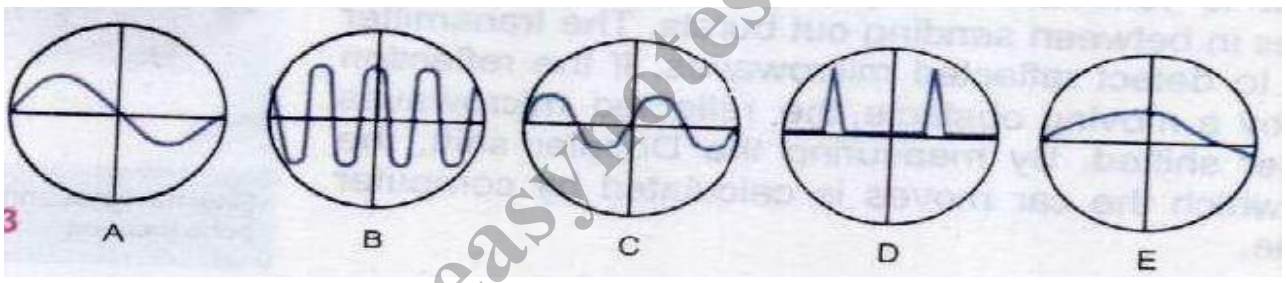
## CHAPTER NO. 8 (WAVES)

**Question 8.1:- What features do longitudinal waves have with transverse wave?**

**Answer:-** Following are the features which longitudinal and transverse wave have in common:-

1) Both type of waves produce disturbance in a medium through which they pass.
2) Both type of waves transport energy and momentum from one place to another.
3) The equation $v = f \lambda$ is valid for both types of waves.
4) Both types of waves can be used to produce stationary waves.

**Question 8.2:- The five possible waveforms obtained, when the output from a microphone is fed to the Y-input of cathode ray oscilloscope, with the time base on, are shown in figure. These waveforms are obtained under the same adjustment of the cathode ray oscilloscope controls. Indicate the waveform a) which trace represents the loudest note? b) which trace represents the highest frequency?**






**Answer:- a)** Loudness depends directly on intensity of sound which depends directly on square of amplitude. The note shown in **(D)** has the maximum amplitude and loudest note.

**b)** Frequency of a wave is number of cycles in unit time. The trace in **(B)** has highest frequency.

**Question 8.3:- Is it possible for two identical waves travelling in the same direction along a string to give rise to a stationary wave?**

**Answer:-** No, it is not possible.

Stationary waves can only be produced by the superposition of two identical waves travelling in opposite direction.

**Question 8.4:- A wave is produced along a stretched string but some of its particles permanently show zero displacement. What type of wave is it?**

**Answer:-** The type of wave produced in a stretched string in which some points permanently show zero displacement is called stationary wave. The points which show zero displacement permanently are called nodes.

**Question 8.5:- Explain the terms crest, trough, node and antinode.**

**Answer:- Crest:-** The portion of a wave or disturbance above the mean position is called crest.

**Trough:-** The portion of a wave or disturbance below the mean position is called trough.

**Node:-** The points which show zero amplitude permanently on a transverse stationary wave are called node.

**Antinode:-** The point which vibrate with maximum amplitude on a transverse stationary wave is called antinode.

**Question 8.6:- Why does sound travel faster in solids than in gases?**

**Answer:-** The speed of sound in any medium is given as $v = \sqrt{\frac{E}{\rho}}$. The speed of sound in any medium depends on square root of the ratio of its modulus of elasticity and density. The ratio of modulus of elasticity and density for solids is much greater than for the gases. Therefore, the speed of sound in solids is greater than its speed in gases.

**Question 8.7:- How are beats useful in tuning musical instruments?**

**Answer:-** A faulty music instrument is played along with a standard source known frequency, beats are produced which is indication that frequency of both instrument differ from each other. The effective length of strings of faulty instruments is adjusted by tightening or loosening the peg at the neck of the instrument so that no beats are heard. At this moment, the faulty instrument is considered to be tuned with standard instrument.

**Question 8.8:- When two notes of frequencies $f_1$ and $f_2$ are sounded together, beats are formed. If $f_1 > f_2$, what will the frequency of the beats?**

**i) $f_1 + f_2$** **ii) $\frac{1}{2}(f_1 + f_2)$** **iii) $f_1 - f_2$** **iv) $\frac{1}{2}(f_1 - f_2)$**

**Answer:-** Beat frequency of two notes is **iii) $f_1 - f_2$.**

**Question 8.9:- As a result of distant explosion, an observer senses a ground tremor and then hears the explosion. Explain the time difference.**

**Answer:-** The explosion which took place some distance away reaches the observer through two different media i.e. ground surface and air. The speed of

any disturbance i.e. mechanical wave in a solid is greater than its speed in air. That is why, ground tremor reaches the observer earlier than the explosion.

**Question 8.10:- Explain why sound travels faster in warm air than in cold air.**

**Answer:-** The speed of sound in any medium is given as v = $\sqrt{\frac{\gamma P}{\rho}}$. The speed of sound in air is inversely proportional to square root of density of air. The density of warm air is much less than the density of cold air, therefore, speed of sound in warm air is greater than its speed in cold air.

(Alternately, the speed of sound in air or a medium is directly proportional to the square root of absolute temperature as $v_t = v_o\sqrt{\frac{T}{T_o}}$. Therefore, speed of sound in warm air is greater than its speed in cold air).

**Question 8.11:- How should a sound source move with respect to an observer so that the frequency of its sound does not change?**

**Answer:-** When a sound source and an observer moves with the same velocity along the same direction (parallel), their relative velocity is zero (relative separation is constant) and no apparent change in frequency of sound waves is produced.