Chapter:13 Sound

Sound is a vibration that travels through a medium (like air, water, or solid objects) and is detected by our ears. These vibrations create pressure waves that move outward from the source.

- Sound is a mechanical wave
- It originates from the vibration of particles in a medium such as air, water or solids.
- It travels in the form of longitudinal waves, where particles move parallel to the direction of the propagation.
- It includes regions of :

Compression (particles close together)

Refraction (particles spread out)

Sound is a form of energy: that we hear. It is made when something vibrates and creates waves that travel through air (or another medium) to our ears.

EXAMPLE: Vibrating guitar strings produce energy.

Production of Sound Waves - Explained

Sound waves are created when an object vibrates, disturbing the particles in the surrounding medium (such as air, water, or solids). These disturbances cause a series of compressions (high-pressure areas) and rarefactions (low-pressure areas) to travel outward from the source. This movement forms longitudinal waves, in which the particles of the medium vibrate parallel to the direction the wave is moving.

Key Points:

Vibrations start the sound.

Compressions & rarefactions form the wave.

Longitudinal wave = particles move parallel to wave direction.

Medium required (no sound in space).

Faster in solids, slower in air.

Why Are Sound Waves Longitudinal?

Sound waves are longitudinal because the vibrations of particles in the medium move in the same direction as the wave travels.

Imagine pushing a slinky from one end. The coils move back and forth along the slinky's length, not up and down. That's how sound travels—by compressing and expanding particles along the same path the wave moves.

EXAMPLES OF SOUND WAVES:

Clapping hands - The clap creates compressions and rarefactions in air, producing a sound wave.

Drum beat - Striking a drumhead pushes air particles together (compression), then they spread out (rarefaction).

Tuning fork - When struck, it vibrates, sending compressions and rarefactions through the air as sound.

Nature of Sound Waves

-Sound waves are mechanical waves - they need a medium (like air, water, or solid) to travel.
-They are longitudinal waves, meaning the particles of the medium vibrate parallel to the direction of the wave.
-Sound waves transfer energy, not matter.
-They consist of compressions (high pressure) and rarefactions (low pressure).
-They cannot travel in a vacuum (like space), because there are no particles to carry the vibrations.

Compression and Rarefaction - Explained in Detail

When a sound wave travels through a medium like air, it does not move the particles permanently from one place to another. Instead, it causes the particles to vibrate back and forth around their rest position. This vibration creates regions of compression and rarefaction that move through the medium.

- *Compression:*

Compression is the region in a sound wave where particles are pushed close together.
It happens when the vibrating object moves forward, pushing nearby particles ahead of it.
This creates an area of high pressure and high particle density.
Compressions represent the crest (peak) of a longitudinal sound wave.
Example: When you speak, your vocal cords push air particles together, forming compressions.

- *Rarefaction:*

Rarefaction is the region where particles are spread apart.
It occurs when the vibrating object moves backward, pulling particles away and creating space.
This results in an area of low pressure and low particle density.
Rarefactions represent the trough of a longitudinal sound wave.
Example: After a compression, your vocal cords move back, causing rarefaction.

Proof: Sound waves need a medium for propagation

In a vacuum bell jar experiment :
A ringing bell is placed inside a glass jar. At first, the sound is heard because of the air inside. When the air is slowly pumped out (creating vacuum), the sound becomes fainter and finally disappears, even though the bell is still vibrating.
This proves that sound cannot travel in vacuum and needs a medium like air, liquid, or solid for propagation.

We can't hear sun blasts or any sound in space because space is a vacuum, and sound needs a medium (like air, water, or solid objects) to travel through.
Sound is a mechanical wave: It travels by vibrating particles.
In space there are almost no particles: The vacuum of space doesn't have enough atoms or molecules to carry these vibrations. *(IMPORTANT)*

SLO BASED QNA:-

Q1:What is a longitudinal wave?
Q2:In a longitudinal sound wave, what are compressions and rarefactions?
Q3:Why do we need a medium for sound to travel?
Q4:How does the density of a medium affect the speed of sound?
Q5:How the sound waves produce ?
Q6:Show that the sound produced through a vibrating.
Q7:Prove that sound waves need medium for propagation.
Q8:Why we can't hear blast occur in sun
Q9:Can sound travel through solids, liquids, and gases? Which is fastest?

