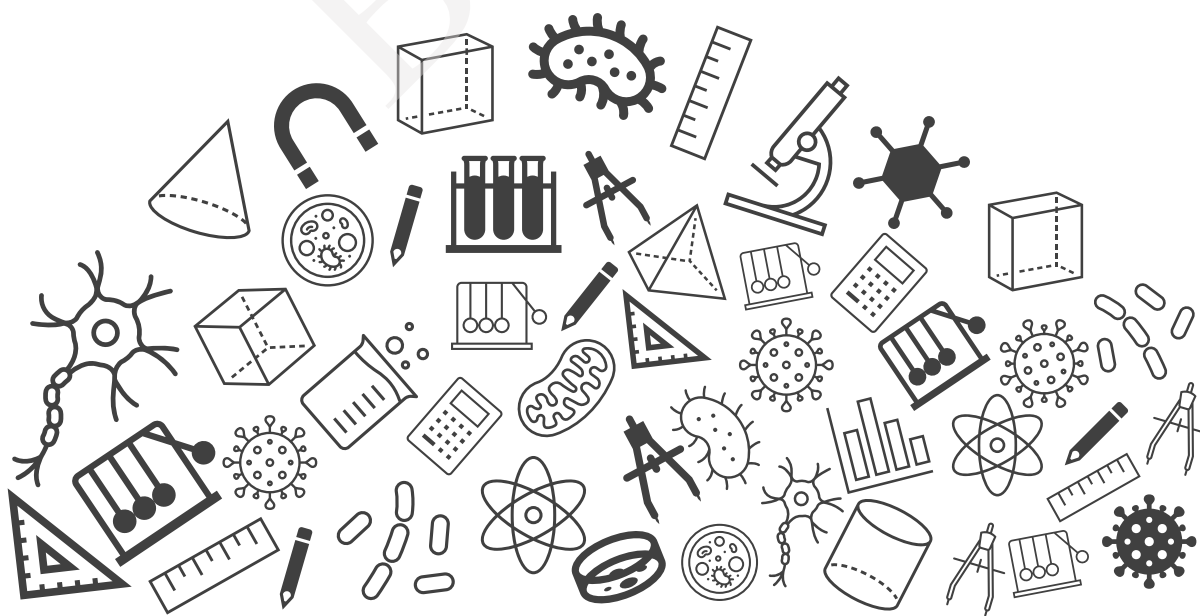




Grade 09

Science Chapter Notes



Chapter Notes



 **BYJU'S**
Classes
Sound

Class 9

Contents

B



1) Introduction to mechanical waves

- Transverse wave
- Longitudinal wave



2) Sound as a wave

- Propagation of sound
- Characteristics of a sound wave



3) Reflection of sound waves

- Echo
- Reverberation
- Uses of multiple reflections of sound



4) Human Ear

- Structure of human ear

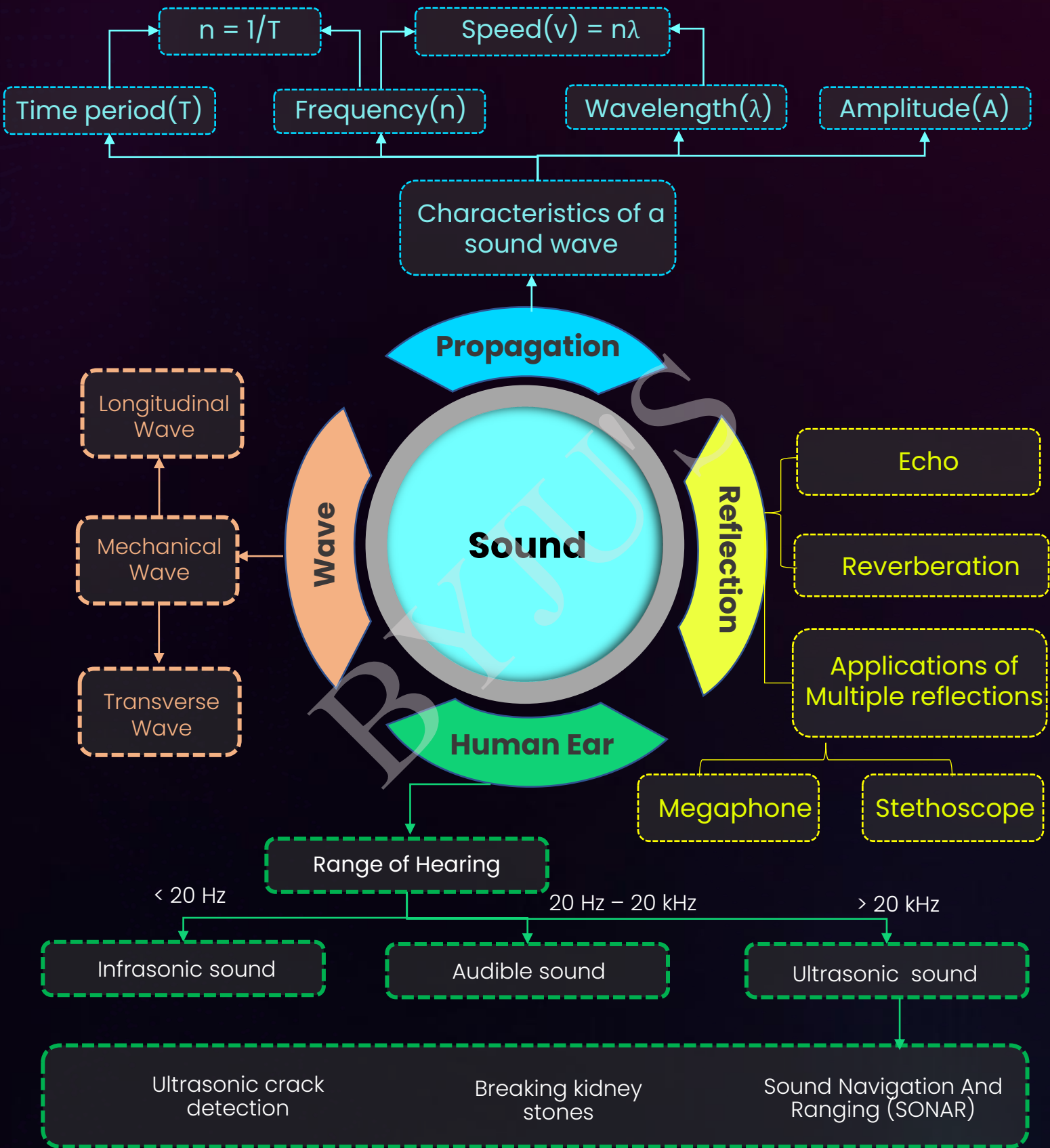


