

EC5461 AVE

Audio fundamentals

Course outcome.

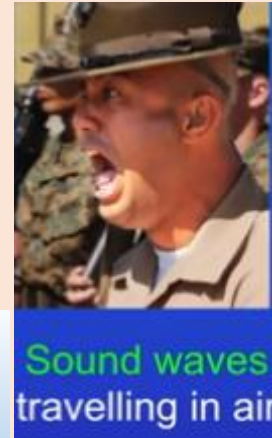
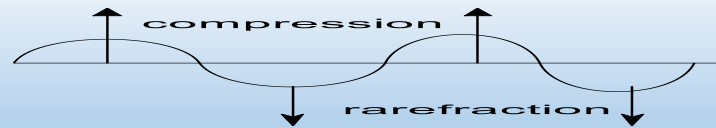
Troubleshoot different types of microphones and speakers

Learning points -- Sound characteristics

Prof –J S RATALE

Sound

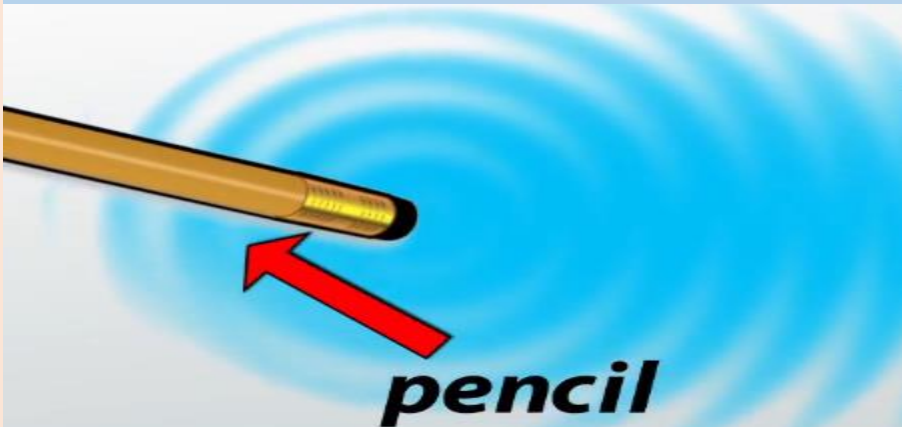
Definition - Sound is **longitudinal wave** motion, consists of train of **positive** and **negative** peaks travelling in a **medium like air**



Sound propagate in a medium in the form of compression and rarefaction

Why sound wave are longitudinal

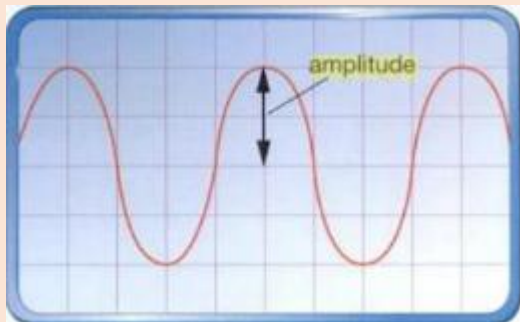
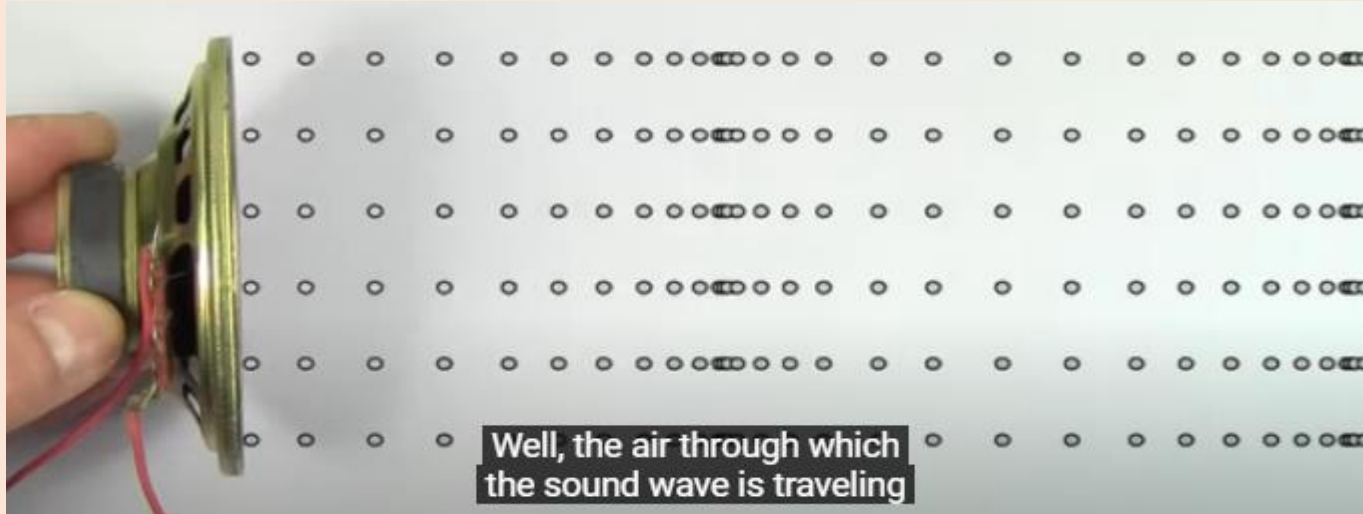
Longitudinal Waves: A wave in which the particles of the medium vibrate back and forth in the 'same direction' in which the wave is moving. Medium can be solid, liquid or gases. Therefore, sound waves are longitudinal waves.