LAST FOUR RED HIGHLIGHTED QUESTIONS ARE IMPORTANT

Diagram:-

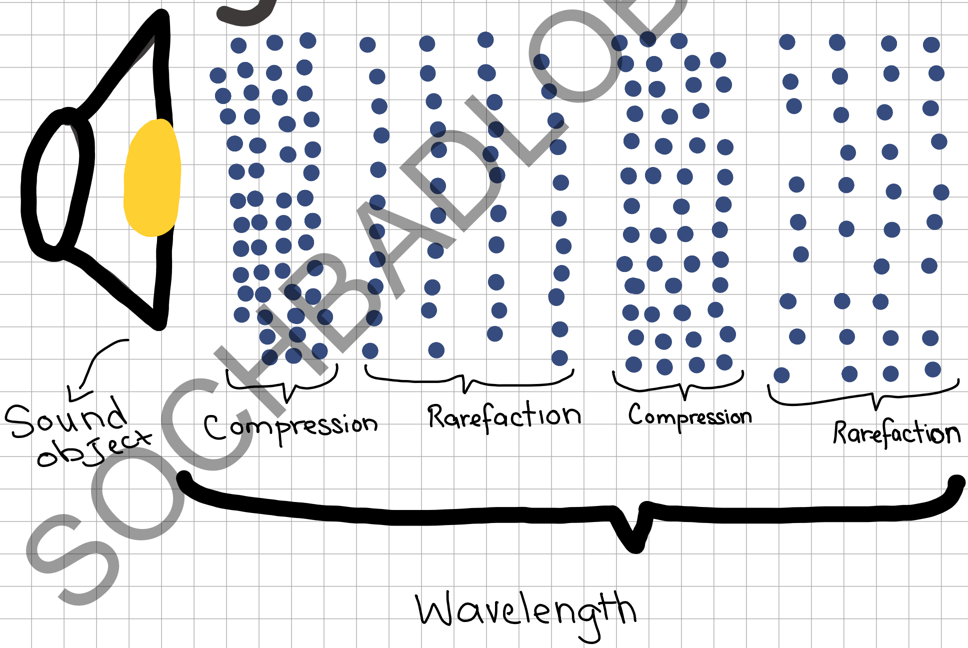


DIAGRAM OF SOUND WAVES

Compression:

High pressure region

Molecules have **low velocity**

Molecules are **closely packed**

They have **high density.**

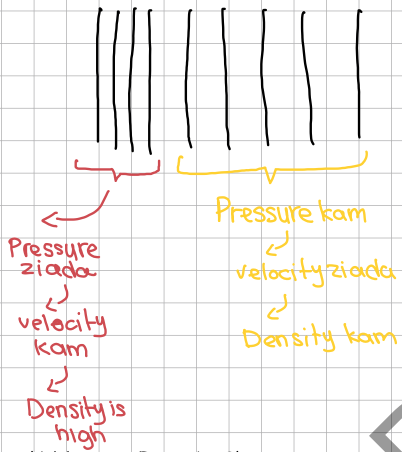
Rarefaction:

Low pressure

Molecules have **high velocity**

Molecules are **far apart**

They have **low density.**



$\therefore$ Pressure $\propto \dfrac{1}{\text{velocity}}$

Sound Wave as Density Changes

Sound is a **longitudinal wave**. It travels through air (or another medium) by pushing and pulling the particles.

Compression (High Density Region)

Particles are **pushed close together.**

Air molecules per unit volume are more than average.

This means **high density and high pressure.**

Analogy: Like a crowd at a concert when everyone pushes forward — packed tightly.

Rarefaction (Low Density Region)

Particles are **spread apart.**

Air molecules per unit volume are less than average.

This means **low density and low pressure.**

Analogy: Like a crowd leaving a stadium — lots of space between people.

1) Compression

High pressure due to molecules are close

Low velocity because prsssure is **inversely related**

It's density **is high**

2) Rarefaction

Low pressure due to molecules are close

High velocity because pressure is inversely related

High velocity because pressure is inversely related
It's density is low

Related terms to Sound Waves :-

Wavelength (λ):

The distance between two successive compressions or two successive rarefactions in a sound wave. It is measured in meters (m).

Frequency (f):

The number of sound wave cycles (compressions and rarefactions) produced in one second. It is measured in hertz (Hz). A higher frequency means a higher pitch.