5) Range of Hearing

- Classification
- Applications of Ultrasound



MIND MAP

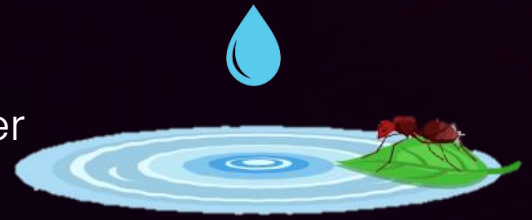


1. Introduction to Waves

B

Wave:

- A wave is a **disturbance in a medium** which moves from one point to another and carries energy without a net movement of particles.

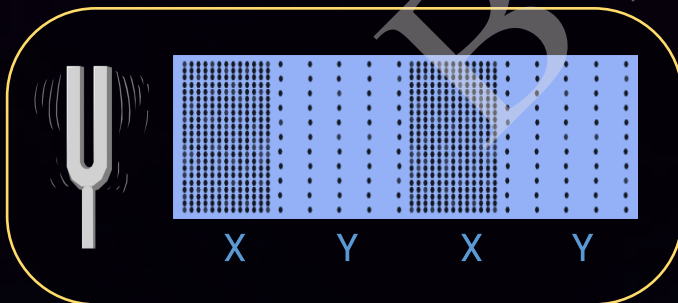


1.1 Mechanical Wave

- A mechanical wave is a wave that is an oscillation of matter and is responsible for the **transfer of energy through a medium**.

