood or metal. In fact, sound can travel through any solid. You can perform interesting activities to show that sound can also travel through strings. Recall if you made a toy telephone. Can you say that the sound can travel through strings?



A toy telephone

**We have learnt so far that vibrating objects produce sound and it is carried in all directions in a medium. How do we hear it?**

# Let's recall what we know

SCAN TO ACCESS

Take a Task

Watch Remedial

Bloom's Taxonomy

## Apply Concept in Real-Life Context

Apply

1. Why do you hear the sound of thunder after seeing the lightning, even though both happen at the same time?
2. Why does sound travel faster through solids than through air?

**Skills Practiced:** Critical and logical thinking, Identification, Application thinking

## Further Analysis

Analyse

1. Explain how sound waves travel through different mediums (solid, liquid, gas) with examples.
2. Why can astronauts not hear sounds in space without special communication devices?

**Skills Practiced:** Critical analysis, logical reasoning, brainstorming

## Self-Assessment Questions

Evaluate

1. What is sound, and how is it produced?
2. Explain the relationship between the speed of sound and the medium it travels through.
3. How does the pitch of a sound change with the frequency of the sound wave?
4. Identify two real-life examples where the reflection of sound is used and explain how it works.

## Creative Task

Create

Conduct a simple experiment to observe sound propagation:

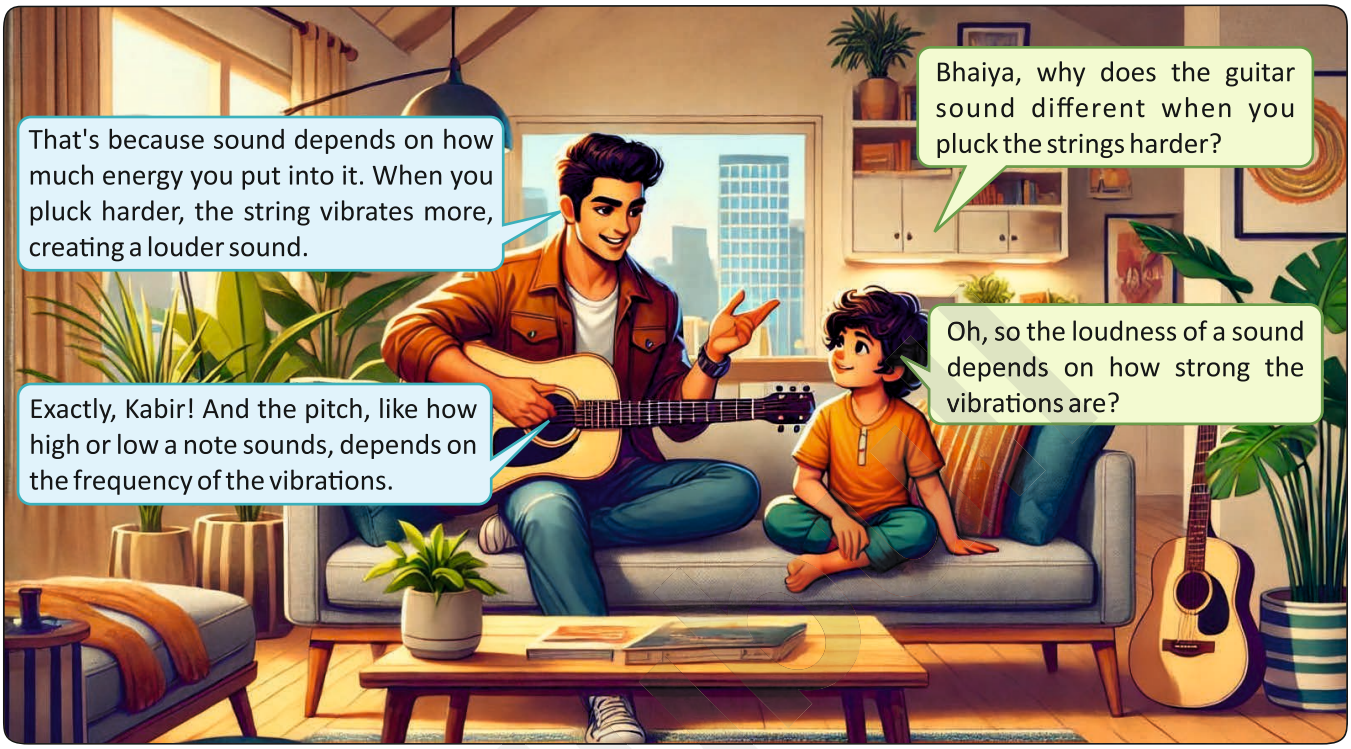
1. Take a steel ruler and tap it gently while holding it in the air.
2. Tap it again, but this time place it against a wooden table or wall.
3. Compare the loudness and clarity of the sound in both cases.