Amplitude:

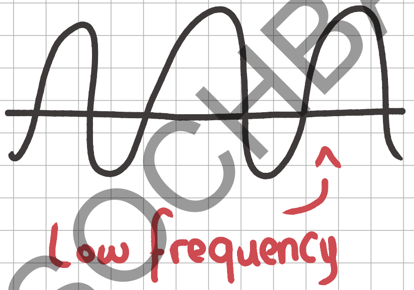
The maximum displacement of particles in the medium from their rest position. It is related to the loudness of the sound. A greater amplitude produces a louder sound.

Velocity (v):

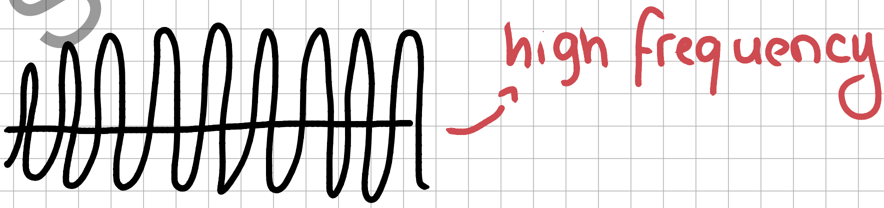
The speed at which a sound wave travels through a medium. It depends on the medium (e.g., faster in solids, slower in gases).

Formula:

$v = f \times \lambda$



FREQUENCY IS BASICLY THE NO. OF WAVES IN TIME TAKEN LIKE..IF THERE ARE MORE WAVES THE FREQUENCY IS HIGH AND IF THERE ARE LESS WAVES THAN FREQUENCY IS LOW



Types of Sound Waves:-

THERE ARE MANY TYPES OF SOUND WAVES...SOME PLEASENT AND SOME UNPLEASENT .THEY ARE CATAGRIZED BY THE FOLLOWING CATOGRIES..

Rhythmic Sound (Periodic Wave)

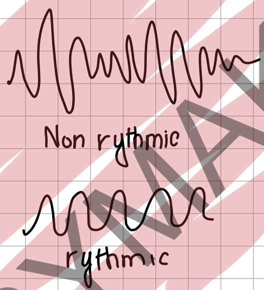
Wave repeats.

Frequency is steady (e.g., 2 beats per second).

Example: Music beat, clapping hands in rhythm.

Visual idea:

(tick tick tick... regular)



Non-Rhythmic Sound (Aperiodic Wave)

No clear pattern.

Frequencies keep jumping around.

Example: Random street noise, thunder.

Visual idea:

Easy Summary:

Rhythmic = Regular + Predictable

Non-Rhythmic = Random + Unpredictable

Audible Frequency Range:

Humans can typically hear sounds with frequencies between *20 Hz* (very low pitch) and *20 kHz* (very high pitch). Frequencies outside this range are generally inaudible to humans.

Ultrasound:-

PKMZ:

Ultrasound aisi sound hoti hai jiski frequency bohat high hoti hai (20,000 Hz se zyada). Iski waves choti hoti hain, is liye ye cheezon ke andar tak ja sakti hain (penetration zyada hoti hai). Medical aur animals dono use karte hain.

Ultrasound Waves: Explained

Ultrasound waves are sound waves with frequencies higher than 20,000 Hz (20 kHz)—beyond the upper limit of human hearing.

Basic Properties

Type: Mechanical, longitudinal waves

Medium Required: Yes — they need a medium (like air, water, or tissue) to travel; they cannot travel through a vacuum.

Speed: Depends on the medium. For example:

In air: ~343 m/s

In water: ~1,480 m/s

In soft tissue (human body): ~1,540 m/s

Uses of Ultrasound:

Medical Imaging - e.g., checking babies during pregnancy (ultrasonography).

Sonar & Navigation - used in submarines and ships to detect objects under water.

Cleaning - ultrasonic cleaners remove dirt from delicate items (jewelry, lenses).

Industry - checking cracks in metals, welding plastics, etc.

Animals - bats and dolphins use natural ultrasound for echolocation.

IN ULTRASOUND:

↑FREQUENCY=1/WAVELENGTH↓

WAVELENGTH OF ULTRASONIC WAVES IS LESS

SLO BASED QnA:-

Q1:What is ultrasound and what is its frequency range?

Q2:Why can't we hear ultrasound?

Q3:State two medical uses of ultrasound.

Q4:How is ultrasound used in SONAR?

Q5:Explain one industrial application of ultrasound.