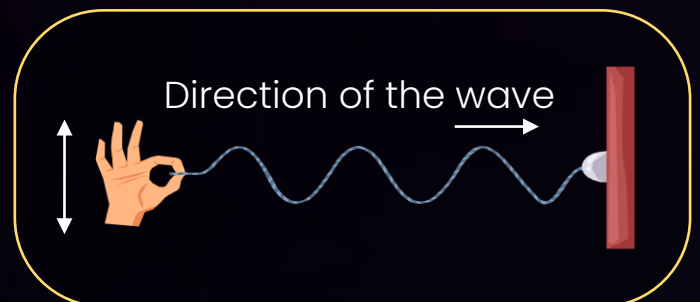
Types

a. Longitudinal Wave



- Particles vibrate in a direction **parallel to the direction of motion** of the wave.
- Contains **compressions and rarefactions**.

b. Transverse Wave



- Particles vibrate in a direction **perpendicular to the direction of motion** of the wave.
- Contains **crests and troughs**.

2. Sound as a wave

B

2.1 Propagation of Sound

- Sound is produced by **vibrating** objects.
- Sound requires a **medium** to be propagated.
- Sound travels **longitudinally** in liquids and gases.
 - In air, sound propagates in the form of compressions and rarefactions.

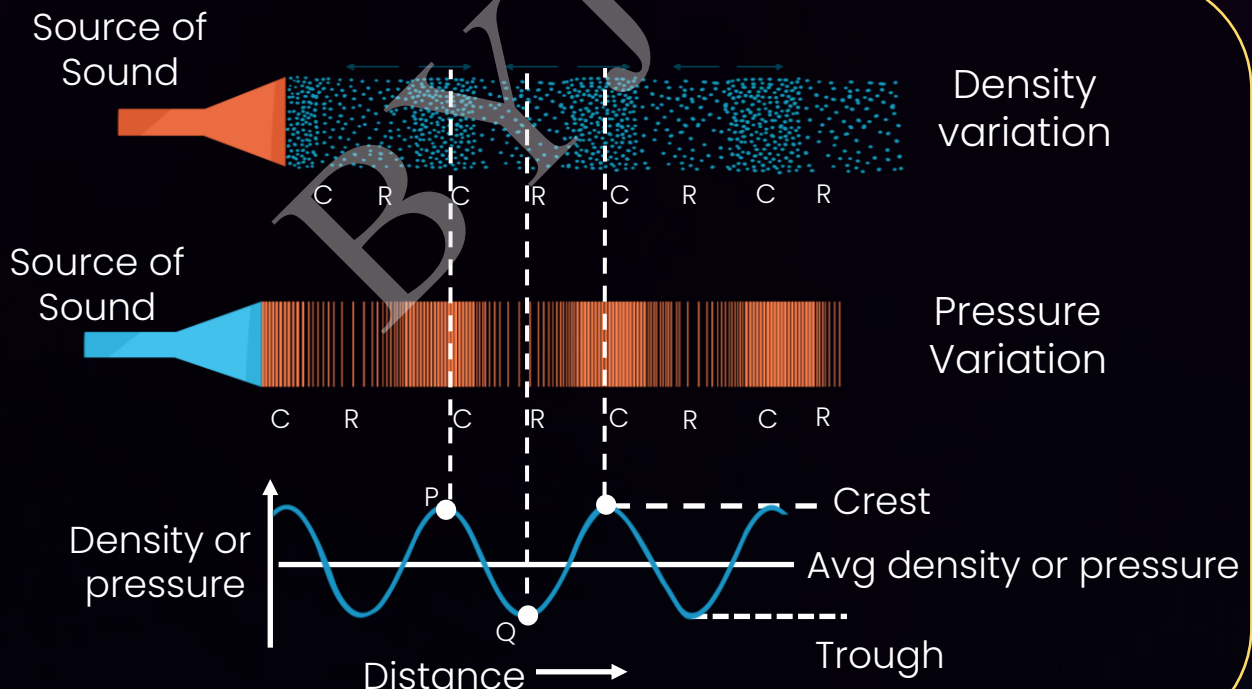


Compression

- Region of high pressure and high density.

