PHYSICS

BOOKS - MODERN PUBLISHERS PHYSICS (HINGLISH)

WAVES

Example

1. Calculate the distance that sound travels in air when a tuning fork of frequency 250 Hz makes 44 vibrations. Take, velocity of sound in air = 320 m/s.

Watch Video Solution

2. A steel wire 0.72 m long has a mass of 5.0×10^{-3} kg . If the wire is under a tension of 60 N, what is the speed of transverse waves on the

wire ?

Watch Video Solution

3. The density of a wire used in the experiment is $6.9 \times 10^3 kg/m^3$. If a stress of $2.5 \times 10^8 N/m^2$ is given to the wire, determine the speed of transverse wave in the wire.

View Text Solution

4. At 27°C a copper wire is held taut between two rigid supports, with negligible tension. If the temperature is now reduced to $12^\circ C$, find the speed of transverse wave in the wire.

For copper coefficient of linear expansion $= 1.7 \times 10^{-5}.^\circ C^{-1}$ Young's modulus $= 1.4 \times 10^{11} N/m^2$

Density $= 9 \times 10^3 kg/m^3$

Watch Video Solution

5. At one end of a brass bar, 1 km long, a source of sound is placed. Two sounds are heard at the other end of the bar, by an interval of 2.6 seconds. Determine the velocity of sound in brass if its velocity in air is 330 m/s.

Watch Video Solution

6. A stone is dropped in an 80 m deep well and its splash is heard 4.28 seconds later. Calculate the speed of sound in air.

Watch Video Solution

7. The speed of sound in a liquid of density $2 \times 10^3 kg/m^3$ is 1000 m/s. Determine the bulk modulus of elasticity of the liquid.

Watch Video Solution

8. Estimate the speed of sound in air at standard temperature and pressure. The mass of 1 mole of air is $29.0 \times 10^{-3} kg$, λ for air $= 7/5$.

Watch Video Solution

9. At what temperature will the speed of sound be double of its value at $0^{\circ} C$?

Watch Video Solution

10. Sound waves of wavelength 2 m are produced in air at S.T.P. by a tuning fork of frequency 180 Hz. What will be the increase in wavelength of the sound waves if the temperature of air is $30^{\circ} C$?

Watch Video Solution

11. At N.T.P., the speed of sound in air is 333 m/s. Calculate the speed of sound in hydrogen at $560^{\circ} C$ and 2.5 atmospheric pressure. Air is 16 times denser than hydrogen.

Watch Video Solution

12. The ratio of densities of helium and hydrogen is 4 : 2. Calculate the temperature at which the speed of sound in helium will be equal to speed in hydrogen at 27° C ?

Watch Video Solution

13. Consider air is composed of 4 parts of nitrogen and 1 part of oxygen. At S.T.P., speed of sound in dry air in 332 rad/s. If the ratio of densities of oxygen and nitrogen at S.T.P. is 16 : 14, calculate the velocity of sound in nitrogen under similar conditions.

Watch Video Solution

14. The displacement y of a particle in a medium can be expressed as

$y = 10^{-4} \sin(10t + 2x + \pi/4)$

where all quantities are in SI units. Find the speed of the wave.

Watch Video Solution

15. A wave travelling along a strong is described by

$y(x, t) = 0.005 \sin(80.0x - 3.0t)$

in which the numerical constants are in SI units $\left(0.005m, 80.0radm^{-1}\right.$ and $\left.3.0rads^{-1}\right)$. Calculate (a) the amplitude. (b) the wavelength (c) the period and frequency of the wave. Also , calculate the displacement y of the wave at a distance $x = 30.0$ cm and time t=20 s?

Watch Video Solution

16. A wave travelling in a string is y(x, t) = 0.4 sin (30x - 2t) where all numerical constants are in SI units. Calculate the displacement at a distance of 25 cm and t = 6s.

Watch Video Solution

17. In a stretched string, the speed of a wave is 25 m/s and its frequency is 60 Hz. Determine the phase difference in radian between two points situated at a disatance of 8 cm on the string.

Watch Video Solution

18. For a progressive wave propagating along positive X-direction, amplitude, frequency and velocity are 10 cm, 300 Hz and 440 m/s, respectively. Write the equation of the wave.

Watch Video Solution

19. The equation of a plane wave is $y = 3 \times 10^{-0.01x} \cos(600t - 0.78x + \pi/2)$ where units of y, t and x are 10^{-5} cm, s and m respectively. Write its general expression of phase and also determine

(i) its phase at x = 0, t = 0

(ii) phase difference between the points separated by 25 cm along X-axis.

(iii) amplitude at x = 200 m

Watch Video Solution

20. A simple harmonic wave train is oscillating with 100 vibration/s and has an amplitude of 1 cm. It is progressig along positive X-axis with a velocity of 10 m/s. At x = 150 cm from the orgin and t = 5 s, determine

(i) the displacement

(ii) the particle velocity

(iii) particle acceleration

Watch Video Solution

21. The distance between two successive nodes in a stationary wave is 30 cm. Calculate the frequency of wave if its speed is 250 m/s.

Watch Video Solution

22. A stationary wave is formed by superposition of two constituent waves, having amplitude, frequency and velocity as 10 cm, 40 Hz and 200 cm/s, respectively. Write the equation of the stationary wave.

Watch Video Solution

23. A stationary wave is formed by superposition of two waves given by

64.88 $y_1 = 0.02\sin(3\pi t - x)$ and $y_2 = 0.02\sin(3\pi t + x)$

where x, y are in metres and t is in seconds. Determine the displacement of a particle situated at a distance of x = 0.5 m.

Watch Video Solution

24. A metal wire is clamped between two rigid supports 1 m apart. It is stretched with a tension of 20 N. If mass of wire is 9.8 g, determine its fundamental frequency.

Watch Video Solution

25. A sonometer wire has a length of 0.75 m and density of the material of the wire is $10^4 kg/m^3$. If the wire can bear a stress of $7.5 \times 10^8 N/m^2$ without exceeding the elastic limit, what fundamental frequency can be produced in the wire ?

Watch Video Solution

26. What will be the fundamental note emitted by a string of length $20\sqrt{10}$ cm under a tension of 6.28 kg st if its radius and density are 0.2 mm and 19.6 g/cm^3, respectively ?

Watch Video Solution

27. A rope of mass 250 g is 5.5 m long. It is stretched under a tensional force of 2 kg wt. If the wire is fixed at one end and is shaken by hand at the other end, what frequency will make it break into four segments ? Take, g = 980 cm/s^2.

Watch Video Solution

28. A fundamental note of frequency 250 Hz is produced by a wire of length 105 cm by 1 kg wt. When stretched by a force of 3 kg wt its pitch is raised by a major tone. Determine the increase in its length.

Watch Video Solution

29. A sonometer wire has a length of 115 cm between its two fixed ends. Determine the positions where the two bridges can be placed so that the fundamental frequencies of the three segments so formed are in the ratio of 1 : 4 : 20.

View Text Solution

30. Calculate the fundamental frequency of an organ pipe, of length 0.8 m open at both ends if the velocity of sound in air is 330 m/s. What will be the fundamental frequency if one end of the pipe is closed ?

Watch Video Solution

31. A pipe 30.0 cm long is open at both ends. Which harmonic mode of the pipe resonates with a 1.1kHz source? Will resonance with the same source be observed if one end of the pipe is closed ? Take the speed of sound in air as $330ms^{-1}$.

Watch Video Solution

32. The second overtone of a closed organ pipe is in unison with the fourth overtone of the open organ pipe. Calculate the ratio of length of the two pipes.

Watch Video Solution

33. The second overtone of an open pipe beats with the seconds overtone of a closed pipe with a beat frequency of 3.2 Hz. If the fundamental

frequency of closed organ pipe is 120 Hz, calculate the lengths of the pipes. Take, Velocity of sound in air = 320 m/s

Watch Video Solution

34. A well of certain depth has vertical sides and wataer at its bottom resonates at 8 Hz (not at a frequency lower than this). Calculate the depth of the well if density of air in the well is 1.12 kg/m^3 and bulk modulus is $1.35 \times 10^5 N/m^2$.

Watch Video Solution

35. At a temperature of $30^\circ C$, a resonance air column resonates with a tuning fork of frequency 525 Hz. The resonated air column has two successive lengths equal to 15 cm and 53 cm. Calculate the speed of sound at $0^\circ C$ and the end correction.

Watch Video Solution

36. Determine the possible harmonics in the longitudinal vibrations of a rod clampred in the middle.

Watch Video Solution

37. A tuning fork X is initially in unison with another tuning fork Y of frequency 342 Hz. The points of the prongs of fork X are filed so that it now produces 4 beats per second when sounded together with Y. Determine the pitch of X after filing.

Watch Video Solution

38. When two tuning fork were sounded together 5 beats/s were produced, with one fork of frequency 282 cps. On another fork of unknown frequency a little wax is placed and as a result, the pair now produces 3 beats/s. Determine the freqency of the unknown fork.

Watch Video Solution

39. A tuning fork A of frequency 256 Hz when sounded with tuning fork B of unknown frequency produces 4 beats/s. When B is loaded with wax, 6 beats/s were heard. If some of the wax is reduced, the number of beats again reduces to 4 beats/s. Determine the initial frequency of B.