SONAR:(IMPORTANT TOPIC)

SONAR (Sound Navigation and Ranging)

A technique that uses sound propagation (usually underwater) to navigate, communicate, or detect objects.

Types:

Active sonar: Emits sound pulses and listens for echoes (like echolocation).

Passive sonar: Just listens for sounds from other sources (e.g., submarines, marine life).

Used in:

Submarines and ships for navigation and detection

Fish finders

Oceanographic research

Marine biology

The sonar formula :

It typically used to calculate the distance to an object based on the time it takes for a sonar pulse (sound wave) to travel to the object and back

Sonar Distance Formula = v.t/2

Where:

v= speed of sound in the medium (e.g. water or air)

t= total time for the pulse to go to the object and return (echo time)

The division by 2 accounts for the round trip (there and back)

Working Principle

1. A ship/submarine sends a sound pulse into water.
2. The sound travels, hits an object, and echoes back
3. The time taken is measured, and distance is calculated.

Infrasonic -

Infrasonic Sounds - Explanation

Infrasonic sounds are sound waves that have a frequency lower than 20 Hz — below the range of human hearing.

While we can't hear them, many animals (like elephants and whales) use these low-frequency sounds to communicate over long distances.

Infrasonic waves can also be produced by natural events such as earthquakes, volcanic eruptions, and tsunamis. Because they travel long distances through the ground or air,

Properties

>Low frequency (< 20 Hz)

>Long wavelength

>Can travel very long distances without losing much energy

Sources of Infrasound

> Volcanoes

> Earthquakes

> Ocean waves

> Explosions

>Animals (elephants use infrasound to communicate over kilometers!)

Uses of Infrasound

>Detecting earthquakes & volcanic eruptions (early warning)

> Military detection of explosions & nuclear tests

> Studying animal communication

> Research on natural disasters

Fun Fact:

Whales and elephants "talk" in infrasound, sometimes across hundreds of kilometers!

How Animals Use Infrasonic Waves to Communicate:

1. Elephants

Frequency Range: ~5 to 20 Hz

Purpose:

Long-distance communication (up to 10 km or more)

Coordinating movement of herds

Warning about predators

Mating calls

How: Specialized vocal cords generate low-frequency rumbles, often transmitted through air and ground.

2. Whales (especially Blue and Fin Whales)

Frequency Range: As low as 10 Hz

Purpose:

Navigation and communication across hundreds of kilometers in oceans

Social interaction and mating

How: Infrasound travels exceptionally well through water, helping whales keep in contact across ocean basins.

3. Giraffes (less known, under research)

Produce low-frequency hums at night, possibly for social bonding or group coordination.

4. Alligators and Crocodiles

Use infrasound during mating season to attract mates and intimidate rivals.

SLO BASED QnA:-

Q1:What is SONAR and how does it work?

Q2:What are the main types of SONAR systems used in marine applications?

Q3:How is SONAR used in underwater exploration and navigation?

Q4:Can humans hear infrasonic sounds? Why or why not?

Q5:Which animals use infrasonic sounds to communicate over long distances?

Q6:How do elephants use infrasonic sounds to stay in touch with other herd members?

Pitch:-

Definition: Pitch is the characteristic of sound by which we distinguish between shrill (high) and deep (low) sounds.

Depends on Frequency of the sound wave.
High frequency → High pitch (shrill sound)
Low frequency → Low pitch (deep sound)

Examples:
Women and children → High pitch (because of shorter, thinner vocal cords).
Men → Low pitch (because of longer, thicker vocal cords).

Funny Story on Pitch (by PKMZ):-

Sir's friend is 6 feet tall, but his voice is soft and girly. One day, sir didn't go to college and was sleeping. Suddenly, sir's friend called, but sir's dad picked up the phone. As soon as sir's friend started talking, his high-pitched voice confused sir's dad. He thought some girl was calling! Later, when sir woke up, he had to explain the whole situation. Everyone laughed about it afterwards.

♪ Pitch Explanation

Pitch = how "high" or "low" a sound seems.
Depends on the frequency of the sound wave.
Higher frequency → higher pitch (like sir's friend's voice).
Lower frequency → lower pitch (like typical male voices).

RELATION BETWEEN PITCH AND FREQUENCY:

Pitch and frequency are closely related in sound. Frequency refers to the number of vibrations per second of a sound wave, measured in hertz (Hz). Pitch is how high or low a sound seems to our ears. As the frequency increases, the pitch becomes higher; as the frequency decreases, the pitch becomes lower. So, pitch is the human perception of a sound's frequency

Why are the voices of women and children shriller than men?

