

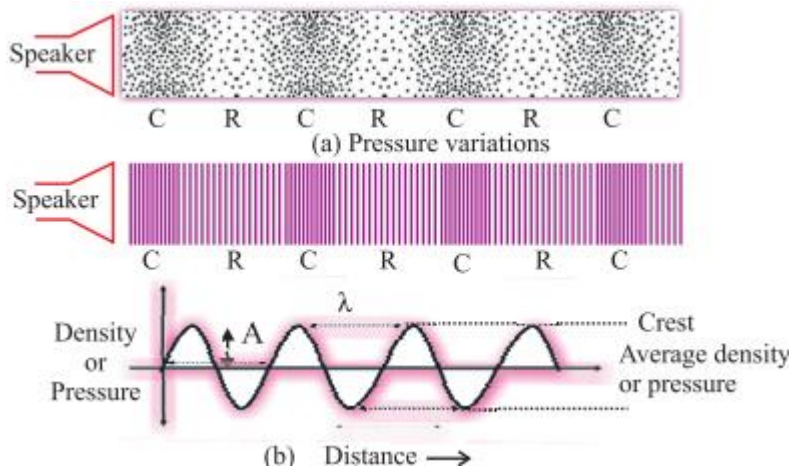
# Sound (Continuation)

(Read, learn and note down on any available copy)

## Characteristics of Sound Wave

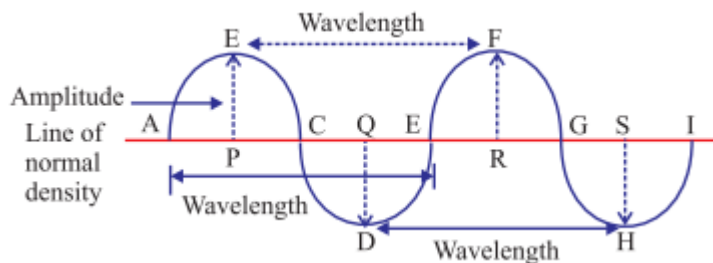
The characteristics of sound waves are : wavelength, frequency, amplitude, time period and velocity

- When a wave travel in air the density and pressure of air changes from their mean position.
- Compression is shown by crest while rarefaction is shown by trough.
- Compression is the region of maximum density or pressure.
- Rarefaction is the region of minimum density or pressure



### (i) Wavelength :

- In sound waves the combined length of a compression and an adjacent rarefaction is called its wavelength.
- The distance between the centres of two consecutive compressions or two consecutive rarefactions is also called its wavelength.
- It is denoted by the Greek letter lamda  $\lambda$ . Its SI unit is metre.



### (ii) Frequency :

- (a) No. of complete waves produced in one second or number of vibrations per second is called frequency.

(b) Number of compressions or rarefactions passed in one second is also frequency.

- Frequency of wave is same as the frequency of the vibrating body which produces the wave.
- The SI unit of frequency is hertz (Hz). The symbol of frequency is  $\nu$  (nu).
- 1 Hertz : One Hz is equal to 1 vibration per second.
- Bigger unit of frequency is kilohertz kHz = 1000 Hz.

### (iii) Time Period :

(a) Time taken to complete one vibration is called time period.

(b) Time required to pass two consecutive compressions or rarefactions through a point is called time period.

- SI unit of time period is second (s). Time period is denoted by T.
- The frequency of a wave is the reciprocal of the time period.

$$\nu = \frac{1}{T}$$

### (iv) Amplitude :

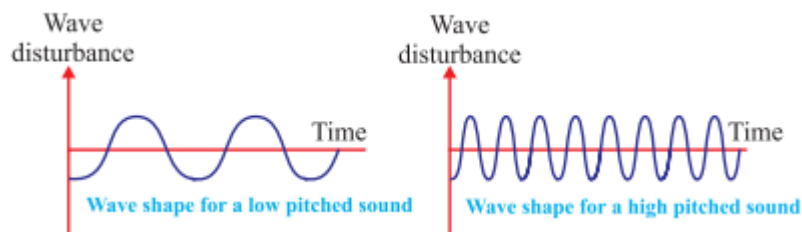
The maximum displacement of the particle of the medium from their original undisturbed position is called amplitude of the wave.

- Amplitude is denoted by A and its SI unit is metre (m).

**Sound have characteristics like pitch and loudness and timbre.**

**Pitch :** The pitch of sound depends on the frequency of sound (vibration). It is directly proportional to its frequency. Greater the frequency, higher is the pitch and lesser the frequency, lower is the pitch

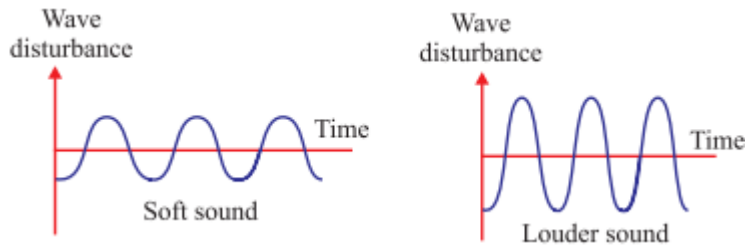
- A woman's voice is shrill having a high pitch while a man's voice is flat having low pitch.
- High pitch sound has large number of compressions and rarefactions passing a fixed point per unit time.



**Loudness :** The loudness depends on the amplitude of the sound wave.

- Loudness is the measure of the sound energy reaching the ear per sec.

- Greater the amplitude of sound wave, greater is the energy, louder the sound; short is the amplitude, less is the energy, soft is the sound.
- Loudness is measured in decibel 'dB'.