Vibration of sound wave are parallel to or along the direction of wave travel.

A way to visualize a wave is to insert pencil into Into pot of water , then surface of water disturb and producing A wave

Sound characteristics are , amplitude, frequency , phase
wavelength



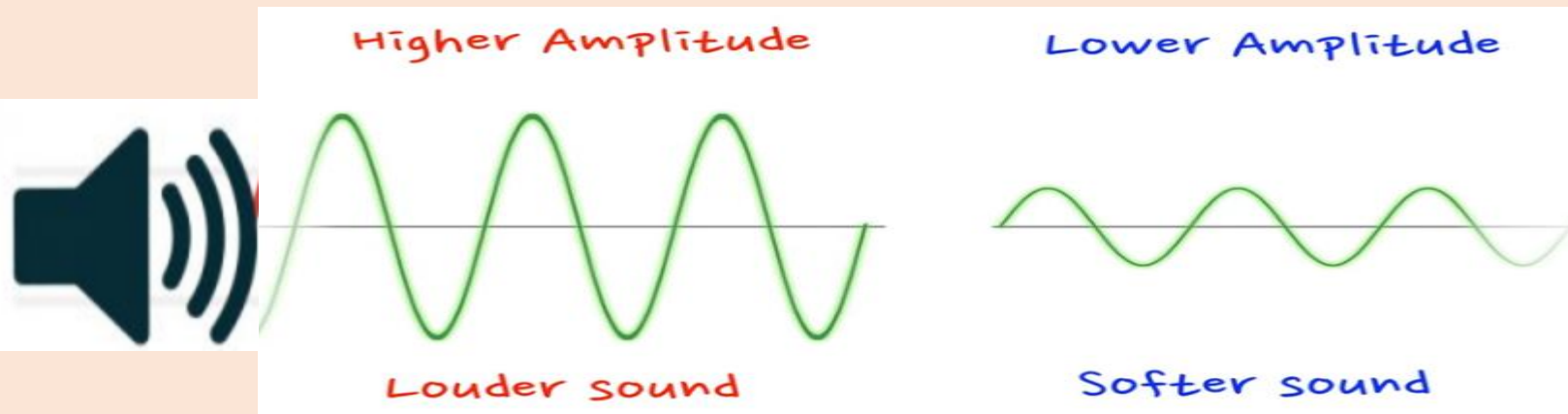
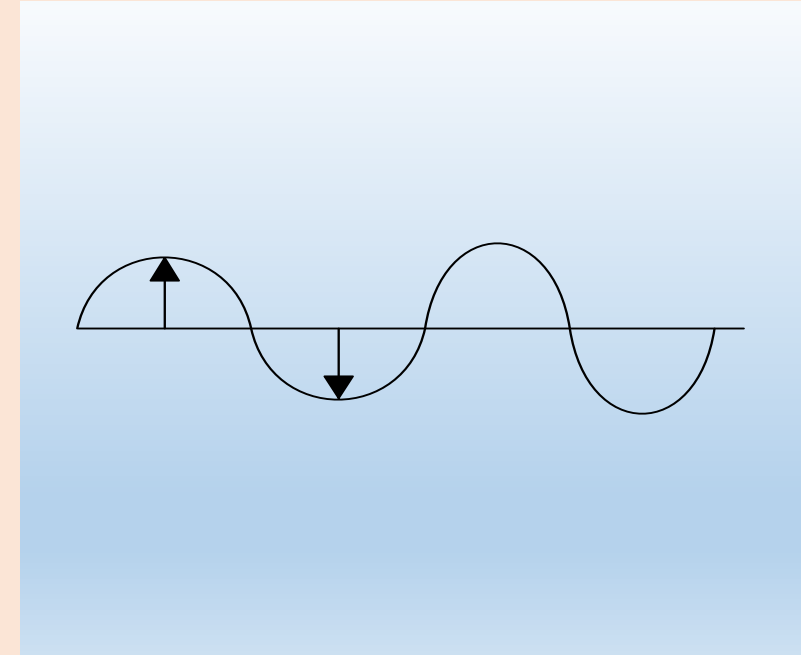
Amplitude