IMPORTANT QUESTION FOR BOARD!!!

Answer:
1. The pitch of a sound depends on its frequency.
2. Women and children have shorter and thinner vocal cords.
3. Shorter and thinner vocal cords vibrate faster.
4. Faster vibrations produce sound waves of higher frequency.
5. Higher frequency sound has a shriller pitch.
6. Men have longer and thicker voc

Loudness:-

Definition:

Loudness is the characteristic of sound that helps us distinguish between loud and faint sounds.

It is not a physical quantity, so it cannot be measured directly.

Loudness depends on the amplitude of the sound wave and is studied in terms of decibels (dB).

Concept:

Loudness is directly proportional to the amplitude of the sound wave:

Loudness $\propto$ Amplitude

High amplitude = Loud sound

Low amplitude = Faint sound

Factors Affecting Loudness:

A. Vibrational Amplitude of Source

Greater amplitude of vibration → higher loudness

B. Surface Area of Source

Larger surface area → more sound energy → higher loudness

C. Distance from Source

Shorter distance → greater perceived loudness

Longer distance → fainter sound

D. Sensitivity of listeners ears

• more sensitive ears→ more effect of loudness

Seismic activity:-

Definition: seismic wave produced during an earthquake.

They are transverse waves, meaning particles move perpendicular to the direction the wave is traveling.

Movement: Causes the ground to shake side-to-side or up-and-down.

Wave Type: Transverse - similar to a wave on a rope.

Travel Through: Can move only through solids — not through liquids or gases.

Energy Transfer: Transfers energy by making rock particles oscillate at right angles to the wave's path.

Speed:

Travels at a moderate speed through Earth's interior — faster than surface waves but not the fastest seismic wave overall.

TYPE OF WAVE:ARE SEISMIC WAVES ULTRASOUND OR INFRASOUND???

Earthquake is basically the sudden movement of tectonic plates of earth which causes tremor of earth crust and it produces infrasound before the main shock wave begins during this process there is a sudden release of seismic waves that makes the ground shake and these seismic waves are classed as infrasound waves.

SLO BASED QUESTIONS :-

What is the difference between loudness and pitch?
Which physical factor determines the pitch of a sound?
What is the unit used to measure loudness?
What are seismic waves and how are they generated?
Which instrument is used to detect and record seismic activity?

IMPORTANT QUESTIONS!!!

Timbre:

TIMBER:

Timbre refers to the unique "tone color" or "sound quality" that distinguishes one musical instrument or voice from another, even when playing the same note at the same volume

Examples of Timbre:

1. *Guitar vs. Piano*: Different tone colors, distinct sound quality
2. *Human voices*: Unique timbre for each person's voice
3. *Brass vs. Strings*: Distinct sound quality in musical instruments
4. *Drums vs. Flute*: Different timbres, characteristic sounds

Overtone:-

Overtones:

Overtones are additional frequencies that resonate alongside the main frequency (fundamental frequency) of a sound. They add complexity and character to the sound, giving it a unique tone or timbre.:

👉 The first sound is called the fundemental(main sound)

👉 The sounds produced above it are called overtones.

Daily Life Example:

When you pluck a guitar string 🎸, you hear the main note (fundamental) plus other faint higher sounds (overtones) that make the music sweet.

1. Fundamental Frequency (1st Harmonic):

|----()----|

👉 One loop (half wave) between two fixed ends.

2. First Overtone (2nd Harmonic):
I---O---O---I
👉 Two loops (one complete wave).
3. Second Overtone (3rd Harmonic):
I---O---O---O---I
👉 Three loops (1.5 waves).

SLO BASED QNA:-

How does the sound quality effect wave formation (IMPORTANT FOR BOARDS!!)
What are the main factors that affect the timbre of a sound?
How does an oscilloscope help us understand sound waves?
What is the difference between a fundamental frequency and an overtone?
How does the human brain recognize a piano sound instead of noise?

SPEED OF SOUND:-

Definition of Speed of Sound:
The speed of sound is the rate at which a sound wave travels through a medium. It depends on the properties of the medium such as its density, elasticity, and temperature. It is typically measured in meters per second (m/s).
In simple terms, it is how fast the vibration (sound energy) moves from one particle to another in a substance.

