SOUND

8th Class

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Sound play an important role in our lives.

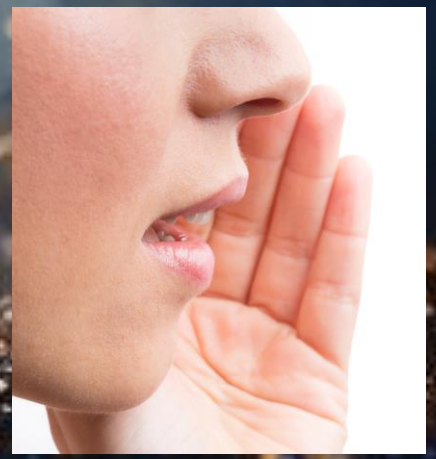
It helps us to communicate with each other.

We hear a wide variety of sounds in our surroundings.

Introduction to Sound

What is Sound?

Sound is a form of energy that produces a sensation of hearing.



Example: Ringing bell, Musical instrument, Human voice.

Examples of Musical Instruments


French Horn


Saxophone


Trumpet


Drum Set


Violin


Double Bass


Grand Piano


Acoustic Guitar


Ukulele


Trombone


Classical Guitar


Mandolin

How is Sound Produced?

Sound is Produced by Vibrations

- The to-and-fro or back-and-forth motion of an object is called **vibration**.
- Sound is produced when an object vibrates.

A tuning fork vibrating.

A stretched rubber band being plucked.

A school bell ringing.

No Vibration = No Sound!

Sound is Produced by a Vibrating Body

Activity

- ✓ Take a metal plate (or a pan).
- ✓ Hang it at a convenient place in such a way that it does not touch any wall.
- ✓ Now strike it with a stick (Fig.5.2).
- ✓ Touch the plate or pan gently with your finger.
- ✓ Again strike the plate with the stick and hold it tightly with your hands immediately after striking.
- ✓ Touch the plate after it stops producing sound.
- ✓ You will **no longer feel vibrations.**

Fig. 5.2 : Striking a pan

Observations

1. When the plate **produces sound**, it is **vibrating.**
2. When the plate **stops vibrating**, the **sound also stops.**

Sound is Produced by a Vibrating Body

Activity

- Take a rubber band.
- Put it around the longer side of a pencil box (Fig. 5.3).
- Insert two pencils between the box and the stretched rubber.
- Now, pluck the rubber band somewhere in the middle.

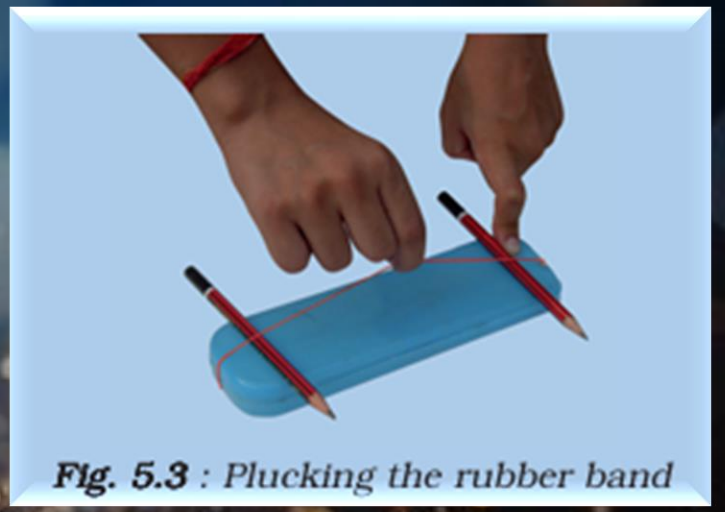


Fig. 5.3 : Plucking the rubber band

Observation

1. You **hear a sound** when the rubber band is plucked.
2. You can **see and feel the rubber band vibrating.**

Sound is Produced by a Vibrating Body

Activity

- ✓ Take a metal dish. Pour water in it.
- ✓ Strike it at its edge with a spoon (Fig. 5.4).
- ✓ Again strike the dish and then touch it.
- ✓ Strike the dish again. Look at the surface of water.
- ✓ Now hold the dish.

