SOUND

Sound :

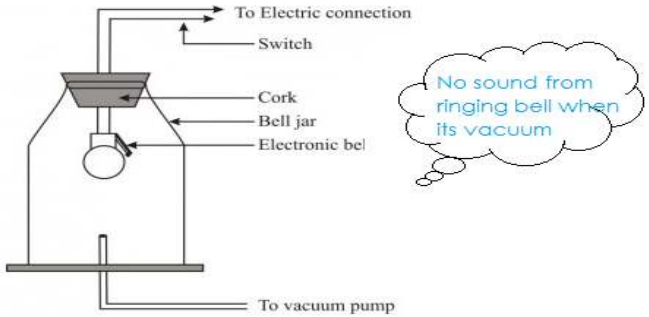
- Form of energy that produces the sensation of hearing in our ears .

Necessary condition to produce sound :

- Vibration of particles of the medium

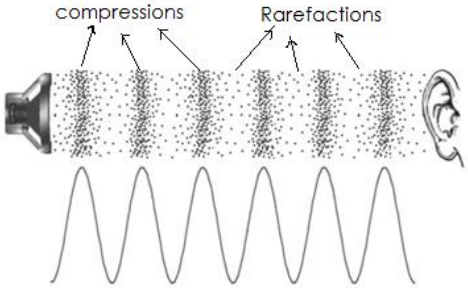
Propagation of sound :

- Sound needs a medium to propagate



Bell jar experiment showing sound cannot travel in vacuum

- Sound can propagate through solids, liquids and gas.
- Propagation of sound through air



- Sound propagates in all directions

Speed of Sound :

Speed of sound = $\frac{Distance\ travelled\ by\ the\ sound}{Time\ taken}$

Sound travels fastest in solids , slower in liquids and slowest in gases.
Speed in air = 332 m/s
Speed in water = 1440 m/s
Speed in iron = 5000 m/s

Types of sound :

Music	Noise
It is pleasant, smooth and acceptable to the ear	It is harsh, discordant and non-acceptable to the ear
It is produced by the vibrations which are periodic	It is produced by an irregular succession of disturbances
All the component waves are similar without any sudden change in their wavelength and amplitude	The component waves change their character suddenly and they are of short duration
The sound level is low (between 10 dB to 30 dB)	The sound level is high (above 120 dB)
The wave form is regular	The wave form is irregular
Example: the sound produced by musical instruments	*Example*: the sound produced by an aeroplane, road roller, etc.

Sources of Sound :

- Turning fork

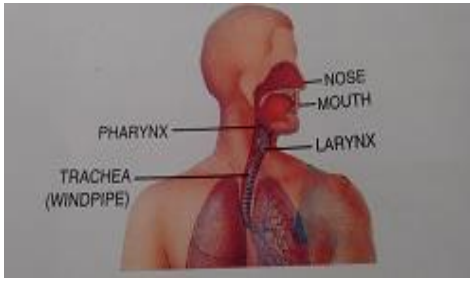
- Musical instruments
  - Stringed instruments

  - Percussion instruments

  - Wind instruments

  - Reed instruments

- Human Sound :



Voice box – Larynx –produce voice.

Reflection of Sound :

Persistence of hearing: the characteristic property of human ear due to which it cannot distinguish between the original and reflected sound, if it reaches the ear within 0.1 second.

Echo :

The sound heard after reflection from a distant obstacle (such as cliff, a hillside, etc.) after the original sound has ceased, is called an echo

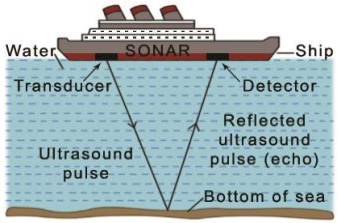
Conditions for formation of an echo

- the reflected sound to reach the person **at least 0.1 second after the original sound** is heard
  - $\boldsymbol{t = \frac{2d}{V} \rightarrow d = \frac{Vt}{2}}$
  - d is the distance between the observer and the obstacle
  - V is the speed of sound
  - t is the time taken for the sound to reach the observer after reflection
- Putting the values t = 0.1 s and V = 332 m/s, we get

***d* = 16.6 m** which is the **minimum distance** between the observer and the obstacle required to hear the echo distinctly

Reverberation : - Multiple echoes

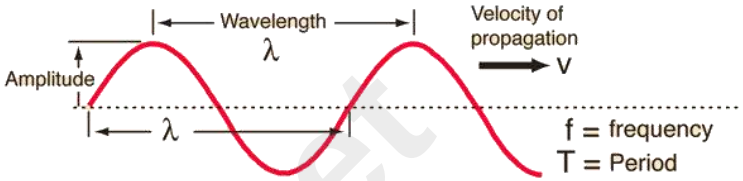
Application of Echo: SONAR



- To determine depth of sea
- By ships to detect submarines
- By bats and dolphins to locate any obstacle in their path

Unit of Sound :- Decibel

Terms Related to Wave motion :



Oscillation	To and fro motion when one full wave is constituted
Amplitude	The maximum displacement of the wave on either side of its mean position
Time period	Time taken to complete one oscillation. Measured in second.
Frequency(f)	Number of wave passing through a point in a second. Measured in hertz. $f = \frac{1}{T}$ 1 Hz = 1cycle/second.
Wavelength(λ)	Distance between two crests or troughs

Characteristics of sound :