Rarefaction

- Region of low pressure and low density.



Special Note:

- Sound waves are **longitudinal waves in fluids**.
- Through **solids**, sound can travel both as **longitudinal and transverse waves**.



2.2 Characteristics of Sound

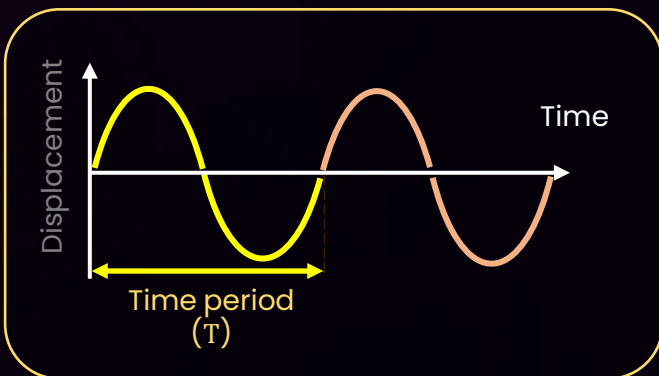
B

a. Time period

- Time taken to complete one oscillation.
- SI Unit – second (s)

b. Frequency

- Number of oscillations per second.
- $n = \frac{1}{\text{Time Period}}$
- SI Unit – hertz (Hz)



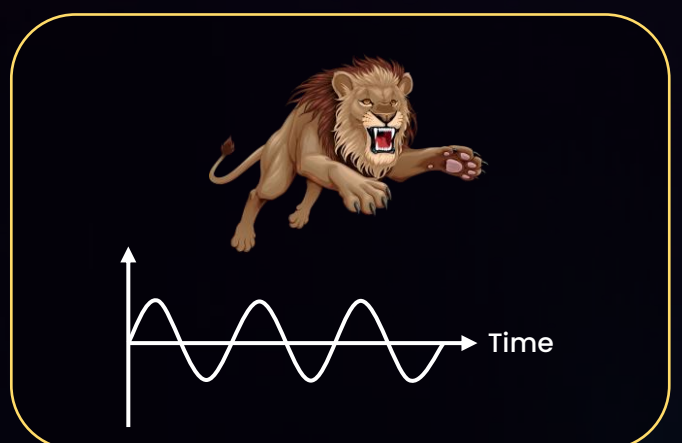
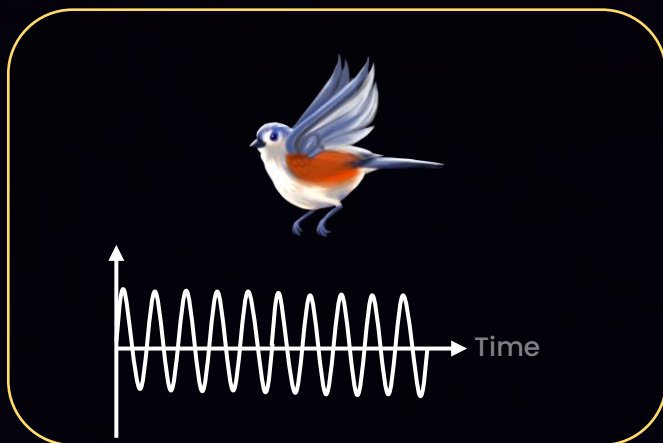
c. Pitch

- Pitch is the **shrillness or acuteness of sound**.
- Pitch depends on frequency.