Write your observations and conclusions in your notebook, explaining how sound travels differently through air and solid surfaces.

**Skills Practiced:** Brainstorming, research, digital literacy, creativity

## Characteristics of sound

One afternoon, Rohan is sitting in the living room, playing with his guitar, when his younger brother, Kabir, walks in.




### Speed of Sound

We have just learnt that sound needs medium to travel i.e. sound travels in solids, liquids and gases. The speed of sound is highest in solid and lowest in gases.

Human ears : We hear sound through our ears

Ears are the sensory organs which enable us to hear sound. Ear may be treated as made up of three parts joint with each other. These are-

**Outer ear** **Middle ear** **Inner ear**

Outer ear : It consists of the pinna and the ear tube. At the end of the ear tube, a thin membrane called tympanic membrane or eardrum is stretched tightly. The eardrum separates the outer ear from the middle ear.

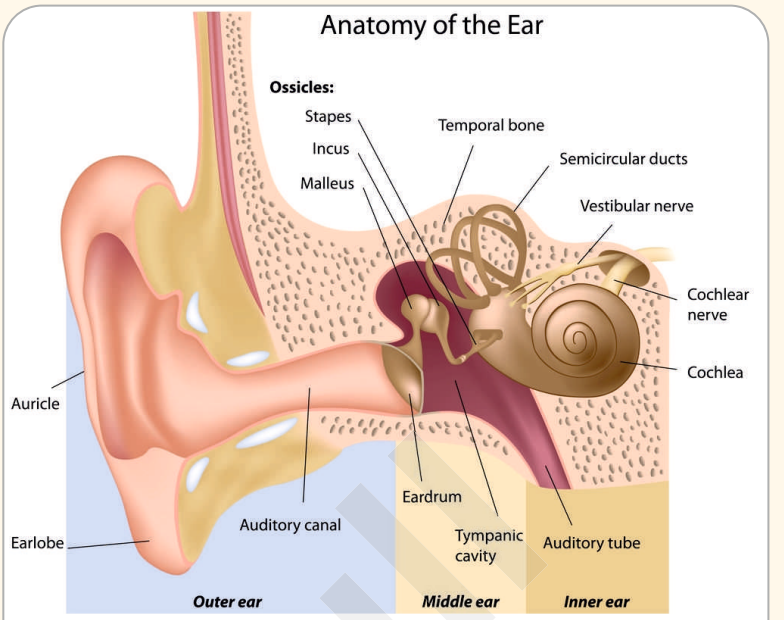
Middle ear : It consists of three very tiny interlocked bones called hammer, anvil and stirrup. The innermost bone i.e. stirrup is connected to the inner ear through a tiny window.

Inner ear : It consists of a coiled organ of hearing (cochlea), semicircular canals, which are organs of balance, and auditory nerves.

## Functioning of ear

Any vibrating object causes air molecules to vibrate. When these vibrations reach our ear, they are collected by pinna and funnelled into the ear tube. Passing through the ear tube, the vibrations reach eardrum and the eardrum starts vibrating with the same frequency. This vibration is passed to the hearing organ where it gets converted into signals. The auditory nerves take the signal to the brain and we hear the sound.

To understand what the eardrum does, let us build a tin can model of the eardrum.



*Human ear*

## Activity

Take a tin can. Cut its ends. Stretch a piece of rubber balloon across one end of the can and fasten it with a rubber band. Put four or five grains of dry cereal on the stretched rubber. Now ask your friend to speak "Hurrey, Hurrey" from the open end. Observe what happens to the grain. Why do the grains jump up and down?

**Conclusion :** 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.


*Plastic can eardrum*

## Amplitude, Time Period and Frequency of a Vibration

We have learnt that the to and fro motion of an object is known as vibration. This motion is also called oscillatory motion. You have already learnt in class VII, about the oscillatory motion taking an example of a simple pendulum. Let us recall.

