Very Short Answer Type Questions

[1 Mark]

Q. 1. What does wave transfer-matter or energy?

Ans. Energy

Q. 2. What are mechanical waves?

Ans. Waves that are characterised by the motion of particles in a medium are called mechanical waves. Mechanical waves require material medium for their propagation.

Q. 3. Where is the density of air higher-at compressions or at rarefactions?

Ans. At compressions.

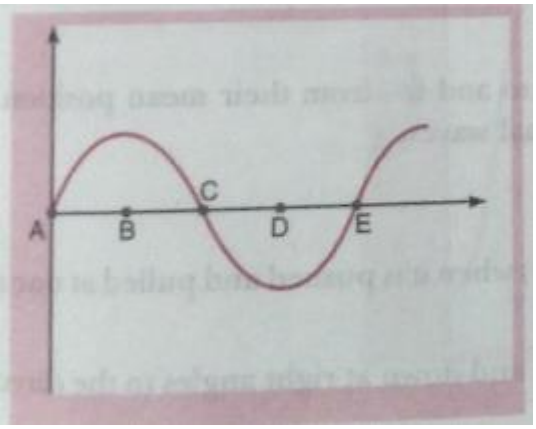
Q. 4. What is one complete oscillation?

Ans. The change in density from one maximum value to the minimum value and again to the maximum value makes one complete oscillation.

Q. 5. On what factor does the pitch of a sound depend?

Ans. The pitch of a sound depends on the frequency of vibrations. Actually, the pitch of a sound is directly proportional to its frequency

Q. 6. What is the wavelength in the given curve?



Ans. AE

Q. 7. If any explosion takes place at the bottom of a lake, what type of shock waves in water will take place?

Ans. Longitudinal waves.

Q. 8. What is intensity of sound?

Ans. The amount of sound energy passing through unit area each second is called the intensity of sound.

Q. 9. What is relation between time period and frequency?

Ans. Frequency = $\frac{1}{\text{Time period}}$

Q. 10. Name two animals that communicate using infrasound

Ans. Rhinoceroses and whales communicate using infrasound.

Q. 11. Name the sound waves used by bats while flying in the dark.

Ans. Bats use ultrasonic waves while flying in the dark.

Q. 12. Earthquake produces which kind of sound before the main shock wave begins?

Ans. Infrasound.

Q. 13. Before playing the orchestra in a musical concert, a sitarist tries to adjust the tension and pluck the string suitably. By doing so, what is he adjusting?

Ans. He is adjusting frequency of the *sitar* string with the frequency of the other musical instruments.

Q. 14. Name the characteristic which helps us to distinguish between a man's voice and a woman's voice, even without seeing them.

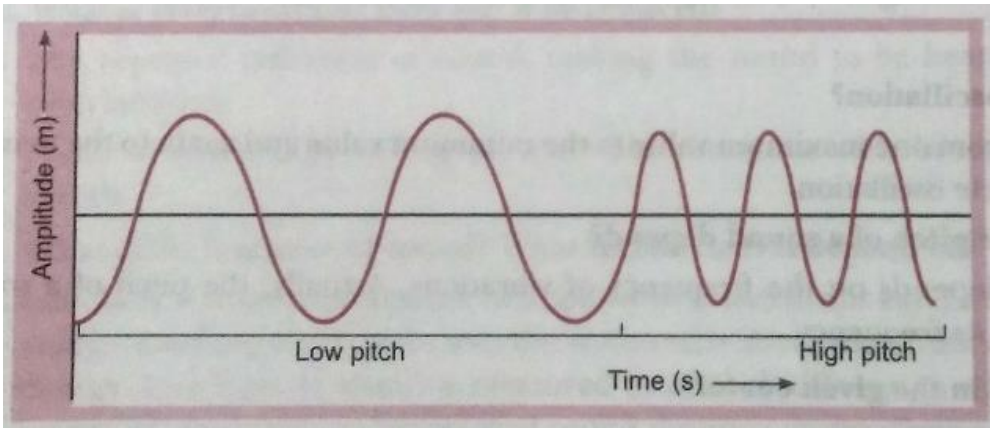
Ans. Quality or timbre.

Short Answer Type Questions – I

[2 marks]

Q. 1. Draw a graph for a wave representing wave disturbance and time for a sound changing from low pitch to high pitch, keeping the amplitude of the sound same.

Ans.