Watch Video Solution

40. When a tuning fork X is sounded with tuning fork Y (v = 256 Hz), 4 beats/s are produced but when X is sounded with tuning fork Z(v = 258 Hz), 6 beats/s are produced. What is the frequency of tuning fork X ?

Watch Video Solution

41. A set of 22 tuning forks is arranged in a series of increasing frequencies. If each fork gives 5 beats per second with the preceding one and last one sounds with the octave of the first, then find the frequencies of the first and the last forks.

Watch Video Solution

Watch Video Solution

42. A sonometer wire is in unison with a tuning fork of frequency 150 Hz. If the tension in the wire is increased by 1%, how many beats per second will be heard ?

Watch Video Solution

43. A sonometer wire of 1 m length is divided into two parts by a movable bridge. The two parts differ by 3mm and produce two beats per second when sounded together. Find their frequencies.

Watch Video Solution

44. A sonometer wire of certain length is stretched under a tension of 5 kgf and vibrates in unison with a tuning fork of unknown frequency. When the tension is changed to 4 kgf, it produces 5 beats per second with the tuning fork. Determine the frequency of tuning fork.

Watch Video Solution

45. Two air columns of resonance tubes of lengths 110 cm and 112 cm give 25 beats in 20 seconds. If each air column is sounding its fundamental mode, calculate the velocity of sound.

Watch Video Solution

46. Two tuning forks give 4 beats/s when sounded together. First tuning fork resounds with a closed air column 20 cm long and second tuning fork resounds with an open air column 40.5 cm long. Determine the individual frequencies of the two tuning forks neglecting end correction.

Watch Video Solution

47. An observer and source are approaching one another with a relative velocity of 50 m/s. If the true frequency of the source is 1000 Hz, determine the observed frequency when

(i) Observer is stationary

(ii) Source is stationary

Watch Video Solution

48. The sirens of two ambulances have a frequency of 500 Hz each. An observer hears the sirem from the two engines, one approaching him with a speed of 18 km/hr and other going away from him at a speed of 36 km/hr. Determine the difference in frequency of two sirens heard by the observer. Take, speed of sound in air = 340 m/s.

Watch Video Solution

49. A man stands on a railway crossing and when a train approaches and recedes from him, he receives frequencies of 2.4 kHz and 1.8 kHz, respectively. Determine the velocity of the train. Take, Speed of sound in air = 320 m/s

Watch Video Solution

50. The frequencies of whistle produced by two persons (X and Y) standing few metres apart, on a quiet day is 550 Hz each. What will be the number of beats heard by each of them in one second when X starts movig towards Y with a velocity of 2 m/s ?

Watch Video Solution

51. A bus standing at a bus stand blows a horn 300 Hz in still air. The speed of sound in still air = 340 m/s.

Determine :

(i) the frequency of the horn heard by a man running away fro the bus at 8 m/s and speed of sound in this case.

(ii) wavelength of sound received by the man.

Watch Video Solution

52. A rocket is movig at a speed of 200 m/s towards a stationary target. While moving, it emits a wave of frequency 1000 Hz. Some of the sound reaching the target gets reflected back to the rocket as an echo. Calculate (a) the frequency of the sound as detected by the target and (b) the frequency of the echo as detected by the rocket.

View Text Solution

53. An ambulance fitted with a siren of v = 400 Hz is going towards a vertical wall at a speed of 54 km/hr. A person standing on the road, behind the ambulance, listens to the siren sound coming from the ambulance as well as that coming after reflection from the wall. Calculate the apparent frequency of the sound wave

(a) directly coming from the siren to the person, and

(b) coming after reflection from the wall

Take, speed of sound = 340 m/s

Watch Video Solution

54. Two buses X and Y are approaching each other and their velocities are 120 km/hr and 140 km/hr, respectively. The frequency of horn emitted by X as heard by the passengers in Y is 1100 Hz. What will be the frequency of the horn heard by the passenger in X. Velocity of sound = 340 m/s.

Watch Video Solution

Problem

1. A metallic rod of length 1m is rigidly clamped at its mid point. Longirudinal stationary wave are setup in the rod in such a way that there are two nodes on either side of the midpoint. The amplitude of an antinode is $2 \times 10^{-6} m$. Write the equation of motion of a point 2 cm from the midpoint and those of the constituent waves in the rod, (Young,s modulus of the material of the rod $= 2 \times 10^{11} Nm^{-2}$, density $= 8000 kg - m^{-3}$). Both ends are free.

Watch Video Solution

2. The frequency of a source of sound is f. A sound wave from this source is moving horizontally twoards right. The wave is reflected from a large vertical plane moving towards left with a speed v.

The speed of sound in medium is C. Find the

(a) number of waves striking the surface per second.

(b) Wavelength and frequency of reflected wave.

(c) beat frequency.

View Text Solution

3. The disturbance of a wave is represented by the equation $y(x, t) = 0.04\cos\left(100\pi t + \frac{\pi}{2}\right)\cos(20\pi x)$ x, y are in m and t is in second.

Find the positions at which

(a) a node will be formed.

(b) an antinode will be formed.

Also find speed and wavelength of the wave.

Watch Video Solution

4. The fundamental frequency of a tube closed at one end is 256 Hz. What should be length of tube on the day when temperature is 23° C. Also find the frequency of fifth overtone. Speed of sound at $0^\circ C$ is 330 m/s.

Watch Video Solution

5. A police car moving with speed 5 m/s is blowing a siren of frequency 600 Hz and travelling towards a vertical wall. Calculate

(a) number of beats heard in 1 s by driver of car.

(b) beats heard by a person standing between car and well.

(c) beats heard by a person standing behind the car. (Speed of sound is 340 m/s)

Watch Video Solution

6. A source of sound of frequency 170 Hz is placed in front of a wall (W'W) at a distance of 3 from it as shown in figure. A detector is also placed in

front of wall at the same distance from the wall.

What will be the minimum distance between source and detector so that maximum sound is heard by dector. Speed of sound is 340 m/s.

View Text Solution

7. The vibrations of a string fixed at both ends are described by the equation $y = (5.00mm)\sin\left[\left(1.57cm^{-1}\right)x\right]\sin\left[\left(314s^{-1}\right)t\right]$

(a) What is the maximum displacement of particle at x = 5.66 cm ? (b) What are the wavelengths and the wave speeds of the two transvers waves that combine to give the above vibration ? (c) What is the velocity of the particle at x = 5.66 cm at time t = 2.00s ? (d) If the length of the string is 10.0 cm, locate the nodes and teh antinodes. How many loops are formed in the vibration ?

Watch Video Solution

8. To one end of a light string, a small source of sound of frequency 1000 Hz is attached. Source is now whirled in a vertical circle of radius 3m. An observer is also located in the same plane at a large distance and at the same height as centre of circle as shown in figure.

(a) What will be the maximum frequency heard by the observer if speed of sound in air is 340 m/s and g = 10 m / s^2.

(b) Calculate the frequency heard by the observer when it is situated at a large distance vertically above centre of circle as shown.

View Text Solution

9. A uniform rod of mass 1.2 kg and length 50 m is supported by two similar and identical wires as shown in figure. At what position of the rod, a 4.8 kg mass should be placed so that the same tuning fork may excite the left side of the wire with fundamental frequency and right side of the

wire with first overtone, (g = 10 m/s^2)

View Text Solution

Practice Problems

1. 1800 waves are passing through a point in 2 minutes in a medium. What will be the wavelength if the speed of wave in the medium is 900 m/s ?

Watch Video Solution

2. A transverse wave of speed 70 m/s is set up in an aluminum wire of diameter 1.60 mm. Calculate the tension in wire if its density is $2.7 \times 10^3 kg/m^3$.

View Text Solution

3. Two points A and B are at a distance of 30 cm on a stretched string. A travelling wave of frequency 300 Hz and velocity 100 m/s is set up in the string. What will be the phase difference between points A and B ?

Watch Video Solution

4. A stone is dropped in a well 107 m deep. If the splash is heard 5 seconds after the stone is dropped, then calculate the speed of sound in air.

Watch Video Solution

5. The sound of a thunder is heard 6 s after the lightning flash from a cloud at an angle of 60° to the horizontal. Calculate the height of cloud above the ground. The velocity of sound in air is 340 m/s.

Watch Video Solution

6. By using (i) Newton's formula and (ii) Laplace's formula, calculate the speed of sound in air at standard pressure and temperature. The density of air is $1.293\ kg/m^3$. γ = 1.4 for air.

Watch Video Solution

7. At NTP, 8g of nitrogen occupies a volume of 22.4 litres. Calculate the speed of sound in nitrogen if γ = 1.6 for nitrogen.

Watch Video Solution

8. Find the depth of sea if longitudinal waves from a ship are sent inside sea and from the bottom of sea, the waves return back after 3s. Density of water $= 10^3 kg/m^3$ and bulk modulus of water = 1960 x $10^6 N/m^2$.

Watch Video Solution

9. Find the temperature at which the speed of sound will be double of its value at $0^{\circ} C$.

Watch Video Solution

10. At STP sound waves of wavelength 2 m are produced in air by a tuning fork of frequency 200 Hz. What will be increase of wavelength at a temperature of $27^{\circ} C$?