**KEYWORDS**

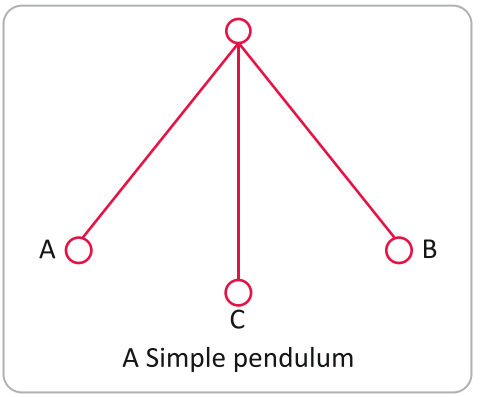
**Pinna:** The outer, visible part of the ear that collects and directs sound waves into the ear canal.

**Eardrum:** A thin membrane in the ear that vibrates in response to sound waves, transmitting them to the middle ear.

## Simple pendulum

Simple pendulum was discovered by an Italian scientist Galileo Galilei in the year 1583. It consists of a small spherical heavy metal ball, called bob, suspended with a light inextensible but flexible string (thread) from a rigid support so that it may oscillate without any friction.

When bob of the pendulum is pulled in one direction and releaseds it starts moving in to and fro motion. This to and fro motion is an example of periodic or oscillatory motion.



A Simple pendulum

**Oscillation**

The to and fro motion of the bob from its centre C to its one extreme A to another extreme B and again from B to the centre C is called oscillation of the pendulum. The pendulum also completes one oscillation when its bob moves from one extreme position A to the other extreme position B and comes back to A.

**Time period**

The time taken to complete one oscillation is called time period of the pendulum. It is generally denoted by T.

**Amplitude**

The maximum distance to which the ball moves from its central position is called the amplitude of oscillation. In fig. CA or CB is the amplitude of the oscillation. Amplitude is denoted by A.

**Frequency**

The number of oscillations per second is called the frequency of oscillation. Frequency is denoted by ν and its unit is $sec^{-1}$ which is called hertz (Hz). If an object oscillates 30 times in one second, then its frequency is 30 Hz. If an object takes 10 second in one oscillation, then its frequency is 1/10 $sec^{-1}$ or Hz, i.e., 0.1 $sec^{-1}$ or Hz.

Thus, $\nu = 1/T$.

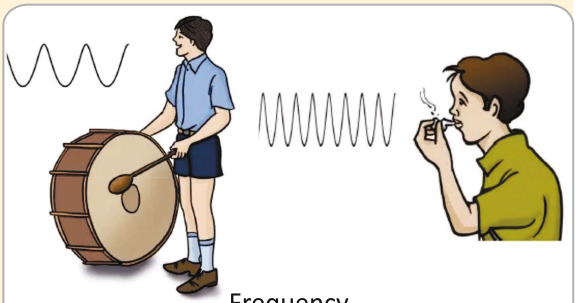
## Loudness and Pitch

**Loudness**: The amplitude of a sound relates to its loudness. Loudness is the characteristics of a sound which differentiates between a feeble sound and a loud sound. In fact, the loudness of a sound is proportional to the square of its amplitude.

$$\text{Loudness} \propto (\text{Amplitude})^2$$

Thus, larger the amplitude, the louder will be the sound. The loudness of a whisper will be smaller than the loudness of a normal conversation.

**Pitch :** The frequency determines the shrillness or pitch of a sound. If the frequency of vibration is higher, we say that the sound is shrill and has a higher pitch. If the frequency of vibration is lower, we say that the sound has a lower pitc. For example, a drum vibrates with a low frequency. Therefore, it produces a low-pitched sound. On the other hand, a whistle has a high frequency and therefore, produces a sound of higher pitch. A bird makes a high-pitched sound whereas a lion makes a low-pitched roar. However, the roar of a lion is very louds while the sound of the bird is quite feeble.



Frequency determines the pitch of a sound

Every day you hear the voices of children and adults. Do you find any difference in their voices? Can you say that the frequency of the voice of a child is higher than that of an adult? Usually the voice of a woman has a higher frequency and is shriller than that of a man.

## Audible and Inaudible Sounds

**We know that we need a vibrating body for the production of sound.**

In fact, the human ear can hear the sound having frequencies between 20 Hz to 20,000 Hz. The sound of frequencies greater than 20,000 Hz is called ultrasonic sound and the sound of frequencies lower than 20 Hz is called subsonic sound.