Q. 2. What are longitudinal waves? Give two examples.

Ans. The waves in which the particles of medium oscillate to and fro from their mean position in the direction of propagation of waves are called longitudinal waves.

***Examples*:**

(i) Sound waves in air.

(ii) The waves which travel along the spring (or slinky) when it is pushed and pulled at one end.

Q. 3. What are transverse waves? Give two examples.

Ans. A wave in which the particles of the medium vibrate up and down at right angles to the direction in which the wave is moving.

***Examples*:**

(i) The waves produced by moving one end of a long spring (or slinky) up and down rapidly.

(ii) Ripples formed on the surface of water in a pond.

Q. 4. Explain the terms crests and troughs of a wave.

Ans. The elevation or hump in a transverse wave is called crest. It is that part of the transverse wave which is above the line of zero disturbance of the medium.
The depression or hollow in a transverse wave is called trough. It is that part of the transverse wave which is below the line of zero disturbance.

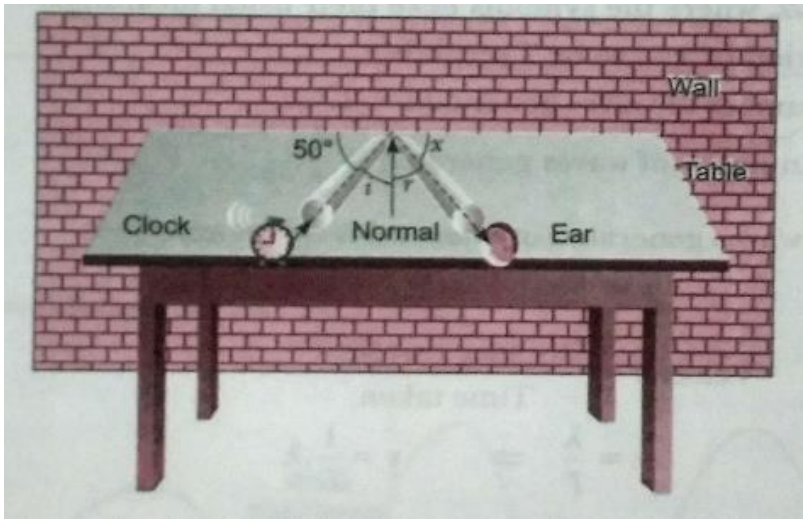
Q. 5. What is a stethoscope? Name the principle on which a stethoscope works.

Ans. Stethoscope is a medical instrument used for listening sounds produced within the body, chiefly in the heart or lungs. Stethoscope works on the principle of multiple reflection of sound.

Q. 6. Why do we hear the sound produced by the humming bees while the sound of vibrations of pendulum is not heard?

Ans. Humming bees produce sound by vibrating their wings which is in the audible range. In case of pendulum, the frequency is below 20 Hz which does not come in the audible range.

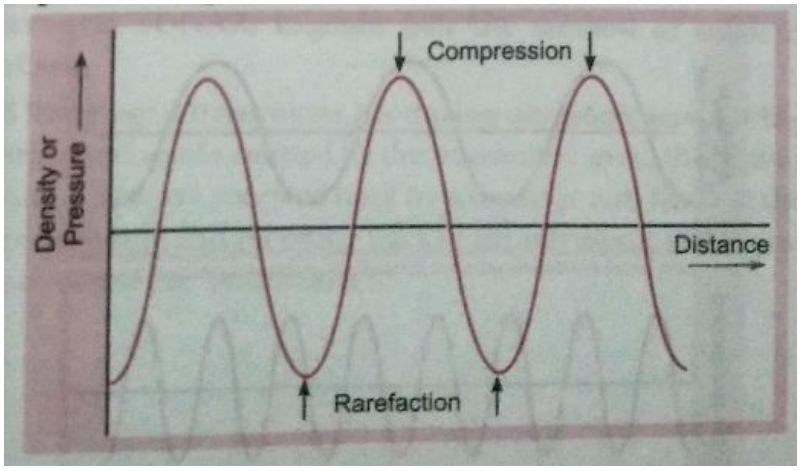
Q. 7. For hearing the loudest ticking sound heard by the ear, find the angle x in the figure.



Ans. According to the laws of reflection, $\angle i = \angle r$

So x = 90°- $\angle r$ = 90°- $50^0 = 40^0$

Q. 8. Draw a curve showing density or pressure variations with respect to distance for a disturbance produced by sound. Mark the position of compression and rarefaction on this curve. Also define wavelengths and time period using this curve.