Watch Video Solution

11. Find the ratio of velocity of sound in Helium to that in nitrogen at same temperature. The molecular weights of helium and nitrogen are 4 and 28.

Watch Video Solution

12. The frequency of a sound wave propagating in air is 3000 Hz. The waves are propagating from a region where T = 30° C to the region where T = $20^\circ C$. What will be the percentage change of wavelength ?

Watch Video Solution

13. The maximum particle velocity and acceleration of a harmonically moving transverse wave set up on a string are 5 ms^{-1} and $100ms^{-2}$ respectively. Write the equation of waveform if velocity of wave is 30 ms^{-1}.

Watch Video Solution

14. A wave is propagating along the positive direction of X-axis. If the amplitude of wave is 10 cm, frequency 200 Hz and velocity 400 m/s, then write the equation of progressive wave.

Watch Video Solution

15. A travelling harmonic wave is given by $y = 5\cos(20t - 0.0070x + 0.12)$ where x, y are in cm and t is in seconds. Calculate the phase difference between two points separated by a distance of 0.5 m.

Watch Video Solution

16. A sonometer wire of length 0.95 m can bear a maximum stress of $9 \times 10^8 N/m^2$. Calculate the fundamental frequency produced in the wire if density of wire is $8 \times 10^3 kg/m^3$.

View Text Solution

17. Equal forces are applied to stretch two wires of same material and same diameters. The ratio of their lengths is 3 : 4. If the first wire has a frequency of 512 Hz, then calculate the frequency of other wire.

Watch Video Solution

18. A wire is stretched betwween two rigid supports under a tension of 500 N. At a frequency of 360 Hz, the wire resonates. The next higher frequency at which resonance of wire takes place is 420 Hz. What will be the length of wire if mass per unit length of wire is $8 \times 10^{-3} kgm^{-1}$.

Watch Video Solution

19. The vibrational frequency of a string is 300 Hz. The tension in the string is made twice and the length of the string is changed in such a way that it vibrates with a frequency of 600 Hz. What will be the ratio of new length to original length ?

Watch Video Solution

20. The fundamental frequency in a string increases in the ratio 1 : 4 on increasing the tension by 10 kg wt. Calculate the initial tension of the string.

View Text Solution

View Text Solution

21. In an experiment, a string is vibrating making 4 loops when 5 g is placed on the pan. Calculate the mass to be placed on the pan so as to make the string vibrate in 6 loops.

Watch Video Solution

22. The length of a pipe open at both ends is 40 cm. A 1.275 kHz source will resonantly excite which harmonic mode of pipe ? If we close one end of the pipe, will resonance again occur with same source ? Speed of sound in air is 340 m/s.

Watch Video Solution

23. On closing one end of an open pipe, the frequency of fifth harmonic of closed pipe becomes larger by 200 Hz than the fundamental frequency of open pipe. Calcuate the fundamental frequency of open pipe.

Watch Video Solution

24. The frequency of 2^{nd} overtone of an open organ pipe is equal to frequency of first harmonic of a closed organ pipe. If the length of open pipe is 80 cm, then find the length of closed pipe.

Watch Video Solution

25. At 20°C, an open organ pipe produces a note of frequency 256 Hz. What will be the length of pipe if velocity of sound at $0^{\circ}C$ is 340 m/s ?

Watch Video Solution

26. A resonance tube shows resonance with a tuning fork of frequency 256 Hz at column length of 24 cm and 90 cm. What will be the (a) speed of sound in air and (b) end correction ?

Watch Video Solution

27. An organ pipe has a fundamental frequency of 200 Hz. Calculate the frequency of

(a) 2^{nd} harmonic if it is open at both ends.

(b) 2^{nd} harmonic if it is closed at one end.

(c) third overtone if it is closed at one end.

(d) fifth overtone if it is open at both ends.

Watch Video Solution

28. If the second overtone of an open organ pipe is in unison with third overtone of closed organ pipe, calculate the ratio of length of open organ pipe with closed pipe.

Watch Video Solution

29. Two sound waves of wavelengths 2m and 2.02 m produce 20 beats in a gas in 5 seconds. What will be the speed of sound in this gaseous medium ?

Watch Video Solution

30. A tuning fork A produces 5 beats/sec with another tuning fork B of frequency 256 Hz. If tuning fork A produces 1 beats/sec with some other tuning fork C of frequency 250 Hz, then calculate the frequency of fork A.

Watch Video Solution

31. A tuning fork A of frequency f gives 5 beats/s with a tuning fork B of frequency 512 Hz. If on filing A, the number of beats remains same, then find the value of f.

Watch Video Solution

32. A fork of unknown frequency gives 3 beats/sec. when sounded with a fork of frequency 256 Hz. On loading the fork of unknown frequency with wax, the number of beats produced per second remain 3. Calculate the unknown frequency of the fork.

Watch Video Solution

33. The fundamental frequencies of two wires P and Q are 200 Hz and 335 Hz respectively. How many beats could be heard by 5th harmonic of P and third harmonic of Q in 2 s ?

Watch Video Solution

34. A tuning fork A sounded together with another fork B produces 5 beats/s. Fork A is in unison with 0.95 m length of a sonometer and fork B is in unison with 0.98 m length of the sonometer wire. Find the frequency of forks A and B.

Watch Video Solution

35. A car and bike are moving in opposite directions on parallel tracks with speeds of 72 km/h and 60 km/h respectively. A boy sitting in car is continuously sounding a whistle of frequency 400 Hz. Calculate the

frequency of sound heard by person sitting on bike

(a) if car and bike are approaching each other.

(b) if car and bike are moving away from each other.

Watch Video Solution

36. A source of sound is moving towards an observer at rest with a speed V = 0.1 times the speed of sound. Find the apparent freuency as heard by the observer if original frequency is 400 Hz.

Watch Video Solution

37. A gatekeeper in a colony observes a drop of 10% in the pitch of a motor car as it crosses him. Calculate the speed of motor car if velocity of sound is 332 m/s.

Watch Video Solution

38. Two cars are moving towards each other with equal speed of 72 km h^{-1}. First car is emitting continuously a note of frequency 512 Hz. Find the apparent pitch heard by a person in 2^{nd} car before and after they cross each other. (Speed of sound = 340 m/s)

Watch Video Solution

Conceptual Questions

1. If a wave can transfer momentum, can it also transfer angular momentum ?

Watch Video Solution

2. Which of the following is/are not the characteristics of a wave ?

(a) Reflection

(b) Refraction

(c) Interference

(d) Polarisation

(e) Diffraction

(f) Rectilinear propagation

Watch Video Solution

3. Given below are some examples of wave motion. State in each case, if the wave motion is transverse, longitudinal or a combination of both?

(i) Motion of a kink in a long coil spring produced by displacing one end of spring side ways.

(ii) Waves produed in a cylinder containing a liquid by moving its piston back and forth.

(iii) Waves produed by a motor boat sailing in water.

(iv) Light waves travelling from sun to earth.

(v) ultrasonic waves in air produced by a vibrating quartz crystal.

Watch Video Solution

4. Can we produce transverse waves in air ?

Watch Video Solution

5. It is possible to detect a distant train, which still can't be heard, approaching us by placing our ear very near to the railway line. How this works ?

Watch Video Solution

6. Sound travels faster on a rainy day than on a dry day. Does it imply that speed of sound in moist hydrogen is greater than in dry hydrogen ?

Watch Video Solution

7. An explosion takes place at the bottom of a lake. Will the shock waves in the water be longitudinal or transverse?

Watch Video Solution

8. A ballon is filled with NO_2 gas. How will it behave as a lens for sound entering it from air ? Will it be converging or diverging ? What if the gas is now replaced with H_2 gas ?

Watch Video Solution

9. A heavy uniform rope is held vertically and is tensioned by clamping it to a rigid support at the lower end. A wave of a certain frequency is set up at the lower end. Will the wave travel up the rope with the same speed?

Watch Video Solution

10. It is observed in case of stringed instruments sometimes that a thick wire is wrapped by a thin wire. Give reason behind this practice.

Watch Video Solution

11. Why is note produces by an open organ pipe sweeter that that produced by a closed organ pipe of same length?

Watch Video Solution

12. When we start filling an empty bucket with water, the pitch of sound produced goes on changing. Why?

Watch Video Solution

13. If instead of water, the resonance tube is filled with a liquid of density higher than of water , then the resonating frequency

Watch Video Solution

14. The temperature of a vibrating string is increased by heating it. What will happen to the pitch of the note produced by it ?

Watch Video Solution

15. Two organ pipes of same length, open at both ends produce sound of different pitch, if their radii are different. Why?

Watch Video Solution

16. Where should a stretched wire, held between two fixed supports, be plucked and touched to excite its second harmonic ?

Watch Video Solution

17. Can beats be produced when two sources of frequencies 550 Hz and 600 Hz superpose ? Will we be ale to hear the beats ?

Watch Video Solution

18. A person riding on a merry go round emits a sound wave of a certain frequency Does a person at the centre observe the Doppler effect?

Watch Video Solution

19. A source of sound and an observer, both are moving with the same speed, in the same direction. Will there be any Doppler effect observed by the observer ?

