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BRAIN MAP Waves

- Speed of transverse wave, v =
- Speed of transverse wave on a stretched string, __

 $v \sqrt{\frac{T}{T}}$

Principle of Superposition: When any number of waves meet simultaneously at a point in a medium, the net displacement at a given time is the algebraic sum of the displacement due to each wave at that time.

Beats: The phenomenon of alternate variation in the intensity of sound with time at a particular position, when two sound waves of nearly same frequencies and amplitudes superimpose on each other.

Beat frequency = number of beats per second = difference in frequency.

Transverse Wave : Individual particles of the medium execute simple harmonic motion about their mean position in a direction perpendicular to the direction of propagation of wave motion.

Wave Motion : It is a means of transferring energy and momentum from one point to another without any actual transportation of matter between these points.

Longitudinal Wave: Individual particles of the medium execute simple harmonic motion about their mean position along the same direction along which the wave is propagating.

Standing Waves : When two sets of progressive wave trains of the same type traveling in same straight line in opposite direction superimpose, standing waves are formed.

Nodes: Points where amplitude of vibration is zero.

Antinodes : Points where amplitude of vibration is maximum.

On String

- The wavelength of n^{th} mode of vibration of a stretched string is $\lambda_n = \frac{2L}{n}$
- and its frequency is

The fundamental frequency of vibration of a

stretched string $v_1 = \frac{1}{2L} \sqrt{\frac{T}{u}}$

Organ pipe closed at one end: Frequency of n^{th} normal mode of vibration,

n = (2n-1)The frequency of fundamental mode is

 $\frac{v}{4L_C}$

Organ pipe open at both ends: Frequency of n^{th} normal mode of vibration

The frequency of fundamental mode is

 $\frac{v}{2L_{O}}$

 $Sound\ waves\ are\ longitudinal\ mechanical\ waves.$

• Speed of sound wave in solids

$$v = \sqrt{\frac{Y}{}}$$

Speed of sound wave in fluid,

$$v = \sqrt{\frac{B}{}}$$

• Speed of sound wave in gas,

$$v \sqrt{\frac{P}{}}$$

Equation of plane progressive waves travelling with a velocity v along positive direction of x-axis is

$$y = a\sin(kx + t)$$

where (kx - t +) is the phase.

Doppler Effect : According to this effect, whenever there is a relative motion between a source of sound and listener, the apparent frequency of sound heard by the listener is different from the actual frequency of sound emitted by the source. Apparent frequency, $v' = \frac{(v \pm v_L) \, v}{v_L - v_L}$

where is the actual frequency of sound emitted. The upper sign on v_S (or v_L) is used when source (listener) moves towards the listener (source) while lower sign is used when it moves away.

Symbols Used

a = amplitude of wave

 v_I = velocity of listener

 μ = linear mass density

= density

L =length of the string

v =velocity of sound

Y = Young's modulus

B = Bulk modulus

 v_1 = fundamental frequency

 γ = ratio of specific heats

 L_C = length of the closed pipe

 L_O = length of the open pipe

 v_s = velocity of source

T = tension in the string

P = pressure