Ans. Wavelength is the distance between two consecutive compressions or two consecutive rarefactions. Time period is the time taken to travel the distance between any two consecutive compressions or rarefactions from a fixed point.

Short Answer Type Questions – II

[3 marks]

Q. 1. Write three differences between transverse waves and longitudinal waves.
Ans.

Transverse Waves	**Longitudinal Waves**
1. The particles of the medium oscillates up and down about their mean position.	**1.** The particles of the medium move in the parallel to the direction of propagation of the disturbance.
2. They propagate as crests and troughs.	**2.** They propagate as compressions and rarefactions.
3. The propagation of waves is possible in solid or surface of liquid but not in gases. **Example:** Light wave	**3.** The propagation of these waves is possible in solids, liquids and gases. **Example:** Sound wave

Q. 2. Prove that $v = v\lambda$, where the symbols have their usual meanings.

Ans. Let the time period of a wave be T seconds.

In T seconds, number of waves generated = 1.
So, in I second number of waves generated = $\frac{1}{T}$.
But number of waves generated in 1 second is frequency.

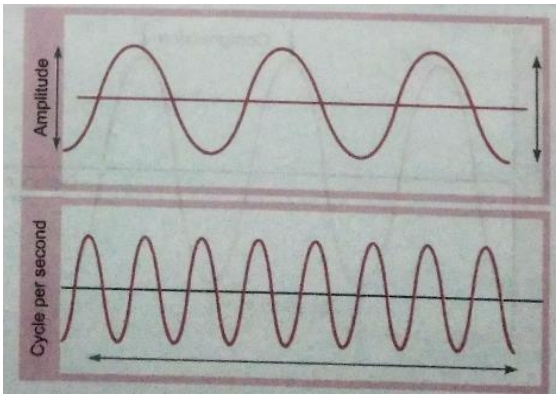
$\therefore \quad v = \frac{1}{T}$

Now, $\text{Velocity} = \frac{\text{Distance travelled}}{\text{Time taken}}$

$\Rightarrow \quad v = \frac{\lambda}{T} \quad \Rightarrow \quad v = \frac{1}{T}.\lambda$

$\Rightarrow \quad v = v\lambda$

Q. 3. Which wave characteristics determine the (a) loudness (b) pitch of sound? Draw two different waveforms and mark these characteristics on it.