High-pitch

Low-pitch

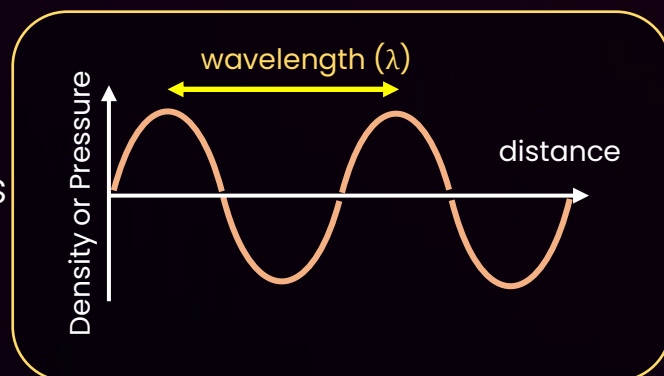


- Higher frequency – Higher pitch

- Lower frequency – Lower pitch

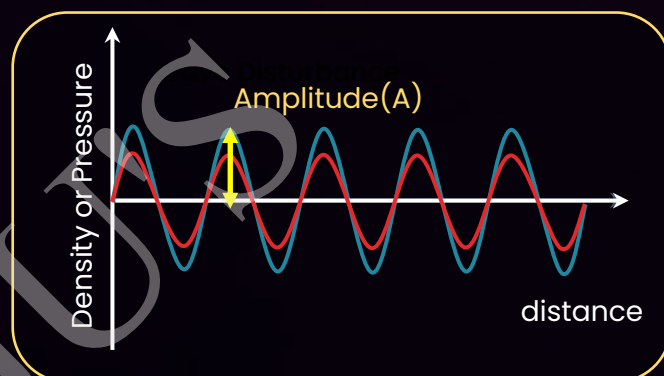
d. Wavelength

- The **distance between two successive crests or troughs** (or) successive compressions and rarefactions is called as wavelength (λ).



e. Amplitude

- It is the **maximum displacement** or distance moved by a particle from its mean position on either side.
- It is the **Distance between mean position and crest or trough**.



f. Speed of sound

- Sound travels through different media with different speeds.
- It depends on the properties of the medium: pressure, density and temperature
- Speed of sound:

Solids > Liquids > Gases

- Speed of the sound wave is the product of the wavelength and the frequency of the waveform.
- Speed = wavelength x frequency

$$v = f \times \lambda$$

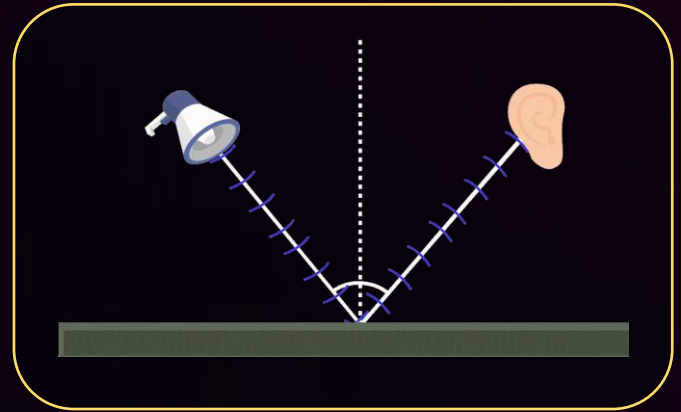
Medium	Speed
Air	344 m/s
Water	1530 m/s
Iron	5130 m/s