Example:
In air at 20°C, the speed of sound is approximately 343 m/s.
In water, it's about 1,480 m/s.
In steel, it can reach around 5,000 m/s.

FACTORS EFFECTING SPEED OF SOUND:

1. Medium
The type of medium sound travels through (solid, liquid, gas) significantly affects its speed.
Solids: Sound travels fastest in solids because particles are tightly packed, allowing vibrations to transfer more efficiently.
Liquids: Slower than in solids, but faster than in gases.
Gases: Sound travels slowest in gases due to larger distances between particles.

2. Temperature
In gases, increasing the temperature increases the speed of sound.
Warmer temperatures give particles more energy, causing them to move faster and transmit sound quicker.

3. Density

Generally, a denser medium slows down sound because heavier particles resist motion more.

However, in gases, both density and temperature affect speed. If two gases are at the same temperature, sound travels faster in the lighter one (lower molecular weight).

4. Elasticity

Elasticity is how easily a material returns to its original shape after being disturbed. Materials with higher elasticity (like steel) allow sound to travel faster because they restore shape quickly, passing the vibration along more efficiently.

5. Humidity (in air)

In air, higher humidity increases the speed of sound.

Water vapor is lighter than dry air, so moist air has a lower average molecular mass, allowing sound to travel faster.

Noise:

Noise is an unwanted or unpleasant sound that is irregular, harsh, and has no fixed pattern.

✓ Example:

Students shouting in class

Loud traffic on the road

👉 Difference from sound:

Normal sound can be pleasant (like music 🎵), but noise is disturbing.

In a thunderstorm, why do we see the lightning first and hear the thunder later?

Answer:

Because the speed of light (3×10^8 m/s) is much greater than the speed of sound (343 m/s) in air, the light from lightning reaches our eyes almost instantly, while sound takes more time to travel, so we hear thunder later.

SLO BASED QNA -

1. Arrange solids, liquids, and gases in order of increasing speed of sound and give a reason.
2. How does temperature affect the speed of sound in air?
3. Why does sound travel faster in humid air than in dry air?
4. In which medium does sound travel the fastest and why?

Reflection:-

Reflection of Sound

Definition: When sound waves strike a surface (e.g., wall, building) and bounce back, it is called reflection.

Example: Echo - when sound reflects off a distant surface and returns to the listener after a short delay.

Conditions for Echo:

Surface should be hard and smooth.

Minimum distance between source and reflecting surface ≈ 17 meters (for normal conditions)

Refraction:-

Refraction of Sound Waves

Refraction means the bending or change in direction of a wave when it passes from one medium (or condition) into another where the wave speed is different.

For sound waves, this usually happens because the speed of sound depends on temperature, pressure, and medium (air, water, solid).

Diffraction:-

Diffraction

Diffraction is a phenomenon in physics where waves (like light or sound) bend around obstacles or spread out after passing through openings.

Examples of Diffraction

- Light through a slit: Light waves diffract when passing through a narrow slit.
- Sound around corners: Sound waves diffract around obstacles, letting you hear sounds from around corners.

SLO BASED QNA:-

What is the principle behind the working of an echo?

Give one practical use of reflection of sound.

Why are sound-reflecting surfaces used in auditoriums?

Why does sound sometimes bend upwards in the daytime and downwards at night?

What happens to sound when it passes from warm air to cool air?

Give one real-life example of refraction of sound.

Why can we hear sound around a corner but not see the source?

ECHO:-

Definition:

- Echo is the repetition of sound caused by reflection of sound waves from a distant obstacle (wall, building, etc.).

Conditions for Echo:

Obstacle must be at least 17 m away

2. Reflected sound should reach the ear after 0.1 s
3. Surface must be large, hard, smooth

Formula:d = (v × t) / 2

- d = minimum distance
- v = speed of sound (≈ 340 m/s)
- t = 0.1 s

d = (340 × 0.1) / 2 = *17 m*

Examples:

- Echo in mountains
- Echo in empty halls/buildings
- Used in SONAR & RADAR
- Medical ultrasound imaging

An echo can be heard if the reflecting surface is at least about 17 meters away from the listener. This is based on how our ears and brain perceive sound.

✓

Here's why 17 meters is significant:

The human brain can only distinguish a reflected sound (an echo) as separate from the original sound if the delay is at least ~0.1 seconds (100 milliseconds).

Sound travels at about 343 meters per second (in normal air at 20°C).

REVERBATION:-

REVERBERATION;

is the phenomenon of overlapping of sound caused by multiple reflections.