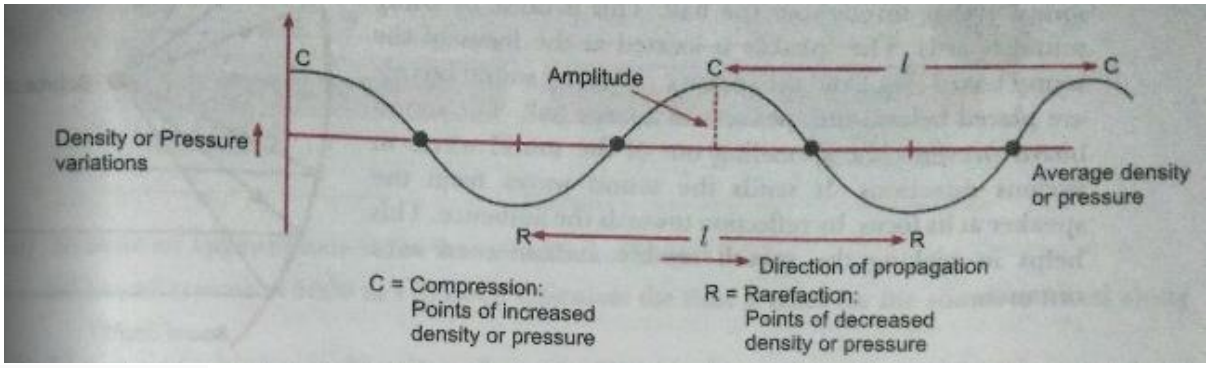
Ans. (*a*) Amplitude

(*b*) Frequency

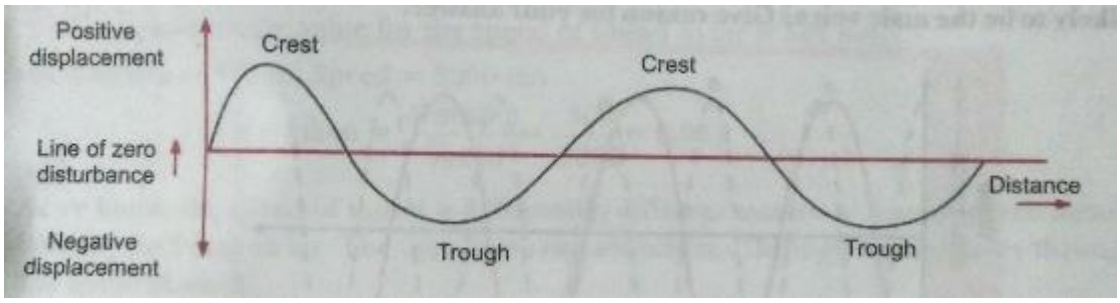
Q. 4. Plot the following:

(i) A longitudinal wave in air on a density-distance graph.
(ii) A transverse wave on a displacement-distance graph.

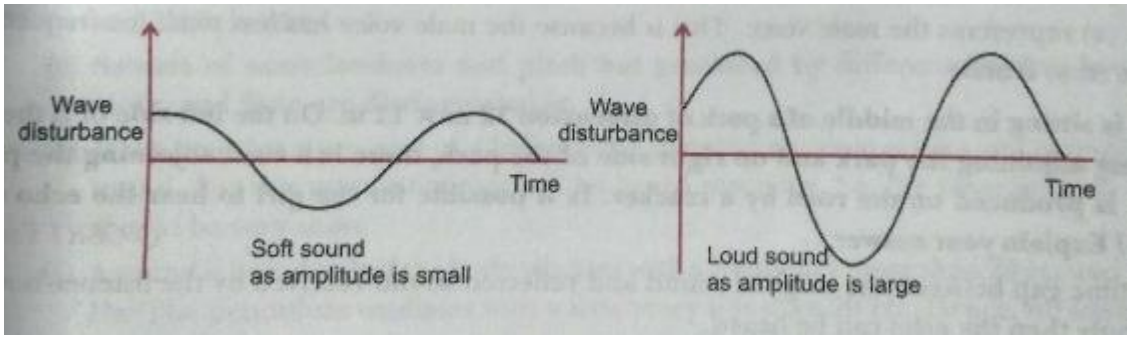
Ans. (i) A longitudinal wave in air



(ii) A transverse wave



Q. 5. Draw diagrams to represent soft sound and loud sound.
Ans.

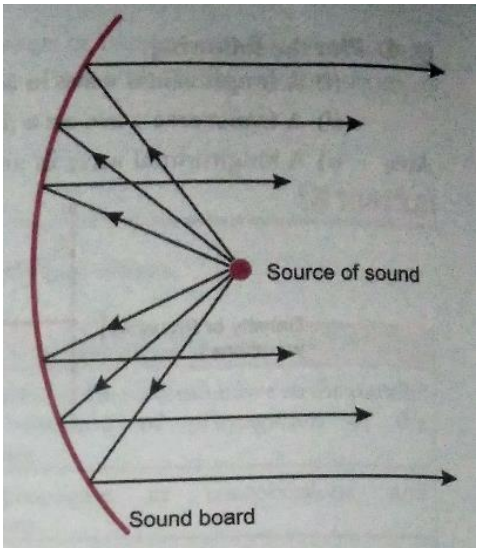


Q. 6. Write full form of acronym SONAR. Explain how the method of echo- ranging is used to determine the depth of sea.

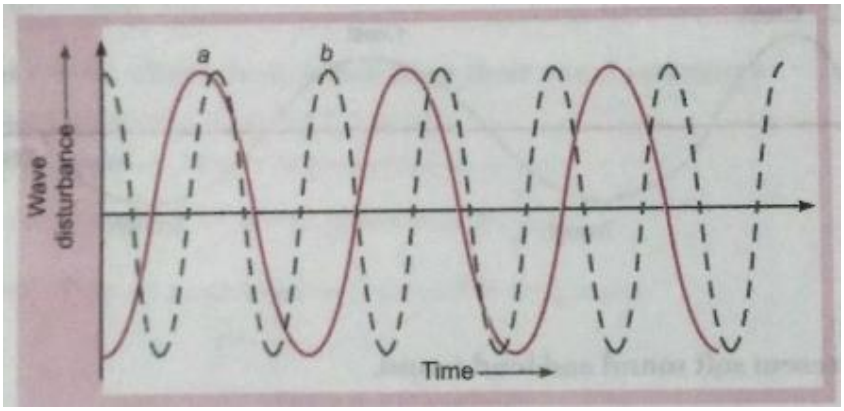
Ans. Sound Navigation And Ranging: A transmitter producing ultrasonic waves is fitted at the bottom of a ship or a boat. The ultrasound waves emitted by the transmitter go to the bottom of the sea and get reflected from the bottom. These are received back by a detector also fitted at the bottom. Knowing the time elapsing between sending and receiving back of the ultrasonic waves and the speed of these waves in water, the depth of sea can be calculated.