3. Reflection of Sound

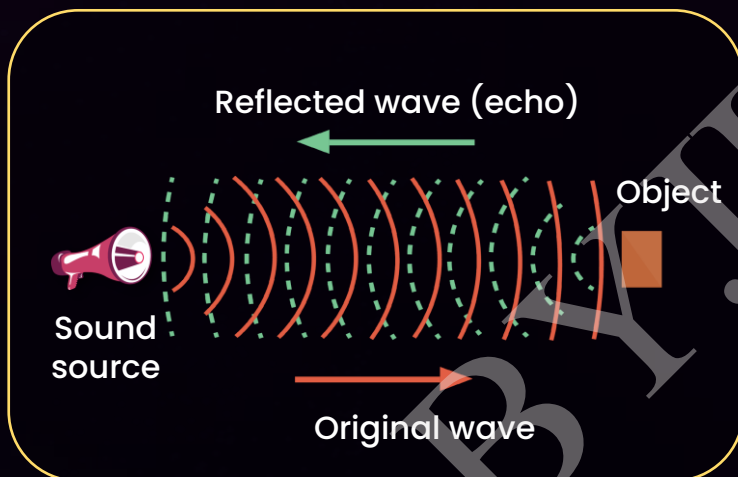
B

• Sound Reflects Just Like Light:

1. The incident wave, reflected wave, and the normal at the point of incidence lie in the same plane.
2. The angle of incidence and angle of reflection are equal.



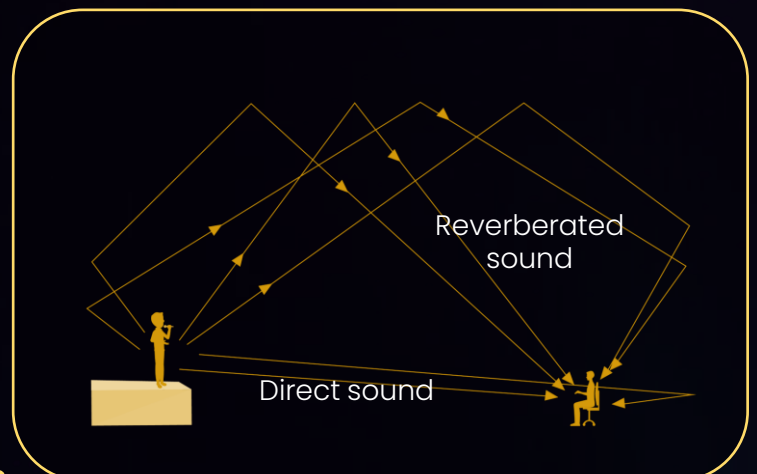
3.1 Echo



- Repetition of sound due to **reflection of sound waves**.
- Time interval between the original sound and the reflected sound is **at least 0.1 s**.

3.2 Reverberation

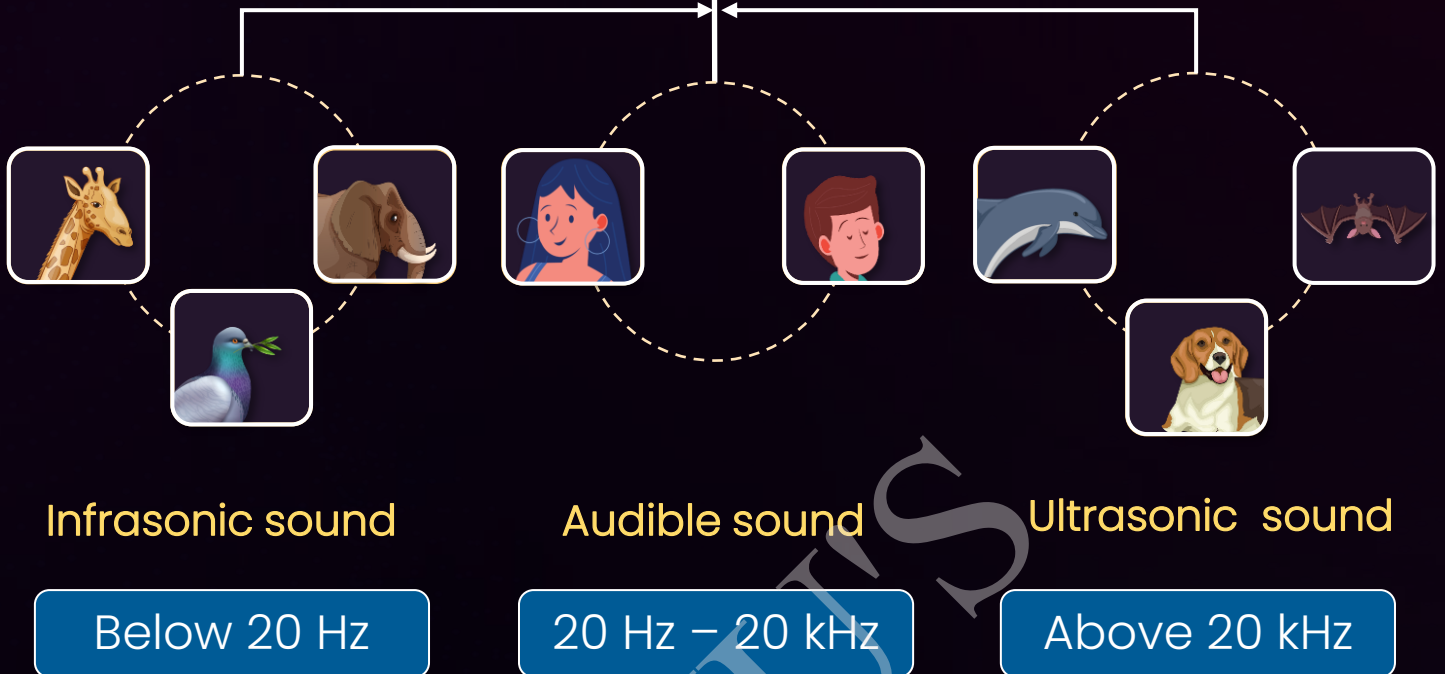
- Created by the **superposition of echoes**.
- It is the **Persistence of sound** because of multiple reflections
- Reflected sound reaches the listener in **less than 0.1 s** after the direct sound.