Thus, the sounds having frequencies between 20 – 20,000 Hz come under the audible sound, while that having frequencies below 20 Hz and above 20,000 Hz comes under the inaudible sound.

Some animals can hear sounds of frequencies higher than 20,000 Hz. Dogs have this ability. The police use high frequency whistles which dogs can hear but humans cannot.

The ultrasound equipment, familiar to us for investigating and tracking many medical problems, works at frequencies higher than 20,000 Hz.

## Noise and Music

Sounds may be pleasant or unpleasant to our ears. For example, the sound produced by musical instruments are pleasant while the sound produced by the traffic at a busy crossing or the screech of automobile beaks are unpleasant. Sounds which produce pleasing sensation to our ears are called musical sound or music while the sounds which produce unpleasant sensation to our ears are called noise.

Sound produced by a harmonium is a musical sound. The string of a sitar also gives out a musical sound. But, if a musical sound becomes too loud, would it remain melodious?

## Noise Pollution

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. What sources in the home may lead to noise? 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?

Do you know that 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 control noise pollution

Given below are some ways by which noise pollution can be controlled or minimized.

- Locating factories and industrial units away from the residential areas.
- Putting restriction on playing loud music at public places.
- Putting restriction on excessive honking by automobiles.
- Running radios and televisions at low volume.

## Hearing impairment and solutions

Hearing impairment refers to the condition of hearing loss. The degree of hearing impairment can very widely from person to person. Some people have partial hearing loss while others have complete hearing loss.

A child with hearing loss may attend a special school, special classes which within a regular school, or may be part of a regular classroom.

Some people with hearing loss may need to use special techniques such as the following to communicate:

- Speech reading, which involves looking closely at a person's lips, facial expressions, and gestures to help figure out spoken words.
- American Sign Language, or ASL, which is a language of hand movements that allows people with hearing impairment to communicate with one another without speaking.

- Cued Speech and Signed Exact English, without uses hand shapes to translate what is being said. Both are meant to be used with spoken language to help people understand anything they cannot comprehend through lip reading.

## Let's recall what we know

SCAN TO ACCESS

Take a Task

Watch Remedial

Bloom's Taxonomy

### Apply Concept in Real-Life Context

Apply

1. Why do some musical instruments produce louder sounds than others, even when played with the same effort?
2. When you shout in an empty room, why do you hear an echo, but you don't in a crowded one?

**Skills Practiced:** Critical and logical thinking, Identification, Application thinking

### Further Analysis

Analyse

1. Explain how the pitch of a sound depends on the frequency of vibrations. Provide examples from musical instruments.
2. Why does sound travel faster in solids than in air? Discuss with examples.

**Skills Practiced:** Critical analysis, logical reasoning, brainstorming

### Self-Assessment Questions

Evaluate

1. What is sound, and how is it produced?
2. Define amplitude and frequency, and explain their roles in determining the loudness and pitch of a sound.
3. What is the difference between noise and musical sound? Provide examples.
4. Name two mediums in which sound travels faster than air and explain why this happens.

### Creative Task

Create

Design a simple experiment to demonstrate how sound changes with different materials:

1. Take a metal spoon, a wooden stick, and a plastic object.
2. Gently tap each object on a hard surface and observe the sounds produced.
3. Note the differences in loudness and pitch for each material.

Write your observations and conclusions in your notebook, explaining how the material's properties affect the characteristics of sound.

**Skills Practiced:** Brainstorming, research, digital literacy, creativity

# SUMMARY

## Sound & Its Propagation

**1. Nature of Sound**

- Sound is a mechanical wave that requires a medium (solid, liquid, or gas) to travel.
- It is generated by the vibration of particles in a medium, creating compressions and rarefactions.

**2. Medium of Propagation**

- Sound travels fastest in solids, slower in liquids, and slowest in gases due to particle density.
- It cannot propagate in a vacuum because there are no particles to carry the vibrations.

**3. Speed of Sound**

- The speed depends on the type of medium and its temperature. For example, sound travels faster in warm air compared to cold air.

**4. Reflection and Refraction**

- When sound waves encounter a barrier, they reflect back, creating echoes.
- When moving between different media, sound waves bend due to refraction.

