

SOUND

(A) Reflection of Sound & Echo

I. General recap

How does sound propagate?

Audible, Infra - Ultrasonic range

Terms

amplitude (A)

Time period (T)

frequency (f)

Wavelength (λ)

Wave velocity $v = f\lambda$

• Sound waves

Longitudinal

Transverse

• Sound waves vs light waves.

II. Reflection of Sound waves

- Laws of reflection in sound
- Requirements for reflection of sound.
- Uses/application of reflection of sound.

III. Echo

- Definition.
- Conditions required for echo.
- Finding speed of sound using echo.
- Applications of echo.
- Numericals.

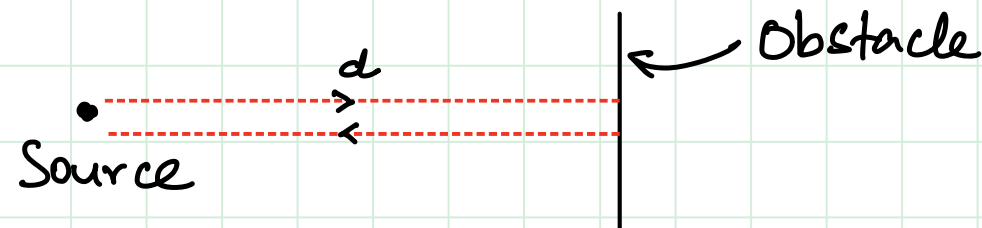
III. Echo - Sound heard after reflection from a distant obstacle after the original sound has ceased is called an Echo.

• Conditions for hearing an echo

Reflected sound must reach observer 0.1s after original sound.

(Reason: Sensation of sound persists for about 0.1s)

$$v = \frac{2d}{t}$$



$$d = \frac{vt}{2} = \frac{340 \text{ m s}^{-1} \times 0.1 \text{ s}}{2} = 17 \text{ m}$$

∴ To be able to hear an echo distinctly, the obstacle must be at a minimum of 17m (in air)

- Under sea water where $v = 1400 \text{ m s}^{-1}$, obstacle must be at least 70m away.

Reverberation :

When obstacle is at a distance less than 17m, the original sound & echo get mixed. If this occurs for several times, the effect is termed reverberation.

Summary

To hear a distinct echo,

- 1.) Obstacle must be at least at a distance of
 - a) 17m in air
 - b) 70m in sea water.
- 2.) Size of reflector must be large enough compared to wave length of sound.
- 3.) Intensity of reflected sound must be loud enough.

(C) Characteristics of sound and their nature

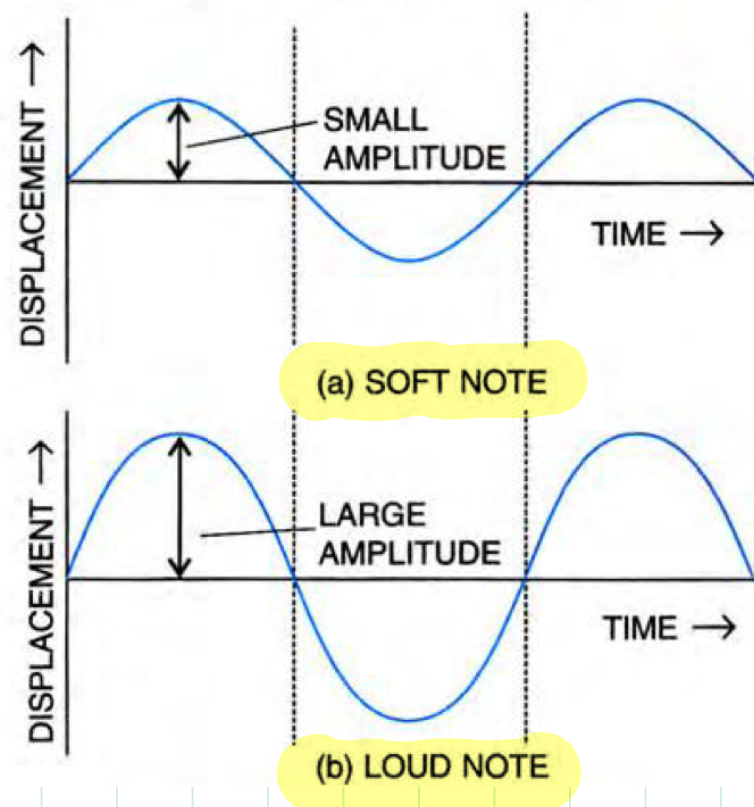
Sound has 3 characteristics :

1. Loudness
2. pitch (or shrillness)
3. quality (or timbre)



A Cathode ray oscilloscope can display a sound wave when attached to a microphone which converts sound energy to electrical input.

1. Loudness and Intensity



Loudness

Is the characteristic by virtue of which a loud sound can be distinguished from a faint one, both having the same pitch and quality.

- Greater is the loudness, more is the amplitude.
- Loudness depends on (i) Sound intensity
(ii) ear sensitivity.
- Loudness is subjective since it depends on the ear sensitivity.
- Unit of loudness is **phon**