Q. 7. What is a sound board? Explain the working of a soundboard with the help of a labelled diagram.

Ans. The reflection of sound may take place at curved surfaces also. This fact is made use of in the large halls to spread sound evenly throughout the hall. This is done by using sound boards. The speaker is located at the focus of the sound board (Fig.) and the concave reflecting sound boards are placed behind the speakers in a large hall. The sound board prevents the spreading out of the sound waves in various directions. It sends the sound waves from the speaker at its focus, by reflection towards the audience. This helps in making the speech readily audible even at a distance.



Q. 8. In the graphs given below representing the human voice, which of the two graphs (a) or (b) is likely to be the male voice? Give reason for your answer.



Ans. Graph (a) represents the male voice. This is because the male voice has less pitch (or frequency) as compared to female.

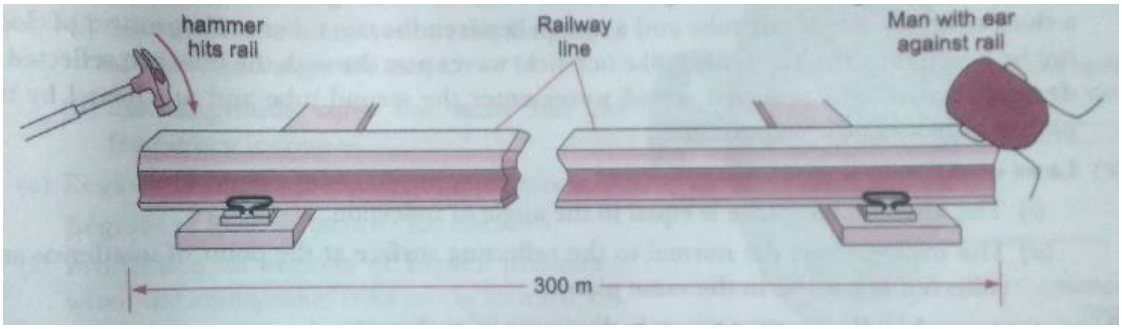
Q. 9. A girl is sitting in the middle of a park of dimension 12 m x 12 m. On the left side of it there is a building adjoining the park and on right side of the park, there is a road adjoining the park. A sound is produced on the road by a cracker. Is it possible for the girl to hear the echo of this sound? Explain your answer.

Ans. If the time gap between the original sound and reflected sound received by the listener is around 0.1 s, only then the echo can be heard.

The minimum distance travelled by the reflected sound wave for the distinctly listening the echo
= Velocity of sound × Time interval
= 344 x 0.1 = 34.5 m

But in this case the distance travelled by the sound reflected from the building and then reaching to the girl will be (6 + 6) = 12 m, which is much smaller than the required distance. Therefore, no echo can be heard.

Q. 10. A disused railway line has a length of 300 m. A man puts his ear against one end of the rail and another man hits the other end with a metal hammer, as shown in figure.



(a) (i) State an approximate value for the speed of sound in air.

(ii) Sound travels at 5000 m/s in steel. Calculate the time it takes for the sound to travel along the rail.

(b) The man with his ear to the railway line actually hears two sounds from the hammer, separated by a short interval. Explain why he hears two sounds.

Ans. (a) (i) The approximate value for the speed of sound in air is 344 m/s

(ii) Distance = 300 m, Speed = 5000 m/s

$\therefore$ Time taken = $\frac{\text{Distance}}{\text{Speed}} = \frac{300}{5000} = 0.06$ s

(b) As we know, the speed of sound is different in different materials. Sound travels about 15 times faster in steel than in air. The man hears two sounds one through air and other through railway line made of steel.

Q. 11. Give reasons for the following:

(a) The reverberation time of a hall used for speeches should be very short.

(b) A vibrating body produces sound. However no sound is heard when a simple pendulum oscillates in air.

(c) Sounds of same loudness and pitch but produced by different musical instruments like a violin and flute are distinguishable.