## Sound Produced by Animals

**1. Communication**

- Animals produce sound for various purposes like mating calls, warnings, or social bonding. For example, birds chirp to communicate territorial claims or attract mates.

**2. Navigation and Echolocation**

- Bats and dolphins emit high-pitched sounds and use the echoes to locate objects or prey.
- This process, known as echolocation, allows them to "see" using sound waves in dark or murky environments.

## Characteristics of Sound

**1. Pitch**

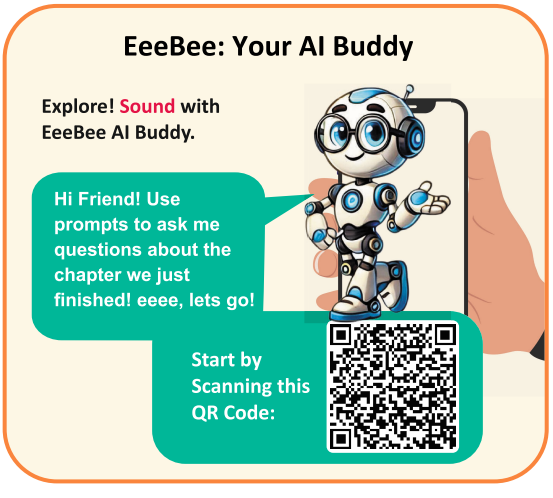
- Pitch is determined by the frequency of sound waves. Higher frequencies produce higher-pitched sounds, while lower frequencies create deeper sounds.
- It helps us distinguish between a child's voice and an adult's or between a flute and a bass drum.

**2. Loudness**

- Loudness depends on the amplitude of sound waves. Larger amplitudes result in louder sounds, while smaller amplitudes produce softer sounds.
- It is also influenced by the distance from the source of the sound.

**3. Quality (Timbre)**

- Timbre allows us to identify different sound sources even if they produce the same pitch and loudness, like the unique tones of a guitar versus a piano.
- It depends on the waveform and harmonics of the sound.



Gap Analyzer™
Take a Test

# EXERCISE

**That turn curiosity into confidence—let's begin!**

## A. Choose the correct answer.

1. Which of the following is necessary for sound to propagate?
   (a) Vacuum ☐ (b) Solid, liquid, or gas ☐
   (c) Light ☐ (d) Magnetism ☐
2. Which animal produces sound using echolocation?
   (a) Elephant ☐ (b) Dog ☐
   (c) Bat ☐ (d) Cat ☐
3. The frequency of sound determines its:
   (a) Loudness ☐ (b) Pitch ☐
   (c) Timbre ☐ (d) Duration ☐
4. Which of the following characteristics distinguishes two sounds of the same pitch and loudness?
   (a) Amplitude ☐ (b) Timbre ☐
   (c) Wavelength ☐ (d) Intensity ☐
5. Which of the following is true about ultrasound?
   (a) It has a frequency below 20 Hz. ☐ (b) It is inaudible to humans. ☐
   (c) It propagates in a vacuum. ☐ (d) It is visible to the human eye. ☐

## B. Fill in the blanks.

1. Sound travels faster in _____ compared to air.
2. The _____ of a sound wave determines how loud it is.
3. Animals like _____ use sound waves for communication under water.
4. The human ear can detect sounds in the frequency range of _____ to _____.
5. The back-and-forth motion of particles in a medium due to sound is called _____.

## C. Write True or False.

1. Sound can travel through a vacuum. _____
2. Whales use low-frequency sound waves to communicate over long distances. _____
3. The pitch of a sound depends on its frequency. _____
4. Sound waves are longitudinal waves. _____

## D. Define the following terms.

1. Sound wave
2. Frequency
3. Timbre
4. Echo
5. Ultrasound

## E. Match the columns.

| Column A | Column B |
|---|---|
| 1. Ultrasound | (a) Bats |
| 2. Medium | (b) Sound travels faster in it |
| 3. Timbre | (c) Quality of sound |
| 4. Echolocation | (d) Cannot travel without it |
| 5. Solid | (e) High-frequency sound |

## F. Give reasons for the following statements.

1. Sound cannot travel through a vacuum.
2. The pitch of a sound increases with its frequency.
3. Dolphins and bats use ultrasound for communication and navigation.
4. A person's voice sounds different over a phone compared to in person.