Fig. 5.4 : Vibrating dish produces waves in water

Observations

1. When the dish is struck freely, it **vibrates** and produces **sound.**
2. The **vibrations of the dish** are passed to the **water**, causing **ripples** (waves).
3. When the dish is **held tightly**, it **cannot vibrate freely** —hence, **sound stops** and **water surface remains calm.**

Sound is Produced by a Vibrating Body

Activity

- ✓ Take a hollow coconut shell and make a musical instrument ektara.
- ✓ You can also make it with the help of an earthen pot (Fig. 5.5).
- ✓ Play this instrument and identify its vibrating part.

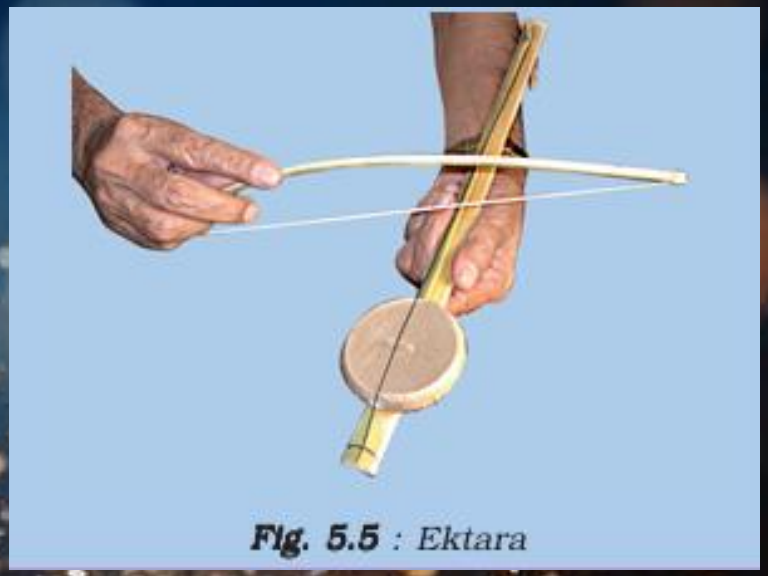


Fig. 5.5 : Ektara

Observations

1. **The vibrating part of the ektara is the stretched string.**
2. When the string is plucked, it **vibrates rapidly**, producing sound.
3. The **hollow coconut shell or pot** acts as a **resonating body** that makes the sound **louder.**

Sound is Produced by a Vibrating Body

Activity

- ✓ Take 6-8 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 pleasant sounds.
- ✓ This is your jaltrang (Fig.5.7).

Fig. 5.7 : Jaltrang

Observations

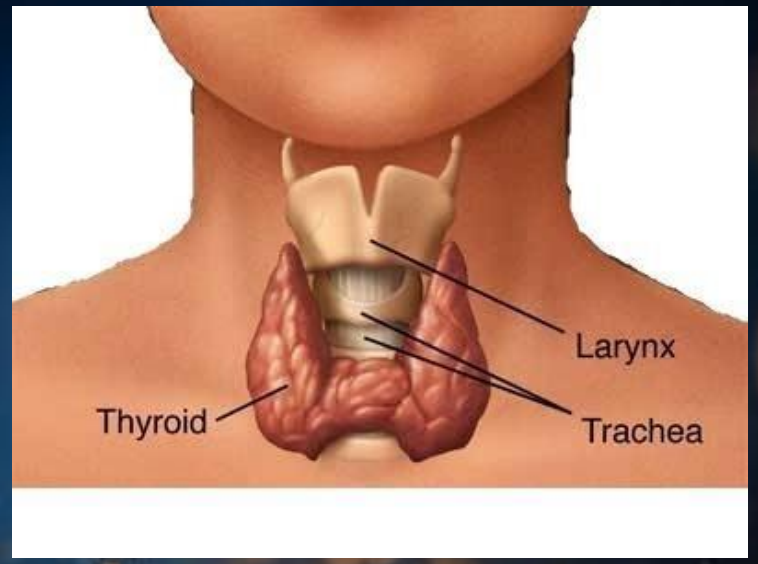
1. **The sound produced depends on the quantity of water in the bowls.**
2. The vibration of the bowl and the water surface produces sound.
3. Changing the water level changes the **frequency of vibration**, hence the **pitch** of the sound.