Watch Video Solution

20. A scuba diver is deep inside the sea when a source produces loud sound in air which can be heard from far distance. Even though the speed of sound is greater in water, reason out a possibility for why he is not able to hear that sound ?

View Text Solution

21. All harmonics are overtones but all overtones are not harmonics . Explain .

Watch Video Solution

22. An organ pipe is in resonance with a tuning fork. What change will have to be made in the length l to maintain resonance if

(i) temperature increases

(ii) air is replaced by hydrogen

(iii) pressure is made higher ?

Watch Video Solution

23. What is the use of having two prongs of a tuning fork ? If one of the prongs is cut off, would the tuning fork be of any use ?

Watch Video Solution

24. A sonometer wire of certain length L between the bridges resonates with an open organ pipe. If L is now made twice, will the wire be still able to resonate with the same open organ pipe ? Give reason in support of your answer.

Watch Video Solution

25. Doppler's effect in light is symmetrical but the same effect in sound is asymmetrical. Explain.

Watch Video Solution

Ncert Textbook Exercises

1. A string of mass 2.50kg is under a tension os 200N. The length of the stretched string is 20.0m. If the transverse jerk is struck at one end of the string, how long does the disturbance take to reach the other end?

Watch Video Solution

2. A stone dropped from the top of a tower of height 300 m high splashes into the water of a pong near the base of the tower. When is the splash heard at the top ? Given that the speed of sound in air is $340ms^{-1}$? $(g = 9.8ms^{-2}$.

Watch Video Solution

3. A steel wire has a length of 12.0m and a mass of 2.10kg. What should be the tension in the wire so that speed of a transverse wave on the wire equals the speed of sound in dry air at $20^{\circ}C = 343ms^{-1}$.

Watch Video Solution

4. Use the formula $v = \sqrt{\frac{\gamma P}{\rho}}$ to explain why the speed of sound in air (a) is independent of pressure, (b) increases with temperature, (c) increases with humidity.

Watch Video Solution

5. You have learnt that a travelling wave in a dimension is represented by a funcation $y = f(x, t)$ where x and t must appear in the combination $x - vt$ or $x + vt$, i.e $y = f(x \pm vt)$. Is the coverse true? (Examine if the following funcations for y can possibly represent a travelling wave :

(a) $(x - vt)^2$

(b) $\log[(x + v)/x_0]$

(c) $1/(x + v)$

Watch Video Solution

6. A bat emits ultrasonic sound of frequency 1000 kHz in air. If the sound meets a water surface, what is the wavelength of (a) the reflected sound, (b) the transmitted sound ? Speed of sound in air is 340 ms^{-1}, and in water 1486 ms^{-1}.

Watch Video Solution

7. A hospital uses an ultrasonic scanner to locate tumour in a tissue. What is the wavelength of sound in a tissue in which the speed of sound is $1.7 km / s$? The operating frequency of the scanner is $4.2 MHz$.

Watch Video Solution

8. A transverse harmonic wave on a strin is decribed by

$y(x, t) = 3.0 \sin(36t + 0.018x + \pi / 4)$

Where x and y are in cm and t in s. The positive direction of x is from left to right.

(a) Is this a travelling wave or a stationary wave ?

If it is travelling, what are the speed and direction of its propagation ?

(b) What are its amplitude and frequency ?

(c) What is the initial phase at the starting point ?

What is the least distance between two successive crests in the wave ?

Watch Video Solution

9. For the wave described in the displacement (y) versus (t) graphs for x = 0, 2 and 4 cm. What are the shapes of these graphs ? In which aspects does the oscillatory motion in a travelling wave differ from one point to another : amplitude, frequency or phase ?

View Text Solution

10. For the travelling harmonic wave $y(x, t) = 2.0 \cos 2\pi(10t - 0.0080x + 0.35)$, where x and y are in cm and t in s. Calculate the phase difference between oscillatory motion of two points separated by a distance of

(a) 4m

(b) 0.5 m

(c) $\lambda/2$

(d) $\frac{3\lambda}{4}$

Watch Video Solution

11. The transverse displacement of a string (clamped at its two ends) is given by

$$y(x, t) = 0.06 \sin\left(\frac{2\pi}{3}\right) x \cos(120\pi t)$$

wherer x ,y are in m and t ini s. The length of the string is 1.5m and its mass is 3×10^{-2} kg. Answer the following: (i) Does the function represent a travelling or a stationary wave ?

(ii) Interpret the wave as a superimposition of two waves travelling in opposite directions. What are the wavelength, frequency and speed of propagation of each wave ?

(iii) Determing the tension in the string.

Watch Video Solution

12. (i) The transverse displacement of a string (clamped at its two ends) is given by $y(x, t) = 0.06 \sin\left[\frac{2\pi}{3} x\right] \cos 120\pi t,$

where x, y are in m and t is in s.

Do all the points on the string oscillate with the same (a) frequency, (b)

phase, (c) amplitude ? Explain your answers. (ii) What is the amplitude of a point $0.375m$ away from one end?

Watch Video Solution

13. Given below are some functions of x and t to represent the displacement (transverse or longitudinal) of an elastic wave. State which of these represent (i) a travelling wave, (ii) a stationary wave or (iii) none at all?

(a) $y = 2\cos(3x)\sin(10t)$ (b) $y = 2\sqrt{x - vt}$

(c) $y = 3\sin(5x - 0.5t) + 4\cos(5x - 0.5t)$ (d)

$y = \cos x \sin t + \cos 2x \sin 2t$

Watch Video Solution

14. A wire stretched between two rigid supports vibrates in its fundamental mode with a frequency of 45Hz. The mass of the wire is 3.5×10^{-2}kg and its linear mass density is $4.0 \times 10^{-2} kgm^{-1}$. What is

(a) the speed of a transverse wave on the string , and (b) the tension in the string?

Watch Video Solution

15. A metre-long tube open at one end, with a movable piston at the other end, shows resonance with a fixed frequency source (a tuning fork of frequency 340Hz) when the tube length is 25.5cm or 79.3cm. Estimate the speed of sound in air at the temperature of the experiment. The edge effects amy be neglected.

Watch Video Solution

16. A steel rod 100 cm long is clamped at its middle. The fundamental frequency of longitudinal vibrations of the rod is given to be 2.53k Hz. What is the speed of sound in steel?

Watch Video Solution

17. A pipe 20cm long is closed at one end. Which harmonic mode of the pipe is resonantly excited by a 430Hz source? Will the same source be in resonance with the pipe if both ends are open? Take speed of sound in air $340m/s$.

Watch Video Solution

18. Two sitar strings A and B playing the note 'Ga' are slightly out of tune and produce beats of frequency 6 Hz. The tension in the string A is slightly reduced and the beat frequency is found to reduce to 3 Hz. If the original frequency of A is 324 Hz, what is the frequency of B?

Watch Video Solution

19. Explain why (or how) : (a) In a sound wave, a displacement node is a pressure antinode and vice-versa,

(b) Bats can ascertain distances, directions, nature and size of obstacles without any eyes,

(c) a violin note and sitar note may have the same frequency, yet we can distinguish between the two notes, (d) Solids can support both longitudinal and transverse waves, but only longitudinal waves can propagate in gases,

(e) The shape of pulse gets distorted during propagation in a dispersive medium.

Watch Video Solution

20. A train, standing at the outer signal of a railway station blows a whistle of frequency 400Hz in still air. (i) What is the frequency of the whistle for a platform observer when the train (a) approaches the platform with a speed of $10ms^{-1}$, (b) receeds from the platform with a speed of $10ms^{-1}$? (ii) What is the speed of sound in each case ? The speed of sound in still air can be taken as $340ms^{-1}$

Watch Video Solution

21. A train, standing in a stationyard, blows a whistle of frequency 400Hz in still air. The wind starts blowing in the direction from the yard to the station at a speed of $10ms^{-1}$. What are the frequency, wavelength, and speed of sound for an observer standing on the station's platform ? Is the situation exactly identical to the case when the air is still and the observer runs towards the yard at a speed of $10ms^{-1}$? Th speed of sound in still air can be taken as $340ms^{-1}$.

Watch Video Solution

Ncert Additional Exercises

1. A travelling harmonic wave on a string is described by $y(x, t) = 7.5\sin(0.0050x + 12t + \pi/4)$ (a) what are the displacement and velocity of oscillation of a point at $x = 1cm,$ and $t = 1s$? Is this velocity equal to the velocity of wave propagation ?

(b) Locate the point of the string which have the same transverse displacement and velocity as $x = 1cm$ point at $t = 2s, 5s$ and 11s.

Watch Video Solution

2. A narrow sound pulse (for example, a short pip by a whistle) is sent across a medium. (a) Does the pulse have a definite (i) wavelength, (ii) frequency, (iii) speed of propagation ? (b) If the pulse rate is 1 after every $20s$, (i.e. the whistle is blown for a split second after every $20s$) is the frequency of the note produced by the whistle equal to $\frac{1}{20} = 0.05Hz$?

Watch Video Solution

3. One end of a long string of linear mass dnesity $8.0 \times 10^{-3} kgm^{-1}$ is connected to an electrically driven tuning fork of frequency 256 Hz. The other end passes over a pulley and is tied to a pan containing a mass of 90 kg. The pulley end absorbs all the incoming energy so that reflected waves at this end have negligible amplitude. At $t = 0$ the left end (fork end) of the string $x = 0$ has zero transverse displacement $(y = 0)$ and is moving along positive y-direction. The amplitude of the wave is 5.0 cm.