## G. Answer in brief.

1. How does sound propagate through a medium?
2. Explain why animals like bats and dolphins use ultrasound.
3. What are the key characteristics of sound, and how do they affect how we hear it?
4. Discuss the role of vibration in producing sound.
5. What precautions can be taken to reduce noise pollution?

## H. Answer in detail.

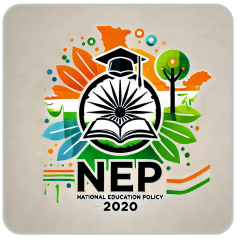
1. Explain the process of sound propagation through solids, liquids, and gases with examples.
2. Describe how animals use sound to communicate and navigate their environment.
3. Explain the characteristics of sound—amplitude, frequency, and timbre—and how they affect our perception of sound.
4. Discuss the importance of echoes and their applications in real life, such as sonar and echolocation.
5. What are the different ways humans and animals produce sound? Provide examples.

## NEP Corner

Know about NEP 2020

### Goodbye, Single Language Studies!

NEP 2020 promotes multilingual education. Learn in your mother tongue, but also master global languages like English and French.




# Skill-based Activity

## Activity Time

STEM

1. Create a chart explaining different types of sound waves (longitudinal waves, transverse waves) with examples from daily life.
2. Conduct a simple experiment: Use a metal spoon and a string to demonstrate sound vibration. Describe how vibrations create sound.
3. Write a brief explanation of how sound travels through different mediums like air, water, and solids.
4. Reflect on situations where sound is beneficial (e.g., communication) and where it becomes noise pollution. Suggest ways to reduce noise pollution.

**Skills Covered:** Creativity, critical and logical thinking, brainstorming, research, problem-solving

## Applications of Sound in Technology

Visualize

1. Research the role of sound waves in technologies like ultrasound, sonar, or noise-canceling headphones.
2. Explain how sound is used in echolocation by animals and its application in technology.
3. Compare the efficiency of sound-based devices (e.g., ultrasonic cleaners vs traditional cleaners) in different industries.
4. Discuss safety precautions when using high-decibel devices or environments with extreme noise levels.

**Skills Covered:** Creativity, critical and logical thinking, brainstorming, communication, teamwork

## Sound in Nature

Group Activity

1. Research how sound plays a role in natural phenomena, such as thunder, animal communication, or ocean waves.
2. Discuss how human-made noise pollution affects wildlife and ecosystems.
3. Share your group's findings through a creative medium, such as a skit, video, or model.

**Skills Covered:** Observation, brainstorming, communication, teamwork, collaboration, critical thinking

## Sound in Music and Entertainment

Case to Investigate

1. Investigate how musical instruments create sound and categorize them into types based on how sound is produced (string, percussion, wind).
2. Write about the role of sound quality (pitch, frequency, amplitude) in music production.
3. Create an infographic showing how sound effects are used in movies or gaming to enhance user experience.
4. Discuss how understanding sound properties can improve the design of musical instruments or audio devices.

**Skills Covered:** Critical and logical thinking, brainstorming, research, problem-solving, responsibility, digital literacy

## Identifying Environmental Issues and Proposing Solutions

Aligning with SDGs

·1.Research the importance of sound in daily life, focusing on its role in communication, warning systems, and navigation.

2. Identify and explain how excessive sound or noise pollution affects health and well-being (e.g., hearing loss, stress).
3. Create a visual representation or mind map of strategies to reduce noise pollution, such as using soundproof materials or planting trees.
4. Discuss how sound-related innovations contribute to sustainable cities and communities, linking it to SDGs.SDG 3: Good Health and Well-Being – Reducing noise pollution to improve physical and mental health.

Aligned with SDGs:

·SDG 11: Sustainable Cities and Communities – Using sound technology for sustainable urban development and reducing environmental noise., SDG 12: Responsible Consumption and Production – Developing efficient sound-based technologies that minimize energy consumption.

**Skills Covered:** Research, Brainstorming, Problem-solving, Presentation skills

## Exploring Wildlife Reserves

Integrated Learning

Create a list of major wildlife reserves in your country, indicating their primary protected species and geographical locations in a tabular format. Use a map to mark the locations of these reserves and identify the type of ecosystems they protect.

**Integrated Learning:** Social Science

**Skills Covered:** Creativity, analytical thinking, critical and logical thinking, brainstorming, research, application