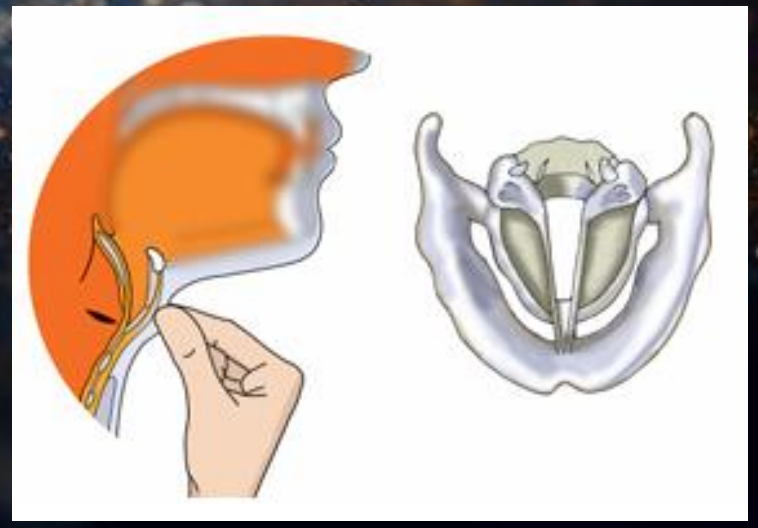
MUSICAL INSTRUMENTS AND THEIR VIBRATING PARTS

MUSICAL INSTRUMENTS	VIBRATING PARTS PRODUCING SOUND
VEENA	STRETCHED STRING
TABLA	STRETCHED MEMBRANE
FLUTE	AIR COLUMN
SITAR	STRETCHED STRING
DRUM	STRETCHED MEMBRANE
GUITAR	STRETCHED STRING
VIOLIN	STRETCHED STRING

Sound Produced by Humans

- In humans sound is produced by the voice box or larynx.
- It is the upper part of the wind pipe.
- Two vocal cords , are stretched across the larynx living a narrow slit. When the lungs force air through the slit , it vibrates and produce sound.





Sound Needs a Medium for Propagation

Activity

- ❑ Take a metal or 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 (Fig. 5.10).
- ❑ 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.

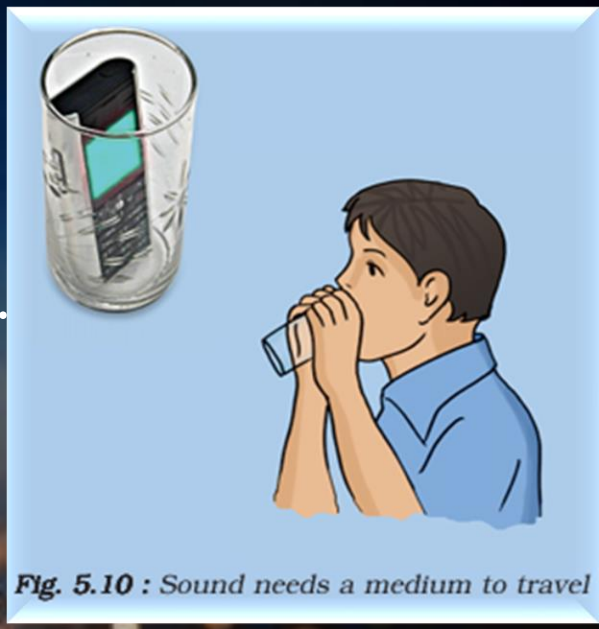


Fig. 5.10 : Sound needs a medium to travel

Observations

1. **Sound needs a medium (like air) to travel.**
2. When you remove air from the tumbler, the amount of medium available for sound to travel **decreases**, so the sound becomes **weaker or faint.**
3. When air re-enters, the medium is restored, and the **sound travels better and louder.**

Sound Needs a Medium for Propagation

Activity

Fig. 5.11 : Sound travelling through water

- 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 (Fig. 5.11).