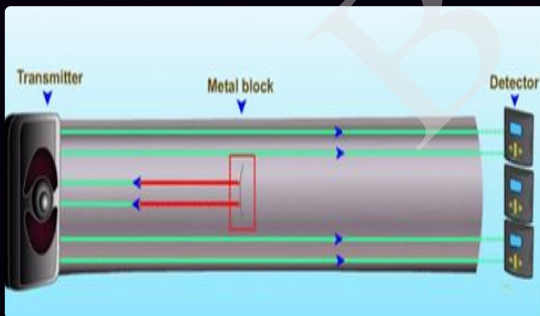
5. Range of Hearing

B

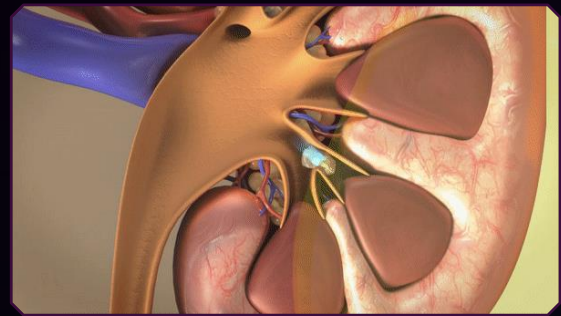
5.1 Classification



5.2 Applications of Ultrasound in Everyday Life



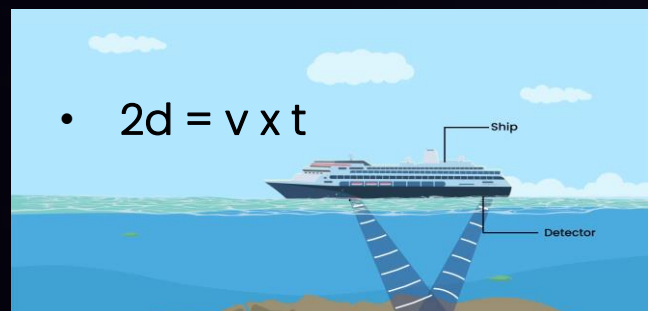
Ultrasonic crack detection



Breaking kidney stones



Ultrasonography



$$\bullet \quad 2d = v \times t$$

Sound Navigation And Ranging (SONAR)