Condition;

Where distance between source and surface is lesser than 17m. More than 17m distance, it'll be echo, not reverberation.

Example;

When talking in an empty room, your sound reflects back to you multiple times. This is called reverberation.

Reverberation means

When distance is less than 17 , and the sound waves are bounced back

Echo means

When distance is equal to or greater than 17 , and the sound waves are bounced back .

DIFFERNCE BETWEEN ECHO AND REVERBATION:

Echo is a distinct reflection of sound, often heard as a repeated sound, whereas reverberation is the propagation of sound due to multiple reflections.

>>Echoes are typically heard after a delay, while reverberation is a continuous effect.

>> Echoes can be heard as separate sounds, whereas reverberation is a blending of sounds.

>>Reverberation adds ambiance to a space, while echoes can be distracting.

Applications of Echo;

1. *Sonar Technology*: Echoes are used in sonar (Sound Navigation and Ranging) to detect and locate objects underwater, such as submarines, ships, and marine life.
2. *Medical Imaging*: Echoes are used in medical imaging techniques like ultrasound to create images of internal organs and tissues.
3. *Radar Technology*: Echoes are used in radar systems to detect and track objects, such as aircraft and weather patterns.
4. *Distance Measurement*: Echoes can be used to measure distances, such as in echo-sounding devices.
5. *Navigation*: Echoes are used in navigation systems, such as in robotics and autonomous vehicles.
6. *Seismic Exploration*: Echoes are used in seismic exploration to study the Earth's subsurface structure.
7. *Animal Navigation*: Some animals, like bats and dolphins, use echoes to navigate and locate prey.

SLO BASED QNA:-

SLO BASED QUESTIONS:

What is an echo?

How is echo used in medicine?

Which animals use echo for navigation?

How is echo applied in technology or machines?

DERIVE THE FORMULA OF ECHO?

LAST QUESTION IS IMPORTANT!!!

Acoustic protection:-

Acoustic Protection:

Acoustic protection refers to measures taken to reduce or prevent the transmission of sound waves, often to protect people or environments from excessive noise.

Types of Acoustic Protection:
1. Soundproofing: Materials and techniques used to absorb or block sound.
2. Noise reduction: Methods to decrease sound levels, such as using silencers or mufflers.
3. Personal protective equipment (PPE): Earplugs, earmuffs, or other devices worn to protect individuals from loud sounds.
Applications:
1. Industrial settings: Protecting workers from machinery noise.
2. Construction sites: Reducing noise exposure for workers and nearby communities.
3. Recording studios: Soundproofing to achieve high-quality audio recordings.
4. Residential areas: Noise reduction measures to improve living environments.
Benefits:
1. Hearing protection: Preventing noise-induced hearing loss.
2. Improved concentration: Reducing distractions caused by excessive noise.
3. Enhanced quality of life: Creating more comfortable living and working environments.
Main Points:

1. Reduces or prevents sound wave transmission.
2. Protects people and environments from excessive noise.
3. Includes soundproofing, noise reduction, and personal protective equipment (PPE).

Soundproofing (Building/Environmental) IMPORTANT!!
Used to block or reduce sound transmission between spaces.

- Mass-loaded vinyl (MLV): Dense barrier material for walls or ceilings.
- Acoustic panels: Absorb sound to reduce echo and reverberation.
- Double-glazed windows: Minimize outside noise penetration.
- Door seals and weatherstripping: Seal gaps that sound can travel through.
- Floating floors and resilient channels: Help isolate structure-borne noise.

SLO BASED QNA.

1. What is meant by acoustic protection?
2. Why is acoustic protection important in workplaces?
3. How does prolonged exposure to loud noise affect human hearing?
4. What is the difference between sound insulation and sound absorption?
5. Why are materials like foam and fiberglass used for acoustic protection?

HUMAN EAR:-

This topic is not that important for boards as its basic and related to biology but do not skip it at least read it thrice

Working Principle (Step-by-Step):

Sound waves → Enter ear → Vibrate eardrum

Vibrations → Amplified by ossicles

Vibrations → Travel to cochlea

Cochlea → Converts to electrical impulses

Impulses → Sent to brain via auditory nerve

Brain → Perceives sound

SLO BASED QNA -

1. What are the three main parts of the human ear?
2. What is the role of the cochlea in hearing?
3. Which part of the ear vibrates when sound waves enter?

End!