it is the height of peaks of sound wave.

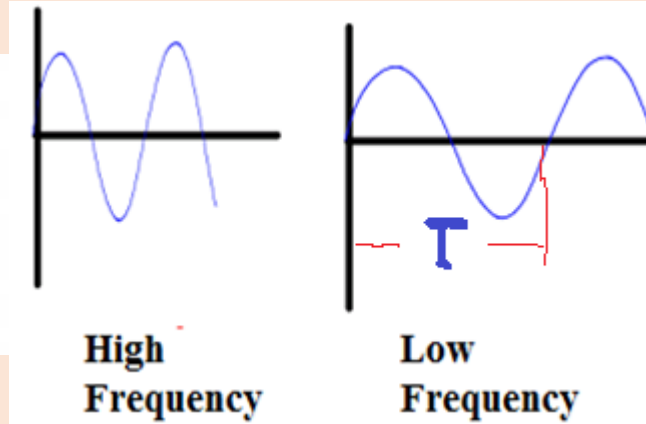
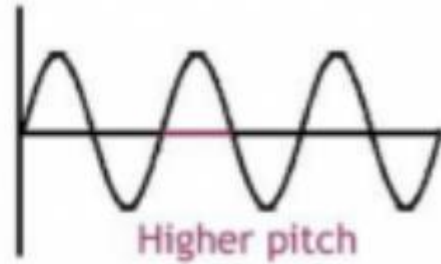
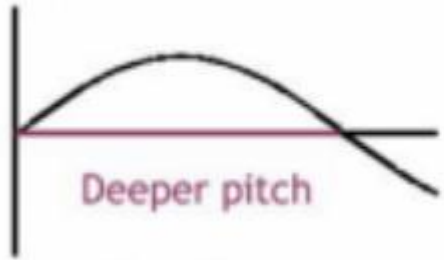
High sound means high amplitude. More energy, sound louder.

Amplitude is the size of the vibration, and this determines how loud the sound is & amount of energy associated with sound.

amplitude is measured in meters .

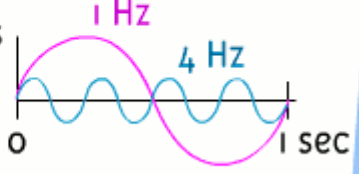


Frequency “f”



The frequency of a sound is the number of waves (or cycles) that pass a point in a certain amount of time.

$$\text{Hertz (Hz)} = \frac{\text{cycles}}{\text{second}}$$



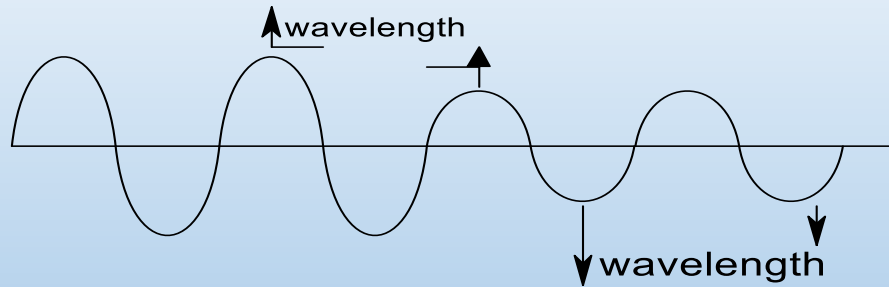
A diagram showing a wave with a horizontal baseline. A pink arc marks one full cycle of the wave, labeled "1 Hz". A blue arc marks four full cycles of the wave, labeled "4 Hz". The time axis is marked with "0" and "1 sec".

1. $F = 1/t$ (where t refers time period of one cycle of wave).

Number of cycle present in one sec
it is measured in hertz (Hz).