Ans. (a) If the reverberation time of a hall is long, then the multiple echoes will enterfere with original sound. For this reason nothing will be heard distinctly. So, the reverberation time of the hall should be very short.

(b) A sound is heard only if the body vibrates with a frequency more than 20 Hz and less than 20,000 Hz. The pendulum oscillates with a frequency less than 20 Hz. Hence, no sound is heard.

(c) This is due to the quality or timbre of sound waves.

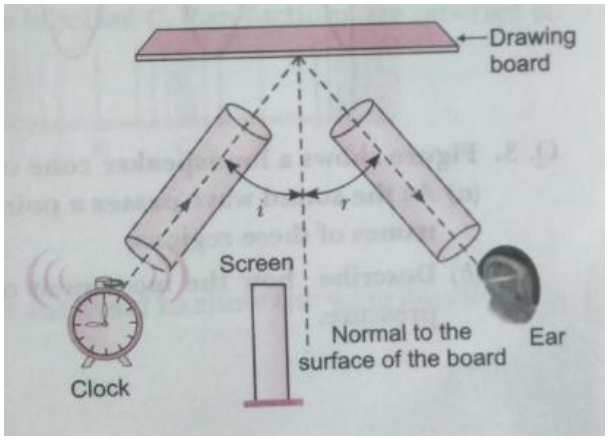
Long Answer Type Questions

[5 marks]

Q. 1. (*a*) What is meant by reflection of sound?

(*b*) Describe an activity to study the reflection of sound.

(*c*) State the laws of reflection of sound.



Ans. (a) Reflection is a phenomenon of reversion of a wave going from one medium to the same medium after striking the second medium. Sound wave also experience reflection like other waves.

(b) To observe the reflection of sound, take a drawing board and fix it on the floor. Put two metallic or cardboard tubes as shown in figure. These tubes are making some angle with each other. Put a clock near the end of one tube and a screen between the two tubes so that sound of clock may not be heard directly. The sound (like tick-tick) waves pass through the tube are reflected by the drawing board. The reflected sound waves enter the second tube and are heard by the ear placed in front of the second tube.

(c) Laws of reflection:

(*i*) The angle of incidence is equal to the angle of reflection.

(*ii*) The incident ray, the normal to the reflecting surface at the point of incidence and the reflected ray, all lie in the same plane.

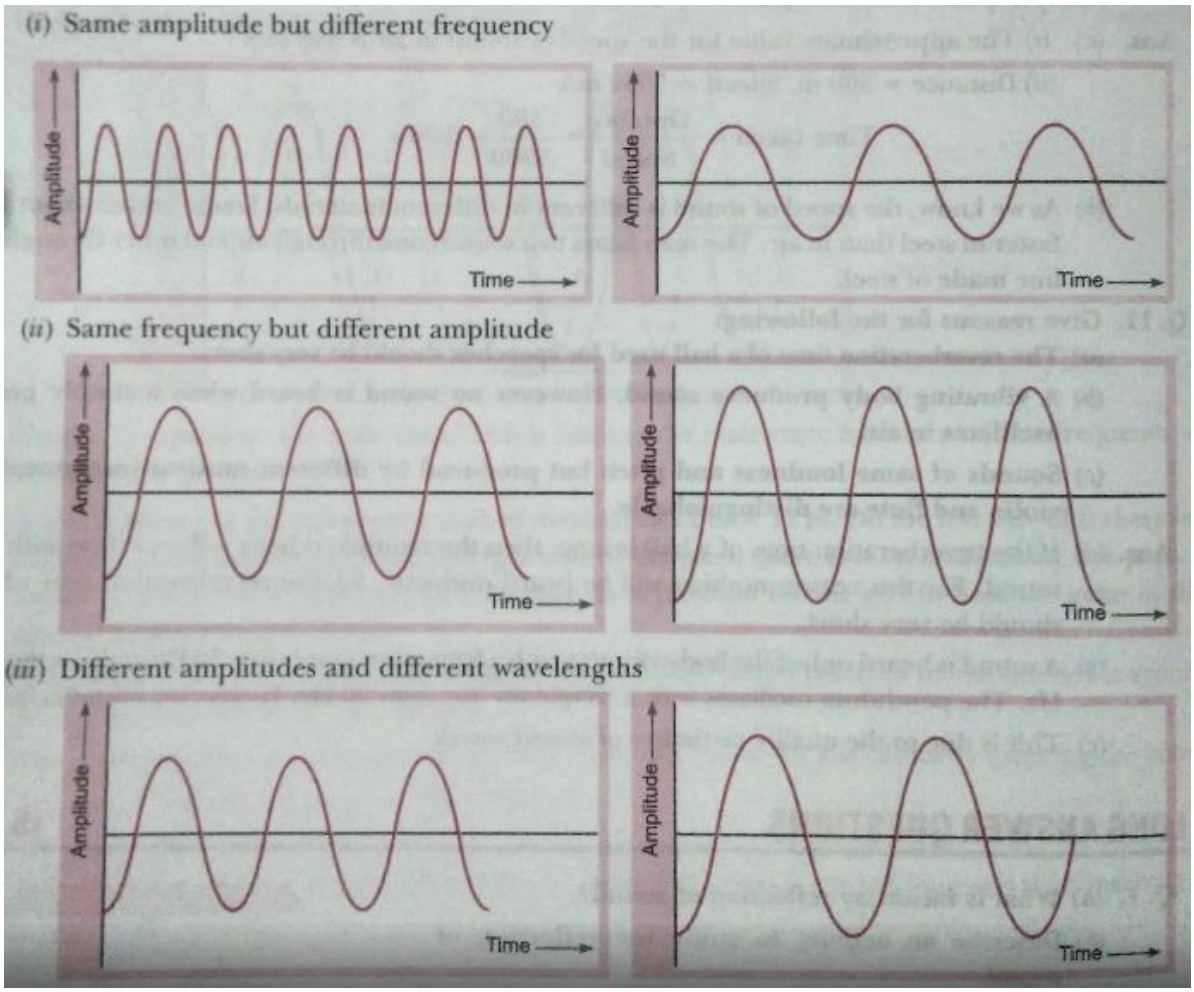
Q. 2. Represent graphically any two separate diagrams in each case:

(*i*) Two sound waves having the same amplitude but different frequencies.

(*ii*) Two sound waves having the same frequency but different amplitudes.

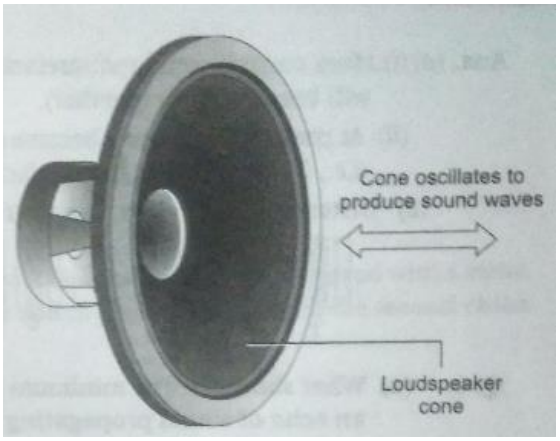
(*iii*) Two sound waves having different amplitudes and also different wavelengths.

Ans.



Q. 3. Figure shows a loudspeaker cone oscillating to produce sound waves:

(*a*) As the sound wave passes a point, it produces regions of higher and lower pressure. State the names of these regions.



(*b*) Describe how the movement of the loudspeaker cone produces these regions of different pressure.

(c) State the effect on the loudness and pitch of the sound from the loudspeaker when

(*i*) the amplitude increases but the frequency of the sound stays the same,

(*ii*) the amplitude stays the same but the frequency increases.

Ans. (a) Regions of higher pressure: Compressions

Regions of lower pressure: Rarefactions

(b) Production of regions of higher pressure: when the loudspeaker cone moves forward, $i.e.,$ in the direction of propagation of wave, it pushes the layer of air closer.

This air layer pushes the next air layer, and process goes on. In this way, the layers of air near the cone are compressed to form a compression, which is a region of higher pressure.

Production of regions of lower pressure: when the cone moves backward, $i.e.,$ away from direction of propagation of wave, it leaves a region of low pressure and the air layers move apart to form a rarefaction.

(c) (*i*) Loudness increases as greater the amplitude of sound waves, louder the sound will be pitch remains same.

(*ii*) Loudness remains same.
Pitch increases as the pitch of a sound is directly proportional to its frequency.

HOTS (Higher Order Thinking Skills)

Q. 1. When we put our ear to a railway track, we can hear the sound of an approaching train even when the train is far off but its sound cannot be heard through air. Why?