Write down the transverse displacement y as function of x and t that describest the wave on the string.

Watch Video Solution

4. A SONAR system fixed in a submarine operates at a frequency 40.0kHz. An enemy submarine moves towards the SONAR with a speed of 360 km h^{-1}. What is the frequency of sound reflected by the submarine ? Take the speed of sound in water to be 1450 ms^{-1}.

Watch Video Solution

5. Earthquakes generate sound waves inside the earth. Unlike a gas, the earth can experience both transverse (S) and longitudinal (P) sound waves. Typically, the speed of S wave is about 4.0 km s^{-1}, and that of P wave is 8.0 kms^{-1}. A seismograph records P and S waved from an earthquake. The first P wave arrives 4 min before the first S wave. Assuming the waves travel in straight line, how far away does the earthquake occur?

Watch Video Solution

6. A bat is flitting about in a cave, navigating via ultrasonic beeps. Assume that the sound emission frequency of the bat is 40kHz. During one fast swoop directly toward a flat wall surface. The bat is moving at 0.03 times the speed of sound in air. What frequency does the bat hear reflected off the wall ?

Watch Video Solution

Ncert Exemplar Problems

1. The waves produced by a motor boat sailing in water are :

A. neither longitudinal nor transverse

B. both longitudinal and transverse

C. only longitudinal

D. only transverse.

Answer: B

Watch Video Solution

2. Sound waves of wavelength α travelling in a medium with a speed of v m s^{-1} enter into another medium where its speed is 2v m s^{-1}. Wavelength of sound waves in the second medium is

A. λ

B. $\frac{\lambda}{2}$

C. 2λ

D. 4λ

Answer: C

Watch Video Solution

3. Speed of sound waves in air

A. is independent of temperature

B. increases with pressure

C. increases with increase in humidity

D. decreases with increase in humidity.

Answer: C

Watch Video Solution

4. Change in temperature of the medium changes

A. frequency of sound waves

B. amplitude of sound waves

C. wavelength of sound waves

D. loundness of sound waves

Answer: C

Watch Video Solution

5. With the propagation of a longitudinal wave through a material medium, the quantities transmitted in the propagation direction are

A. matter

B. energy

C. energy and matter

D. enegy, matter momentum

Answer: B

Watch Video Solution

6. Which of the following statements are true for wave motion ?

A. Mechanical transverse waves can propagate through all mediums

B. Longitudinal waves can propagate through solids only.

C. Mechanical transverse waves can propagate through solids only.

D. Longitudinal waves can propagate through vacuum.

Answer: C

Watch Video Solution

7. A sound wave is passing through air column in the form of compression and rerefactions. In consecutive compressions and rerefactions.

A. density remains contant

B. Boyle's law is obeyed

C. bulk modulus of air oscillates

D. there is no transfer of heat.

Answer: D

Watch Video Solution

8. Equation of a plane progressive wave is given by $y = 0.6 \sin 2\pi\left(t - \frac{x}{2}\right)$. On reflection from a denser medium, its amplitude becomes $2/3$ of the amplitude of the incident wave. The equation of the reflected wave is

A. $y = 0.6 \sin 2\pi\left(t + \frac{x}{2}\right)$

B. $y = -0.4 \sin 2\pi\left(t + \frac{x}{2}\right)$

C. $y = 0.4 \sin 2\pi\left(t + \frac{x}{2}\right)$

D. $y = -0.4 \sin 2\pi\left(t - \frac{x}{2}\right)$

Answer: B

Watch Video Solution

9. A string of mass 2.50kg is under a tension os 200N. The length of the stretched string is 20.0m. If the transverse jerk is struck at one end of the string, how long does the disturbance take to reach the other end?

A. 1 second

B. 0.5 second

C. 2 second

D. data given is insufficient

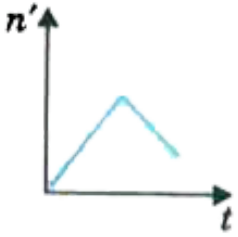
Answer: B

Watch Video Solution

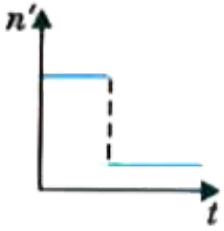
10. A train whistling at constant frequency is moving towards a station at a constant speed V. The train goes past a stationary observer on the station. The frequency n' of the sound as heard by the observer is plotted as a function of time t, figure. Identify the expected curve.

A.

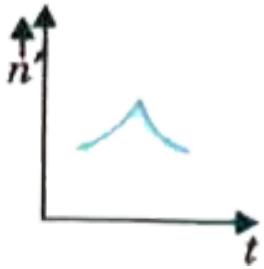
B.



C.



D.



Answer: C

Watch Video Solution

11. A transverse harmonic wave on a string is descrbed by $y(x, t) = 3.0 \sin\left(36t + 0.018x + \frac{\pi}{4}\right)$ where x and y are in cm and t is in s. The position direction of x is from left to right.

A. The wave is travelling from right to left

B. The speed of the wave is 20 m/s

C. Frequency of the wave is 5.7 Hz.

D. The least distance between two successive creasts in the wave is 2.5 cm.

Answer: A::B::C

Watch Video Solution

12. The displacement of a string is given by $y(x, t) = 0.06 \sin(2\pi x / 3)\cos(120\pi t)$ where x and y are in m and t in s. The lengthe of the string is 1.5m and its mass is $3.0 \times 10^{-2} kg$.

A. It represents a progressive wave of frequency 60 Hz.

B. It represents a stationary wave of frequency 60 Hz.

C. It is the result of superposition of two waves of wavelength 3m, frequency 60 Hz each travelling with a speed of 180 m/s in opposite direction.

D. Amplitude of this wave is constant.

Answer: B::C

Watch Video Solution

13. Speed of sound waves in a fluid depends

A. directly on density of the medium

B. square of bulk modulus of the medium

C. inversely on the square roots of density

D. directly on the square root of bulk modulus of the medium.

Answer: C::D

Watch Video Solution

14. During propagation of a plane progressive mechanical wave,

A. all the particles are vibrating the same phase

B. amplitude of the particles is equal

C. particles of the medium excutes S.H.M.

D. wave velocity depends upon the nature of the medium.

Answer: B::C::D

Watch Video Solution

15. The transverse displacement of a string (clamped at its both ends) is given by $y(x, t) = 0.06 \sin(2\pi x / 3)\cos(120\pi t)$.

All the points on the string between two consecutive nodes vibrate with

A. same frequency

B. same phase

C. same energy

D. different amplitude.

Answer: A::B::D

Watch Video Solution

16. A train, standing in a station yard, blows a whistle of frequency 400Hz in still air. The wind starts blowing in the direction from the yard to the station with a speed of 10m//s. Given that the speed sound in still air is `34om//s,

A. the frequency of sound as heard by an observer standing on the platform is 400 Hz

B. the speed of sound for the observer standing on the platform is 350 m/s

C. the frequency of sound as heard by the observer standing on the platform will increase

D. the frequency of sound as heard by the observer standing on the platform will decrease.

Answer: A::B

Watch Video Solution

17. Which of the following statements are true for a stationary wave ?

A. Every particle has a fixed amplitude which is different from the amplitude of its nearest particle.

B. All the particles cross their mean position at the same time.

C. All the particles are oscillating with same amplitude.

D. There are some particles which are always at rest.

Answer: A::B::D

Watch Video Solution

18. A sonometer wire is vibrating is resonance with a tuning fork. Keeping the tension applied same, the length of the wire is doubled. Under what conditions would the tuning fork still be in resonance with the wire?

Watch Video Solution

19. An organ pipe of length L open at both ends is found to vibrate in its harmonic when sounded with a tuning fork of 480Hz. What should be the length of a pipe closed at one end, so that it also vibrates in its first harmonic with the same tuning fork?

Watch Video Solution

20. A tuning fork A, marked 512 Hz, produces 5 beats per second, when sounded with another unmarked tuning fork B. If B is loaded with wax,

the number of beats is again 5 per second. What is the frequency of tuning fork B when not loaded?

Watch Video Solution

21. The displacement of an elastic wave is given by the function $y = 3\sin\omega t + 4\cos\omega t$.

where y is in cm and t is in second. Calculate the resultant amplitude.

Watch Video Solution

22. A sitar wire is replaced by another wire of same length and material but of three times the earlier radius. If the tension in the wire remains the same, by what factor will the frequency change ?

Watch Video Solution

23. At what temperatures $(in^{\circ}C)$ will the speed of sound in air be 3 times its value at $O^{\circ}C$?

Watch Video Solution

24. When two waves of almost equal frequencies n_1 andn_2 reach at a point simultaneously, what is the time interval between successive maxima ?

Watch Video Solution

25. A steel wire has a length of 12 m and a mass of 2.10 kg. What will be the speed of a transverse wave on this wire when a tension of 2.06×10^4 N is applied ?