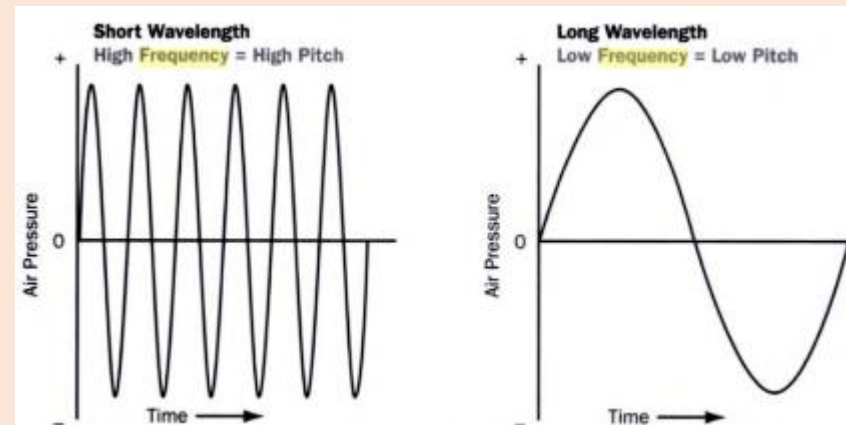
If sound signal frequency increase then pitch is higher
A higher frequency sound is called as a higher note,
like a flute or violin playing

Wavelength



$$\lambda = v_c / f$$

Inversve relation
between F and λ



it's the distance between two nearest peak in a wave ,which r in same phase
It is denoted by a Greek letter λ (lambda)
wavelength is metre (m).

What is the relationship between Velocity, Frequency and Wavelength of a Wave?

Velocity – distance travelled in one second of the sound wave.

The velocity of Sound = Frequency * Wavelength

$$v = f \times \lambda$$

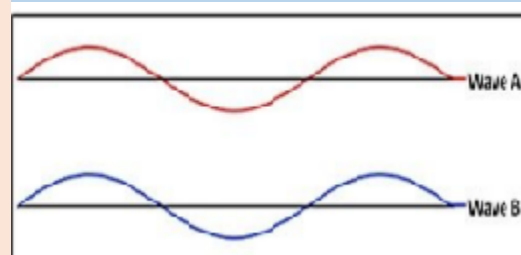
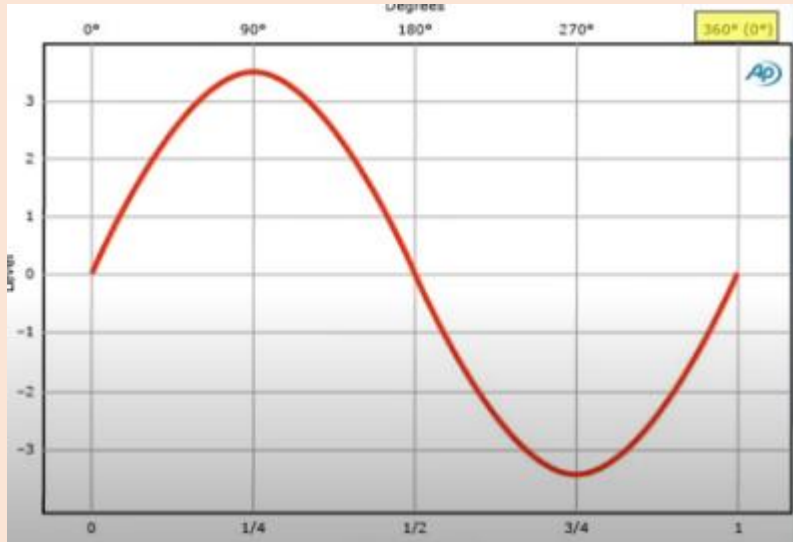
Where v = velocity of the wave