Observations

1. You **can hear the sound of the bell** even though it is **inside the water.**
2. The sound may seem **a bit muffled** or **different**, but it is clearly heard.
3. **Sound can travel through liquids.**
4. The sound produced by the bell travels **through water** and reaches your ear.
5. This shows that **liquid is also a medium** through which **sound can propagate**

Activity

Sound Needs a Medium for Propagation

1. Take a metre scale or a long metal rod and hold its one end to your ear.
2. Ask your friend to gently scratch or tap at the other end of the scale (Fig. 5.12).
3. Can you hear the sound of the scratching?
4. Ask your friends around you if they were able to hear the same sound?

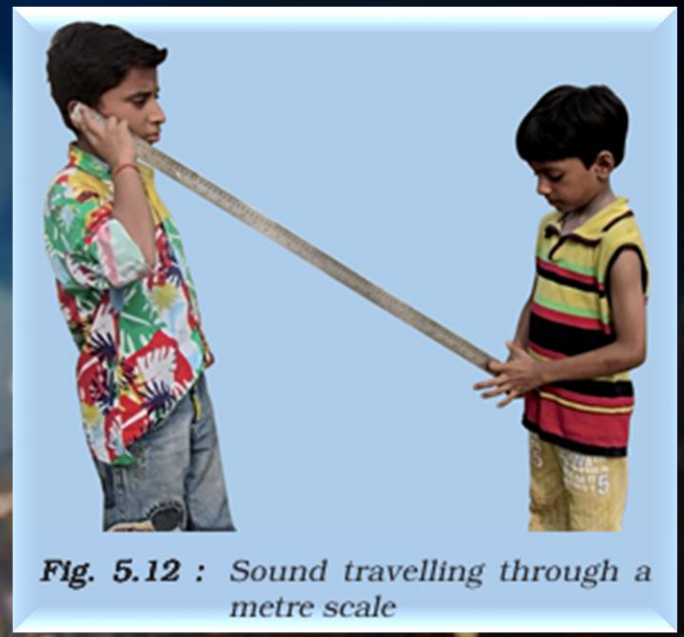


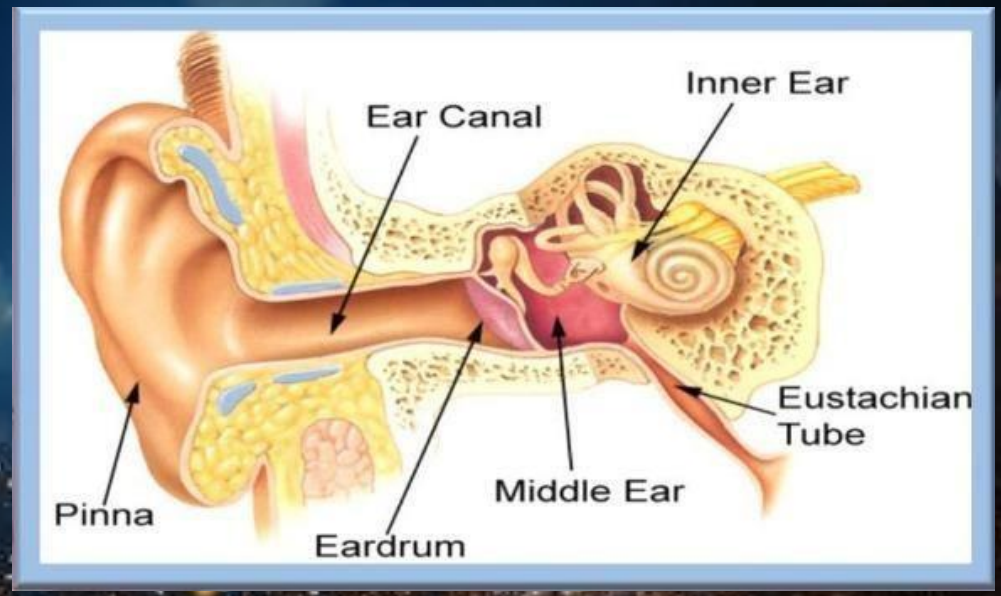
Fig. 5.12 : Sound travelling through a metre scale