Watch Video Solution

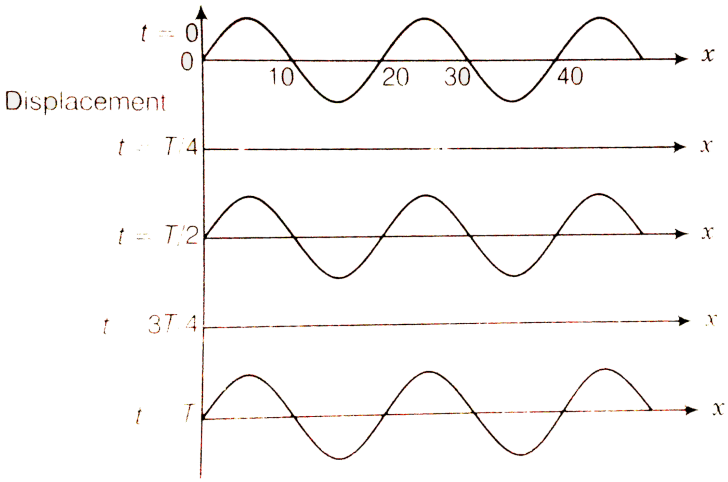
26. A pipe 20 cm long is closed at one end. Which harmonic mode of the pipe is resonantly excited by a source of 1237.5 Hz ? (sound velocity in air $= 330ms^{-1}$)

Watch Video Solution

27. A train standing at the outer signal of a railway station blows a whistle of frequency 400Hz in still air. The train begins to move with a speed of $10ms^{-1}$ towards the platform. What is the frequency of the sound for an observer standing on the platform ? (sound velocity in air $= 330ms^{-1}$)

Watch Video Solution

28. The wave pattern on a stretched string is shown in figure . Interpret what kind of wave this is and find its wavelength

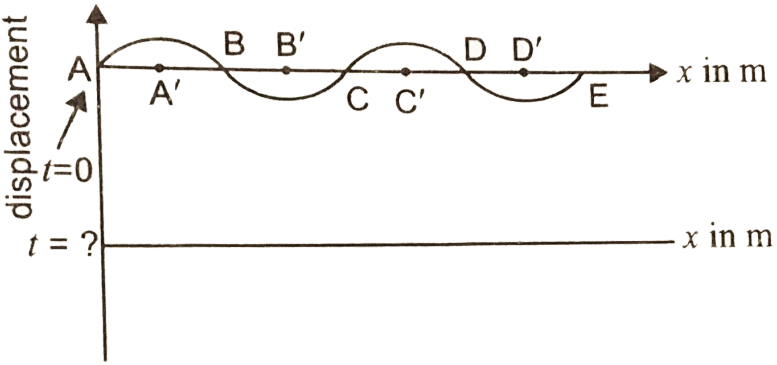


Watch Video Solution

29. The pattern of standing waves formed on a stretched strinig at two instants of time are shown in figure. The velocity of two waves superimposing to form stationary wave is $360ms^{-1}$ and their frequencies are 256 Hz.

(a) Calculate the time at which the second curve is plotted. ltbr. (b) Mark nodes and antinodes on the curve.

(c) Calculate the distance between A' and C'.



Watch Video Solution

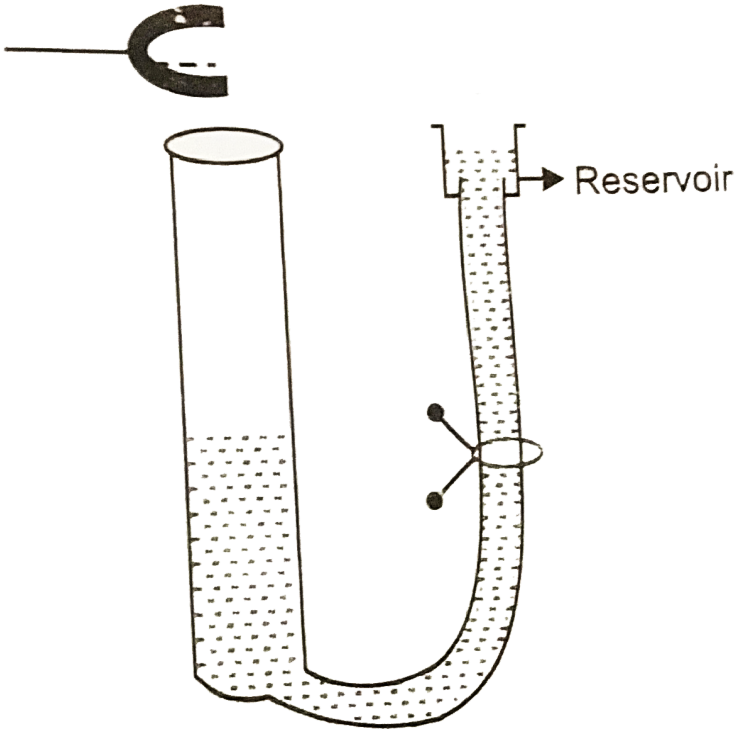
30. A tuning fork vibrating with a frequency of 512 Hz is kept close to the open end of a tube filled with water , figure. The water level in the tube is gradually lowerd. When the water level is 17cm below the open end, maximum intensity of sound in heard. If the room temperature is $20^\circ C$, calculate

(a) speed of sound in air at room temperature.

(b) speed of sound in air at $0^\circ C$

(c) if the water in the tube is replaced with mercury, will there be any

difference in your observations?



Watch Video Solution

31. Show that when a string fixed at its two ends vibrates in 1 loops, 2 loops , 3 loops and 4 loops , the frequencies are in the ratio $1:2:3:4$.

Watch Video Solution

High Order Thinking Skills Advanced Level

1. The second overtone of an open organ pipe beats with the third overtone of the closed organ pipe. The beat frequency is 3.3 Hz. What will be the length of pipes if fundamental frequency of closed organ pipe is 120 Hz ?

Velocity of sound = 340 m/s

Watch Video Solution

2. A guard on duty observes a fall of 25% in the pitch of the silencer of a motor bike as it crosses him. What will be the speed of car if velocity of sound is 340 m/s ?

View Text Solution

3. A piezoelectric quartz plate of thickness 5mm is vibrating is resonance. Calculate its fundamental frequency if for quartz.

$Y = 8 \times 10^{10} N/m^2$ and $\rho = 2.65 \times 10^3 kg/m^3$.

Watch Video Solution

4. A source of sound of frequency 256 Hz is rotating in a circle of radius 3 m with angular speed of 20 rad/s. A listener is standing at rest along the line of centre of the circle. Under which position of the source of sound the listener will hear sound of

(a) maximum frequency

(b) minimum frequency

(c) same frequency as the frequency of source.

Watch Video Solution

5. Two wires are stretched under tension of T_1 and T_2 such that $T_2 > T_1$, producing 4 beats per seconds on vibrating. When the tension in one of them is changed slightly even then the beat frequency remains 4. Which of the two T_1 or T_2 should be increased or decreased ?

Watch Video Solution

6. A sinusoidal transverse wave of amplitude 10^{-2} m, wavelength λ, frequency f is travelling with speed (V = 20 m/s) on a stretched string. If the maximum speed at any point of the string is $\frac{V}{5}$ then find the frequency and wavelength of the wave.

Watch Video Solution

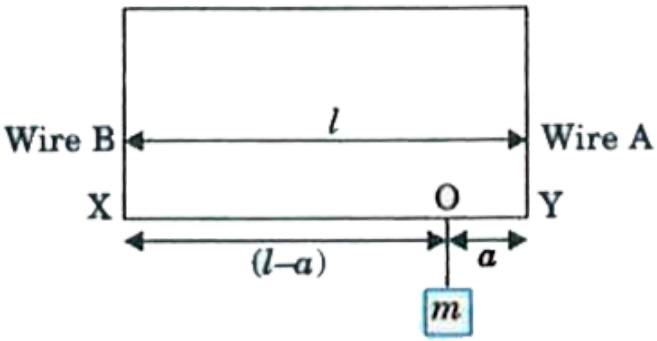
7. An ideal gas expands from an initial temperature T_1 to a final temperature T_2. Prove that the work done by the gas is $C_V(T_2 - T_2)$.

Watch Video Solution

8. A wire when stretched between two rigid supports under a tension of 60 N vibrates in p loops. The frquency at which the wire resonates is 318 Hz and the next frequency when it resonates is 390 Hz. Find the values of p and length of wire if mass per unit length of the wire is 10^{-4} kg/m.

Watch Video Solution

9. From two identical wires, a rod XY of length l is hung. A wooden block of mass m is hung at point O of the rod at a distance a from wire A. Find the value of a in the case when a tuning fork excites the fundamental note in wire A and third harmonic in wire B.



Watch Video Solution

10. Three sinusoidal displacements are applied in X-direction to a point mass in such a way that total displacement is zero and the mass comes to rest. What are the values of B and ϕ if the equations are

$x_1(t) = A \sin 2\omega t$

$x_2(t) = A\sin\left(2\omega t + \frac{4\pi}{3}\right)$

$x_3(t) = B\sin(2\omega t + \phi)$

Watch Video Solution

11. From a rigid support, a rope of mass M is hung vertically. To the free end of this rope, a wooden block of mass m is attached. At the lower end of rope, a transverse pulse of wavelength λ is produced. What will be wavelength of pulse when it reaches the top of the rope ?