Ans. Sound travels about 15 times faster in iron (or steel) than in air. So, sound travels much faster through the railway track made of steel than through air. That is why, we can hear the sound of an approaching train even when the train is far off but its sound cannot be heard through air.

Q. 2. In a ripple tank, 12 full ripples are produced in one second. If the distance between a crest and next trough is 10 cm, find
(a) wavelength, (b) frequency and (c) velocity of the wave.

Ans. **(a)** Here, $\frac{\lambda}{2} = 10 \Rightarrow \quad \lambda = 20$ cm = 0.20 m

(b) Frequency, = v Number of ripples produced in 1 second = 12 Hz

(c) Velocity, $v = v\lambda = 12 \times 0.20 = 2.40\ ms^{-1}$

Q. 3. Figure shows the position of layers of air, at one moment, as a sound wave of constant frequency passes through the air. Compressions are labelled C. Rarefactions are labelled R.

(a) State how figure would change if

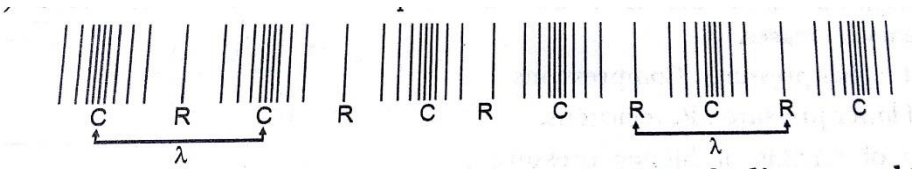
(i) the sound had a higher frequency,

(ii) the sound were louder.

(b) On figure, draw a line marked with arrows at each end to show the wavelength of the sound.

Ans. (a) (i) More compressions and rarefactions will be produced in a given time interval (i.e., C and R will become closer together).

(ii) At compressions, layers become closer together. At rarefactions, layers become farther apart (i.e., C will narrower and rarefactions wider).
(b) Distance between two compressions or two rarefactions are called wavelength (λ).



Q. 4. (a) What should be the minimum distance between the listener and the reflector to hear an echo of sound propagating with a speed v ms-?

(b) Does the speed of sound increase or decrease on a hotter day? Justify.

Ans. (a) Time = $\frac{\text{Distance}}{\text{Speed}}$

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

or $d = \frac{v \times t}{2} = \frac{v \times 1}{2 \times 10}$ ($\because$ Time = 0.1 s) = $\frac{v}{2d}$

(b) The speed of sound increases with temperature. So, on a hotter day speed of sound is more.

Value Based Questions

1. Kanika carried out an experiment on determination of speed of sound in air using resonance tube apparatus and obtained absurd results. She should
(a) record the result as such.
(b) manipulate the result and report the answer nearer to actual value of velocity of sound in air.
(c) copy the result obtained by another student.
(d) report the result as such and discuss the matter with the teacher to find out the reasons for wrong results.

Answer the following questions based on the above information:

(*i*) Which is the most appropriate option for Kanika?
(*ii*) What values will Kanika be promoting through preferring this option?
(*iii*) Give one more example of promoting such values in real life situations.

Ans. (*i*) (d)

(*ii*) Intellectual honesty, desire to know more and improve.

(*iii*) Submitting honest information for income tax returns, honest dealings.

2. Kunal and Abhimanyu were waiting to go across a railway crossing. Kunal jumped over the barrier and curiously put his ear on the railway track. Abhimanyu opposed Kunal and pulled him away from the railway track.

(*i*) Why did Kunal put his ear on the railway track?
(*ii*) Can sound travel faster through (a) Copper (b) water.
(*iii*) Why did Abhimanyu pull Kunal away from the railway track?

Ans. (*i*)To hear the sound of the coming train because sound travel within the rail track and get the idea of distance of incoming train.

(*ii*) Copper.

(*iii*) For safety as he cares for his friend..

3. Reena's grandmother took her mother to a doctor as she was four months pregnant for ultra-sonography. But she showed her interest in determining whether the child is a boy or a girl. The doctor was annoyed and refused to disclose the gender of the child.

(*i*) What is ultra-sonography?
(*ii*) Why do you think the doctor refused to determine the gender of the child?
(*iii*) What values are promoted by the doctor?

Ans. (*i*) The technique of obtaining pictures of internal organs of body by using echoes of ultrasound pulses is called ultrasonography.

(*ii*) To disclose the gender is against the law and also to discourage the curiousity of knowing the sex of the child before birth.

(*iii*) Obeying laws, honesty.