Observations

1. You can **hear the sound of scratching or tapping clearly** through the scale.
2. The **friends standing nearby** may **not hear** it as distinctly or may **not hear it at all.**
3. **Sound can travel through solids.**
4. The **vibrations** produced by scratching or tapping **travel through the solid rod or scale** directly to your ear.
5. Solids are therefore **good conductors of sound.**

We Hear Sound through Our Ears

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



Characteristics of Sound Waves

1. Amplitude

2. Time Period

3. Frequency of a Vibration

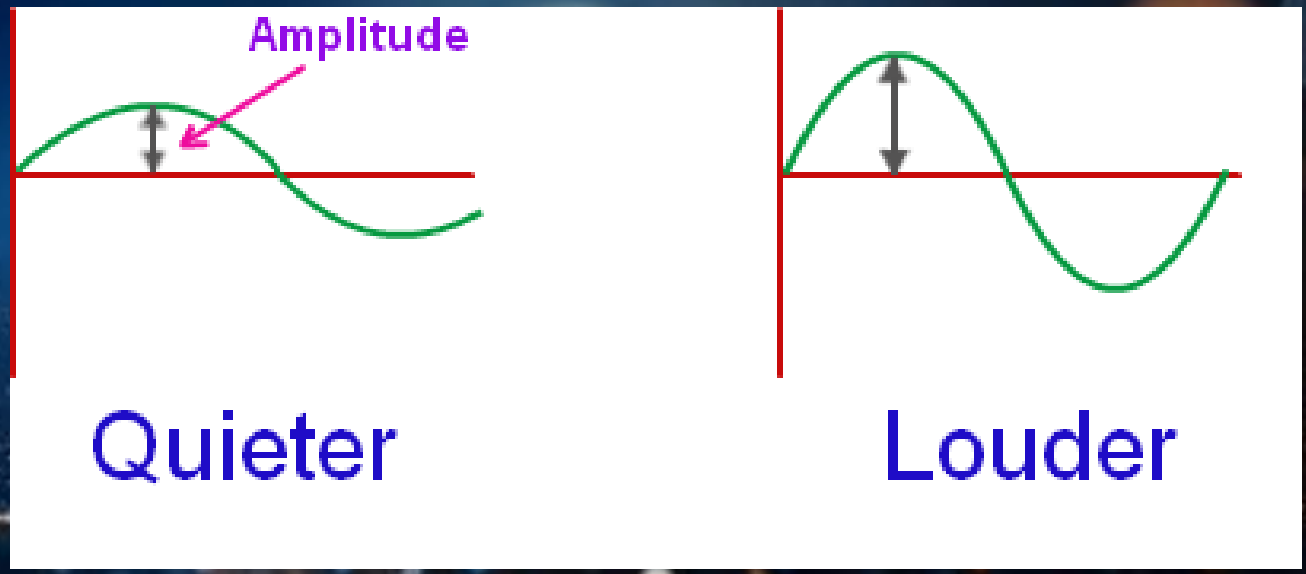
Characteristics of Sound Waves

Amplitude

Maximum displacement of a vibrating particle is called “Amplitude”.

Determines **loudness** of sound.

Higher amplitude → louder sound.



High Amplitude = LOUD Sound **Low Amplitude = SOFT Sound**

Characteristics of Sound Waves

Time Period

The time taken to complete one oscillation is called as “Time Period”.

Unit of Time period is Seconds (s).