Watch Video Solution

12. Two identical wires are put under same tension and have same frequency of vibration. When tension in one of the wire is increased by 2%, then 6 beats/sec can be heard. What will be the original frequency of the wires ?

Watch Video Solution

13. The frequency of two continuous overtones of a vibrating string are 290 Hz and 340 Hz.

(a) What will be the frequency of the fundamental note formed ?

(b) By how many decibels will the intensity level change if amplitude of the sound wave is made 2 times ?

Watch Video Solution

14. Two sound waves are originating from a single source. They are travelling along different paths in air before meeting at a point. If the source is vibrarting with frequency of 2 kHz and one path is 58 cm longer than the other path then discuss the nature of interference. Speed of sound in air is 336 m/s.

Watch Video Solution

15. 6 beats are produced in 3 seconds by two tuning forks T and T'. T resounds with a closed air column 20 cm long and T' is resounding with

an open column 42 cm long. Neglecting end correction, find the frequencies of two forks.

Watch Video Solution

Revision Exercises

1. Define the term wave motion.

Watch Video Solution

2. What are matter waves ?

Watch Video Solution

3. What are longitudinal waves and transverse waves ?

Watch Video Solution

4. Is it possible to have longitudinal waves on a string? A transverse wave in a steen rod?

Watch Video Solution

5. Transverse wave motion is possible in which media : solid, liquid, gases

Watch Video Solution

6. Define crest and trough.

Watch Video Solution

7. Longitudinal waves are possible in

Watch Video Solution

8. Which property is common in all types of mechanical waves?

Watch Video Solution

9. On plucking the wire of a sonometer, which type of waves are produced in a string and in the air ?

Watch Video Solution

10. What is the effect of pressure on speed of sound in air?

Watch Video Solution

11. What is the distance between a compression and its nearest rarefaction in a longitudinal wave?

Watch Video Solution

12. What is the effect of temperature on the speed of sound ?

Watch Video Solution

13. In which medium the speed of sound is greater : in moist air or in dry air ?

Watch Video Solution

14. What will be the the time period of a vibrating source if the wavelength is 4 m and velocity of sound is 340 m/s ?

Watch Video Solution

15. Can sound waves travel through vacuum ?

Watch Video Solution

16. How velocity of sound in a gaseous medium is affected by the density of the meidum ?

Watch Video Solution

17. What is the effect of pitch and loudness on the velocity of sound ?

Watch Video Solution

18. Stethoscope used by doctors is based on which phenomenon ?

Watch Video Solution

19. What is the shape of the graph between the pressure and speed of sound in a gaseous medium ?

Watch Video Solution

20. State the principle of superposition of waves.

Watch Video Solution

21. Stationary waves are formed when

Watch Video Solution

22. Why is a stationary wave so named?

Watch Video Solution

23. What are the positions of maximum and minimum displacements called in a stationary wave ?

Watch Video Solution

24. The distance between any two successive nodes or antinodes is

Watch Video Solution

25. What is the distance between a node and an adjoining antinode in a stationary wave?

Watch Video Solution

26. A string is vibrating in n loops. The numbers of nodes and anitnodes respectively are

Watch Video Solution

27. The fundamental frequency of an open organ pipe is 256 Hz. What will be its value if one of its end is closed ?

Watch Video Solution

28. Harmonics and overtones .

Watch Video Solution

29. In an open organ pipe, second harmonic is 400 Hz. Find the frequency of sixth harmonic.

Watch Video Solution

30. What is the essential condition for the formation of beats?

Watch Video Solution

31. What is the difference between a tone and a note?

Watch Video Solution

32. Is Doppler effect applicable only to sound waves.

Watch Video Solution

33. Why cannot we hear an echo in a small room ?

Watch Video Solution

34. What determines the quality of sound ?

Watch Video Solution

35. What is meant by fidelity of instrument ?

Watch Video Solution

36. On which factor the pitch of the sound depends ?

Watch Video Solution

37. Where will a person hear maximum sound, at node or antinode?

Watch Video Solution

38. DOPPLER EFFECT

Watch Video Solution

39. In a stationary longitudinal wave, nodes are points of

A. pressure variation is maximum

B. amplitude is maximum

C. the particles execute simple harmonic motion

D. the particles can never be at rest

Answer: A

Watch Video Solution

40. Doppler effect is applicable for

A. only sound waves

B. only light waves

C. both of them

D. none of these

Answer: C

Watch Video Solution

41. According to Newton, when a wave passes through a gas, changes taking place in pressure and volume of air are

A. isothermal

B. isobaric

C. isochoric

D. adiabatic

Answer: A

Watch Video Solution

42. Where should a stretched wire, held between two fixed supports, be plucked and touched to excite its second harmonic ?

Watch Video Solution

43. When a wave coming from a medium where its velocity is..... meets a medium where its velocity is....., it is reflected back with a reversal of phase.

Watch Video Solution

44. During the formation of a stationary wave, the medium is broken into loops between equally spaced points called.....

Watch Video Solution

45. The second overtone can also be called as .....harmonic.

Watch Video Solution

46. .....is a musical instrument in which sound is produced by setting an air column into vibrations.

Watch Video Solution

47. In an.....Organ pipe, both odd and even harmonics are present.

Watch Video Solution

48. If the prong of a tuning fork is filed, its frequency.....and if it loaded with wax, its frequency.....

Watch Video Solution

49. Pitch of the sound appears to.....when the source of sound moves away from the observer.

Watch Video Solution

50. When the observer is at rest and the source moves with a supersonic speed, the resultant wave motion is a conical wave known as..... wave.

Watch Video Solution

51. What is a wave function ? Write its general form.

Watch Video Solution

52. Distinguish between periodic and harmonic wave function.

Watch Video Solution

53. Distinguish between longitudinal and transverse waves.

Watch Video Solution

54. State Newton's formulas for velocity of sound in air. Point out the error and hence discuss Laplace's correction.

Watch Video Solution

55. What are the major points of difference between sound waves and light waves ?

Watch Video Solution

Watch Video Solution

56. What are the factors on which the frequency of vibration of a stretched string depends ? Explain.

Watch Video Solution

57. Discuss the dependence of velocity of sound on temperature and density of a medium.

Watch Video Solution

58. Show that the pressure is independent of the velocity of sound.

Watch Video Solution

59. What do you mean by temperature coefficient of the velocity of sound ? Explain.

Watch Video Solution

60. What do you mean by reflection of sound waves ? What are various applications of this phenomenon ?

Watch Video Solution

61. State the principle of superposition of waves. Derive an expression for the resultant wave formed due to superposition of two waves.

Watch Video Solution

62. Why all the stringed instruments are provided with hollow boxes?

Watch Video Solution

63. Does the speed of light waves also depend on the temperature like sound waves ?

Watch Video Solution

64. While going up in the atmosphere, how the velocity of sound changes ?

Watch Video Solution

65. What is meant by beats? Discuss graphical method of beats.

Watch Video Solution

66. What would a person hear, if he moves away from a source of sound with the speed of sound?

Watch Video Solution

67. Set up a relation between speed of sound in a gas and root mean sqare velocity of the molecules of that gas.

Watch Video Solution

68. What will be the effect on the fundamental frequency of a closed organ pipe if instead of air it is filled with a gas lighter than air ?

Watch Video Solution

69. The frequency of sound emitted by two wires is 250 Hz each. To hear 10 beats per second, how much percentage increase of tension of the wire should take place ?

Watch Video Solution

70. Discuss some charcteristics of standing waves.

Watch Video Solution

71. Establish relation between particle velocity and wave velocity.

Watch Video Solution

72. Describe the factors on which the pitch of a tuning fork depends.

Watch Video Solution

73. Show that the Doppler effect in sound is asymmetric.

Watch Video Solution

74. How do you use the phenomenon of beats for determination of unknown frequencies ?

Watch Video Solution

75. Deduce the relations for (a) particle velocity (b) particle acceleration

Watch Video Solution

76. Obtain the equation of a plane progressive simple harmonic wave.

Watch Video Solution

77. Derive an expression for the speed of transverse waves on a stretched string.

Watch Video Solution

78. Discuss the effect of (i) density (ii) pressure (iii) temperature (iv) humidity (v) wind velocity on the velocity of sound.

Watch Video Solution

79. Discuss the formation of stationary waves in a string using graphical method.

Watch Video Solution

80. Discuss the formation of stationary waves in a string fixed at both the ends and also explain different modes of vibration.

Watch Video Solution

81. Discuss the formation of stationary waves in a closed organ pipe and also explain different modes (nodes, antinodes, overtones) of vibration.

Watch Video Solution

82. Discuss the experimental demonstration of the formation of beats. How can we find the unknown frequency of a fork (i) by loading with wax (ii) by filing fork ?

Watch Video Solution

83. The frequency of a vibrating tuning fork is 256. Calculate the wavelength if velocity of sound is 340 ms^{-1}.

Also calculate the distance travelled by a sound wave in air during the time when the fork makes 100 vibrations.

Watch Video Solution

84. At one end of a steel bar of 1 kilometre length, a source of sound is placed and two sounds are heard at the other end at an interval of 2.74

seconds. Calculate the velocity of sound in steel if velocity of sound in air is 340 ms^{-1}.