f = frequency

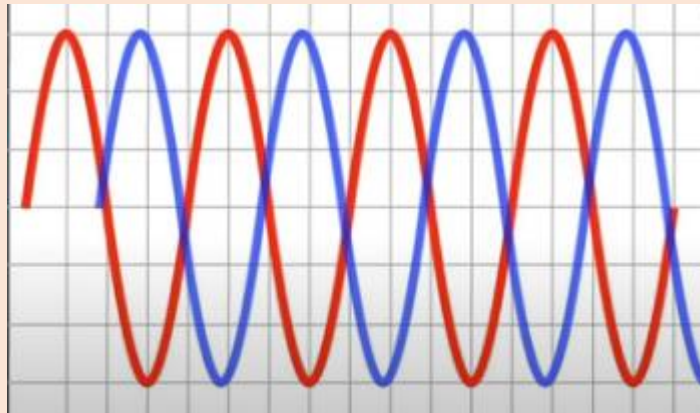
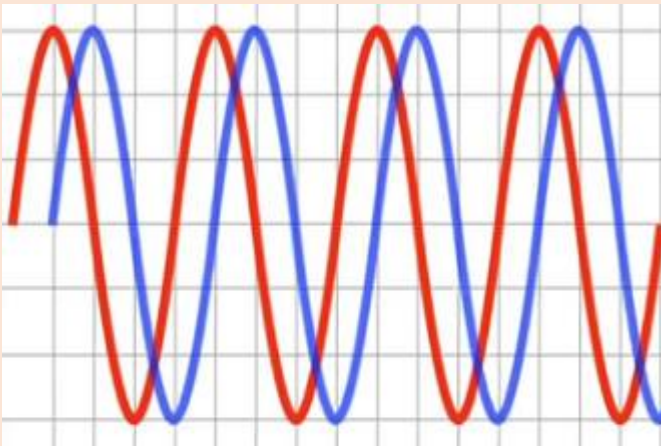
λ = wavelength

Phase

it indicates state of motion of wave.
Phase can be measured in
distance, time, or degrees

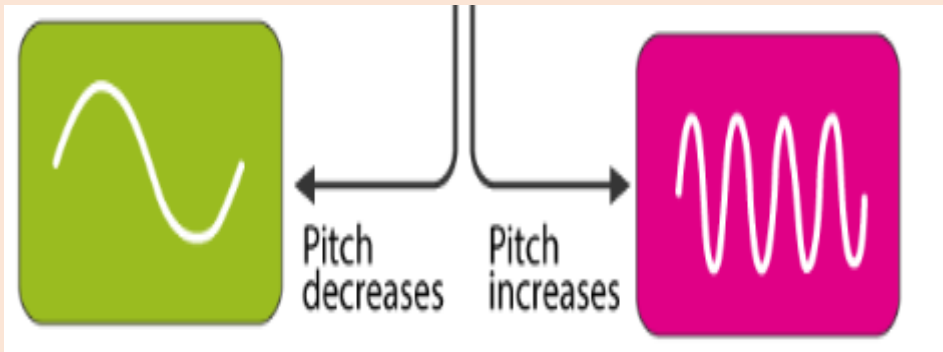


Each point of the horizontal axis the two wave
Have 45 and 90 phase difference.



Pitch

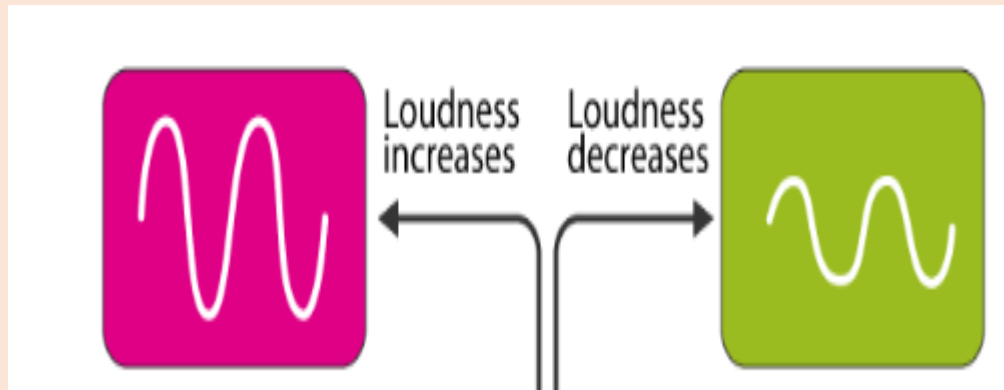
pitch is determine by frequency of sound wave, standard
pitch is a sound of 440 Hz/ frequency of musical notes
tuning all music instruments to 440 Hz(432 to 435 and 440)



Loudness

it depend upon sound wave amplitude , if amplitude is higher the sound is louder.

It also determined by the intensity of sound wave
It can measure in decibel scale db.