**Quality or Timbre** : The timbre of a sound depends on the shape of sound wave produced by it. It is the characteristic of musical sound.

- It helps us to distinguish between two sounds of same pitch & loudness.
- Sound of single (same) frequency is called tone while a mixture of different frequencies is called note.

Noise is unpleasant to hear while music is pleasant to hear and it is of good quality.

### (v) Velocity :

The distance travelled by a wave in one second is called velocity of the wave. Its SI unit is metre per second (ms<sup>-1</sup>).

$$\text{Velocity} = \frac{\text{Distance Travelled}}{\text{Time Taken}}$$

$$V = \frac{\lambda}{T}$$

( $\lambda$  is the wavelength of the waves travelled in one time period T)

$$V = \lambda v \left( \frac{1}{T} = v \right)$$

So, Velocity = Wavelength  $\times$  Frequency

This is the wave equation

### Q. Answer the following

1. Define wavelength. What is its S.I unit?
2. On what factors does quality of sound depend?
3. Which wave property determines loudness and pitch?
4. What are frequency, time period and amplitude of a sound wave?
5. How are wavelength and frequency of a sound wave related to its speed?
6. Distinguish between Note & Tone.
7. Represent graphically :

- (a) Low pitched sound
- (b) High pitched sound
- (c) Soft sound
- (d) Loud sound

8. Calculate the wavelength of a sound wave whose frequency is 220Hz and speed is 440m/s in a given medium.
9. The frequency of a source of sound is 100Hz. How many times does it vibrate in a minute?
10. A sound wave has a frequency of 2KHz and wavelength 35cm. How long will it take to travel 1.5km ?

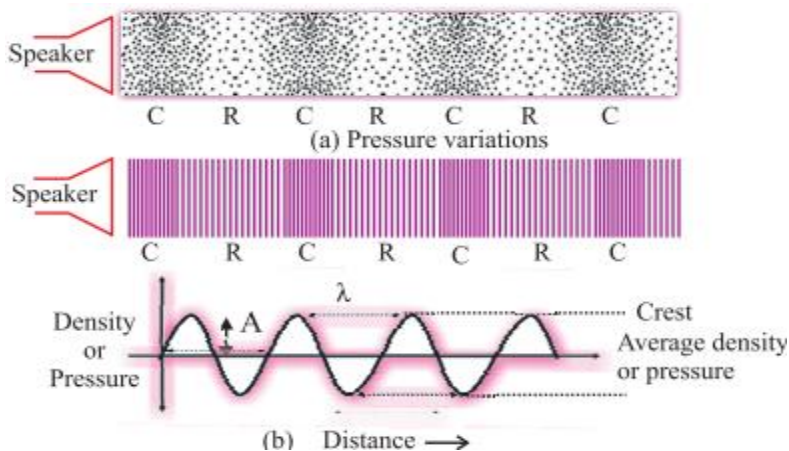
**ANSWERS OF THE ASSIGNMENT UPLOADED ON 6<sup>TH</sup> APRIL.**

1. A wave is a disturbance that moves through a medium when the particle of the medium set neighboring particles into motion.
2. Sound wave is called a mechanical wave because, it needs a material medium for its propagation.
3. Transverse Wave – Light, Longitudinal wave - Sound
4.  $V = \frac{1}{T} = \frac{1}{0.05} = 20 \text{ Hz}$

5. The audible range of human being is between 20Hz and 20,000 Hz.
6. Compression is the part of wave in which particles of the medium are closer to one another forming high pressure.

Rarefaction is the area of wave in which particles of the medium are further apart from one another forming a low pressure or low density area.

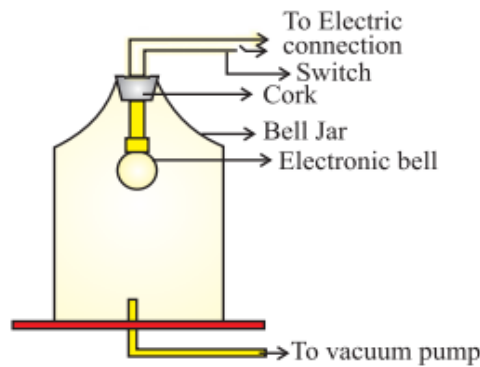
7.



8.

### Sound needs Medium for Propagation

- Sound waves are mechanical waves.
- It needs material medium for propagation like air, water, steel etc.
- It cannot travel in vacuum.
- An electric bell is suspended in airtight bell jar connected with vacuum pump.
- When bell jar is full of air, we hear the sound but when air is pumped out from the bell jar by vacuum pump and we ring the bell, no sound is heard.
- So medium is necessary for propagation of sound.



### Experiment to show that sound cannot travel through vacuum

9. The sound is produced when bell is struck with a hard metallic rod or wooden hammer which produces vibration. These vibrations reach our ear through the air.
10. Light is a transverse wave. The oscillations produced are not of the medium or their pressure or density. Therefore it is not a mechanical wave.
- 11.

Transvers Wave	Longitudinal Wave
<ul style="list-style-type: none"><li>• Particles of the medium vibrates perpendicular to the direction of propagation of the wave</li></ul>	<ul style="list-style-type: none"><li>• Particles of the medium vibrates parallel to the direction of propagation of the wave</li></ul>
<ul style="list-style-type: none"><li>• It does not need a material medium for its propagation.</li></ul>	<ul style="list-style-type: none"><li>• It needs a material medium for its propagation</li></ul>
<ul style="list-style-type: none"><li>• It is not a mechanical wave.</li></ul>	<ul style="list-style-type: none"><li>• It is a mechanical wave.</li></ul>