Relationship between Frequency and Time period:

Frequency (ν) = 1 / Time Period (T)

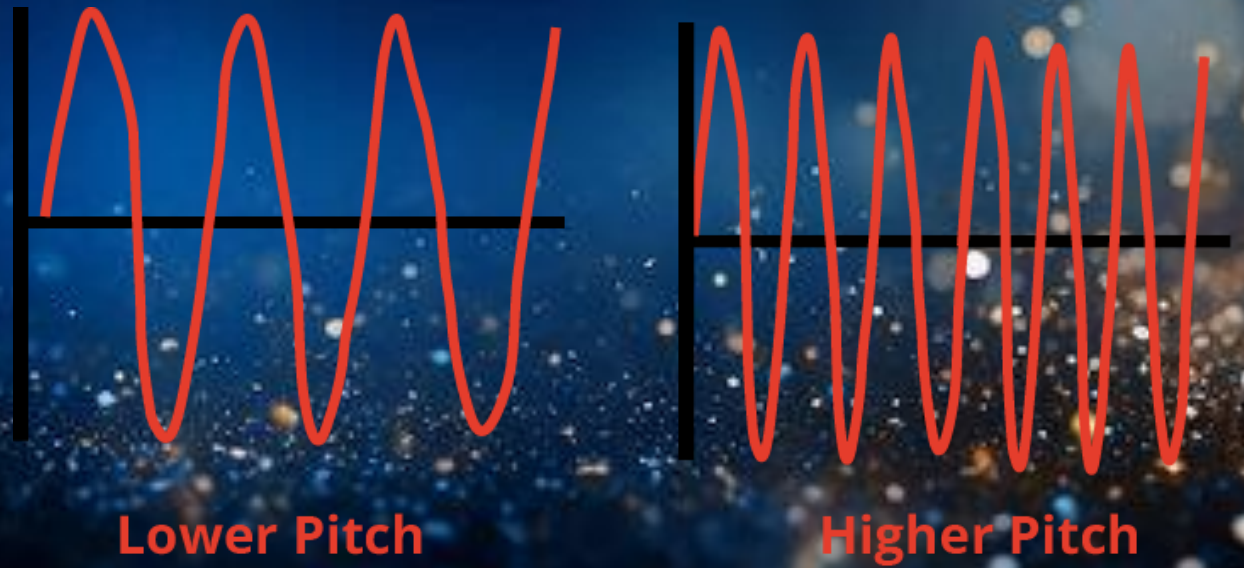
Characteristics of Sound Waves

Frequency of a Vibration

The number of oscillations/vibrations per second is called the frequency.

Unit of frequency: **Hertz – Hz**

Determines **pitch** of sound.



High frequency → high pitch **Low frequency → low pitch**

Loudness

Loudness is the characteristic of sound that helps us distinguish between a **loud sound** and a **soft sound.**

It depends on the **amplitude** of vibration.

✓ When an object vibrates with **large amplitude**, it produces a **loud sound.**

✓ When an object vibrates with **small amplitude**, it produces a **soft sound.**

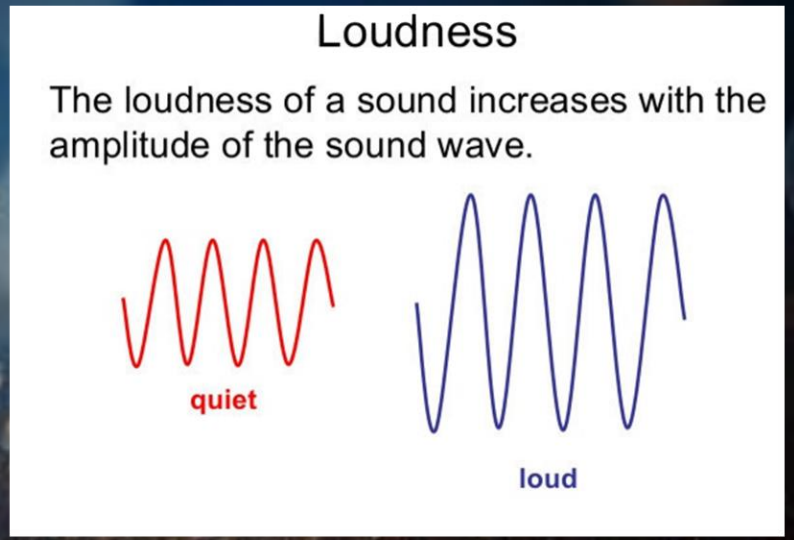
Loudness ∝ (Amplitude)²

→ If amplitude doubles, loudness increases **four times.**

Loudness is measured in **decibel (dB).**

Loudness

Example	Loudness Level
Normal breathing	10 dB
Soft whisper (at 5m)	30 dB
Normal conversation	60 dB
Busy traffic	70 dB
Average factory	80 dB