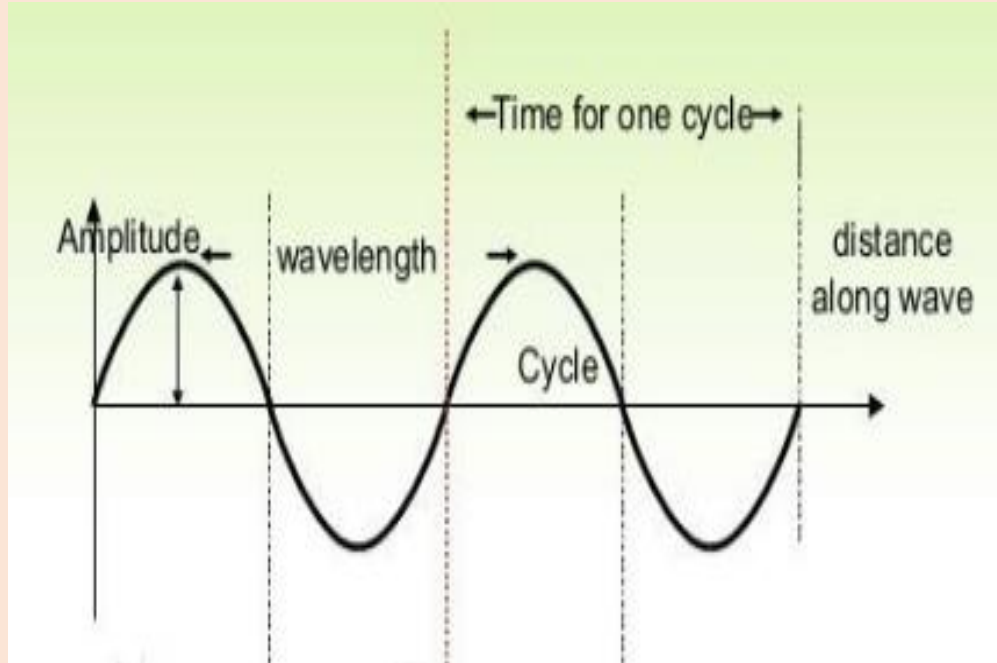


Sensitivity – our ears are sensitive to sound intensity. It decreases with age for high frequencies.

Selectivity – it is the action in which people focus their attention on specific sources of sound

Fidelity – fidelity of sound is the way it reproduces the accurate copy of the original sound. Or faithful reproduction of sound (Hi-Fi)

Review



Frequency, period, wavelength, and speed

The following symbols are commonly used:

c = speed

λ = wavelength

f = frequency

T = period

f is defined as $f = 1/T$

For sinusoidal waves we have:

$c = f \lambda$ and by the definition of f we have $c = \lambda/T$.



1. Humans can hear sound at frequency from 20 to 20kHz.

What about animals-----

2. How we measure sound level --- using sound level meter.

Practice test question

Where the sound required .

List the speed of sound travels in air.

Which equipment convert sound wave to electrical signal. .

Calculate the frequency of sound that has wavelength Of 0.50m

It is need to convert sound wave in to digital signal

List the property of sound wave.

A wave has frequency 20 Hz and wavelength 200 meters.
Find the speed of the wave.

How sound wave is measure using Mic and CRO.

Which devise reproduces sound.

https://books.google.co.in/books?id=1FWWfcwzc5oC&pg=PA405&dq=sound+wave+amplitude+and+frequency&hl=en&sa=X&ved=0ahUKEwiltK7swu_pAhUGbn0KHW9sC_c4HhDoAQhXMAU#v=onepage&q=sound%20wave%20amplitude%20and%20frequency&f=false

PROPERTIES OF SOUND WAVES

The properties of sound waves can be summed up as follows.

- (i) Sound waves are *longitudinal waves*.
- (ii) Sound travels through *all states of matter*.
- (iii) The velocity of sound is *maximum* in solids and *least* in gases.
- (iv) Sounds which can be heard by human beings are known as *audible sounds*. Their frequency range is from 20 to 20,000 Hz.
- (v) Sounds of frequencies greater than 20,000 Hz are called *ultrasonic sounds*. Ultrasonic sounds can be received and emitted by bats.
- (vi) Sounds of frequencies less than 20 Hz are called *infrasonic sounds*. Infrasonic sounds can be received by snakes.
- (vii) Sound waves can be *reflected*. In the phenomenon of reflection, the speed, frequency and wavelength of the sound waves do not change.
- (viii) Sound waves can be *refracted*. In the phenomenon of refraction, the frequency of the sound waves does not change but their velocity and wavelength change.
- (ix) Sound waves exhibit the phenomenon of *diffraction*.
- (xi) The *normal level* of sound is 60 dB to 120 dB.
- (xii) Sound waves cannot travel through *vacuum*.