Pitch

Pitch is the characteristic of sound that helps us distinguish between a **shrill sound (high-pitched)** and a **deep sound (low-pitched).**

It depends on the **frequency** of vibration.

Higher frequency → Higher pitch (shrill sound)
Lower frequency → Lower pitch (deep sound)

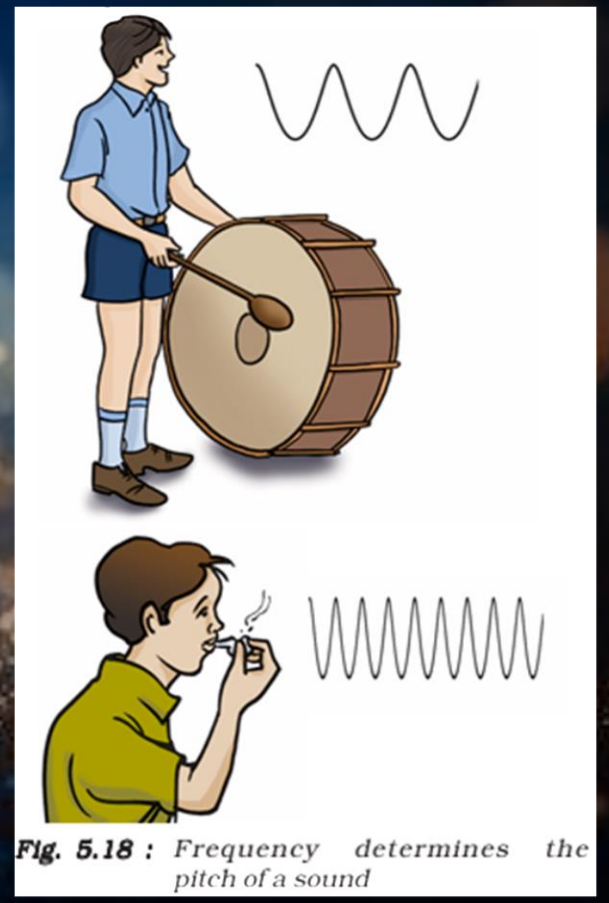


Fig. 5.18 : Frequency determines the pitch of a sound

For example, a drum vibrates with a low frequency. Therefore, it produces a low-pitched sound.

Audible and Inaudible Sounds

Inaudible Sounds

Sounds of frequencies less than about 20 vibrations per second (20 Hz)
Sounds of frequencies more than about 20,000 vibrations per second (20 KHz)

Audible range: 20 Hz – 20,000 Hz (Humans)

Infrasonic: Below 20 Hz (Example: elephants)

Ultrasonic: Above 20,000 Hz (Example: Bats, Dolphins)

Noise and Music

Music	Noise
Pleasant to hear	Unpleasant
Regular pattern	Irregular
Example: song	Example: traffic

Noise Pollution

Presence of excessive or unwanted sounds in the environment is called noise pollution.

Major causes of noise pollution

- ✓ Sounds of vehicles
- ✓ Explosions including bursting of crackers
- ✓ Machines
- ✓ Loudspeakers etc.

Causes of noise pollution at home

- ❑ Television and transistor radio at high volumes
- ❑ Some kitchen appliances
- ❑ Desert coolers
- ❑ Air conditioners

What are the Harms of Noise Pollution?

Definition: Unwanted or harmful sound.

Sources: Vehicles, loudspeakers, industries.

Effects: Lack of sleep, hypertension (high blood pressure), anxiety and many more health disorders, Temporary or even permanent impairment of hearing.

Measures to Limit Noise Pollution

- 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.
- 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.


thank you