Watch Video Solution

85. The length of a steel wire is 0.82 m and its mass is 4×10^{-3} kg. Calculate the speed of transverse waves on the wire if the wire is under a tension of 80 N.

Watch Video Solution

86. The speed of transverse waves produced in a copper wire is 40 m/s. Calculate the tension developed in the wire if diameter of wire is 1.8 mm and density of wire is $8.9 \times 10^{3} kgm^{-3}$.

Watch Video Solution

87. What will be the speed of sound in water if volumetric strain of water is 4×10^{-5} at a pressure of $10^5 N/m^2$?

Watch Video Solution

88. At normal temperature and pressur, 4g of He occupies a volume of 22.4 litre. Determine the speed of sound in helium. Take 1 atmospheric pressure $= 10^5 N/m^2$ and γ for helium $= 1.67$.

Watch Video Solution

89. The speed of sound in air at NTP is 340 m/s. What will be the speed of sound in hydrogen at $500^\circ C$ temperature and 2 atmospheric pressure ? Assuming air is 16 times heavier than hydrogen.

Watch Video Solution

90. Find the temperature at which speed of sound in nitrogen is equal to speed of sound in chlorine at $20^\circ C$. The densities of nitrogen and chlorine are in ratio 14 : 35.

Watch Video Solution

91. The frquency of a sound wave propagating in air is 3000 Hz. The waves were initially in region where $T = 30^\circ C$ and then enter in the region where $T = 10^\circ C$. Calculate the percentage change in wavelength.

Watch Video Solution

92. The molecular weights of helium and oxygen are 4 and 16 respectively at $27^\circ C$. What will be the ratio of velocity of sound in helium $(\gamma = 5/3)$ to oxygen $\left(\gamma = \frac{7}{5}\right)$?

Watch Video Solution

93. A wave travelling along a string is given by $y(x, t) = 20 \sin 2\pi(t - 0.003x)$ x, y are in cm and t is in seconds.

Find the amplitude, frequency, wavelength and velocity of the wave.

Watch Video Solution

94. A plane progressive wave is propagating along positive direction of X-axiss where frequency is 100 Hz, amplitude is 20 cm and velocity is 300 m/s. Find the equation of wave.

Watch Video Solution

95. Two particles of a medium are vibrating due to a wave propagating through the medium. If the phase difference between these particles is $\frac{\pi}{3}$ and distance between the particles is 10 cm then calculate the wavelength of wave.

Watch Video Solution

96. Write the equation of a stationary wave whose constituting waves have velocity, amplitude and frequency as 150 cm/s, 10 cm and 50 Hz respectively.

Watch Video Solution

97. The fundamental note of a stretched wire is 128 Hz. If we increase the length by 20 cm keeping the stretching force constant, the frequency becomes 110 Hz. What will be the original length of the wire ?

Watch Video Solution

98. A wire stretched between two ends of a sonometer wire is of length 200 cm. What should be the position of wedges so that the fundamental frequency of three parts will have the ratio 1 : 3 : 5.

Watch Video Solution

99. A string is vibrating in 4 loops when a mass of 10 g is placed on a pan attached to the string. To make the string vibrate in 10 loops how much mass should be placed on the pan ?

Watch Video Solution

100. The string length of an instrument is 100 cm and fundamental frequency is 120 Hz. To get a fundamental frquency of 150 Hz, where it should be pressed ?

Watch Video Solution

101. On increasing the tension in the string by 10 kg wt, the fundamental frequency increases in the ratio of 1 : 2. Calculate the initial tension in the string.

Watch Video Solution

102. Calculate the fundamental frequency of an open organ pipe of length 0.7 m. What will be the fundamental frequency if one end of the pipe is closed. The velocity of sound in air = 340 m/s.

Watch Video Solution

103. Calculate the ratio of length of an open organ pipe to closed organ pipe if the third overtone of open pipe is in unison with the fifth overtone of closed pipe.

Watch Video Solution

104. A tuning fork of frequency 512 Hz produces 6 beats per sec. with vibrating string of an instrument. On increasing the tension in the string, the beat frequency reduces to 3 beats/sec. Find the original frequency of the instrument.

Watch Video Solution

105. Calculate the velocity of sound when two resonance tubes 100 cm and 102 cm give 40 beats in 25 seconds sounding with fundametnal mode.

Watch Video Solution

106. What will be the velocity of source of sound if the apparent frequency received by a stationary observer is double of the original frquency ? Velocity of sound is 340 m/s.

Watch Video Solution

107. Two cars P and Q are approaching each other with velocities of 36 km/h and 72 km/h respectively.

The frequency of a note emitted by car P as heard by the person sitting in car Q is 850 Hz. What will be the frequency of note heard by person sitting in car P ? Velocity of sound = 340 m/s.

Watch Video Solution

Watch Video Solution

Multiple Choice Questions

1. A transverse harmonic wave is described by $y(x, t) = 0.05 \sin \pi(4t - 0.03x)$ (x is in metre). What will be the instantaneous phase difference between two points separated by 20 cm ?

A. $\frac{\pi}{200}$ rad

B. $\frac{\pi}{800}$ rad

C. $\frac{6\pi}{1000}$ rad

D. $\frac{\pi}{670}$ rad

Answer: C

Watch Video Solution

2. The amplitude of a wave produced in a string is 5 cm. The wave is moving along positive direction of X-axis with a speed of 150 m/s and 5 vibrations are completed in 3 m length of the string. The equation representing the wave will be

A. $0.05\sin(5t - 100t)$

B. $0.05\sin(10.4x - 1571t)$

C. $0.09\sin(10.9x - 2000t)$

D. $0.05\sin(9x - 1000t)$

Answer: B

Watch Video Solution

3. A simple harmonic wave is represented as $y = 5\sin\frac{\pi}{2}(100t - 2x)$ x, y are in metres, t in seconds.

The ratio of maximum particle velocity to wave velocity will be

A. 2π

B. 3π

C. 4π

D. 5π

Answer: D

Watch Video Solution

4. In a sonometer experiment, two wires are fixed whose tensions are in the ratio of 4 : 1, lengths in the ratio of 29 : 26 and diameter are in ratio of 2 : 1 and densities are in ratio of 4 : 5. What will be the frequency of beats produced if the frequency of note of higher pitch is 400 s^{-1} ?

Watch Video Solution

5. The speed of sound waves in air is 340 m/s and 5600 m/s through steel. The wavelength of a 1000 Hz acoustic wave travelling from air to steel will

A. decrease by a factor 15

B. increase by a factor 20

C. decrease by a factor 10

D. increase by a factor 16.5

Answer: D

Watch Video Solution

6. A pipe closed at one end resonates with sound waves of frequency 77 Hz and with 99 Hz. What will be frequency of fundamental note if the pipe does not resonate with any intermediate frequency between the two ?

A. 11 Hz

B. 22 Hz

C. 10 Hz

D. 12 Hz

Answer: A

Watch Video Solution

7. A cylindrical tube of fundamental frequnecy 20 Hz in air is open at both the ends. The tube is now half dipped in a liquid. What will be the fundamenntal frequency of air column in this case ?

A. 20 Hz

B. 10 Hz

C. 30 Hz

D. 40 Hz

Answer: A

Watch Video Solution

8. A motor bike is initially at rest. It then starts and further accelerates by 3 m/s^3. At the rest position or at the starting point of motion there is a loud strong and stationary electric siren. What will be the distance travelled by the bike if the biker hears the siren frequency at 80% of its value when the bike was at rest. Speed of sound = 340 m/s.

A. 770.7 m

B. 467.8 m

C. 234 m

D. 500 m

Answer: A

Watch Video Solution

9. Towards a stationary object, a train is moving with a speed of 300 m/s and emits a sound wave of frequency 2000 Hz. Small percentage of the sound is reflected back to train in the form of echo. The frequency of the

echo as detected by a person sitting in the train will be (speed of sound is 340 m/s).

A. 31000 Hz

B. 35000 Hz

C. 32000 Hz

D. 45000 Hz

Answer: C

Watch Video Solution

10. The progressive waves produced by two sources of sound placed close to each other are given as

$y_1 = 5 \sin 300\pi t$

$y_2 = 10 \sin 290\pi t$

An observer standing near these two sources will observe.

A. 3 beats/sec

B. 4 beats/sec

C. 5 beats/sec

D. 6 beats/sec

Answer: C

Watch Video Solution

11. A string of length l is divided into four segments of fundamental frequencies f_1, f_2, f_3, f_4 respectively. The original fundamental frequency f of the string is given by

A. $f^2 = f_1^2 + f_2^2 + f_3^2 + f_4^4$

B. $\frac{1}{\sqrt{f}} = \frac{1}{\sqrt{f_1}} + \frac{1}{\sqrt{f_2}} + \frac{1}{\sqrt{f_3}} + \frac{1}{\sqrt{f_3}}$

C. $\frac{1}{f} = \frac{1}{f_1} + \frac{1}{f_2} + \frac{1}{f_3} + \frac{1}{f_4}$

D. $f = f_1 + f_2 + f_3 + f_4$

Answer: C

Watch Video Solution

12. A tuning fork of frequency 256 Hz is producing 5 beats/sec with the vibrating string of a sitar. On increasing the tension in the string, the beat frequency becomes 3 beats/sec. The initial frequency of sitar before increasing the tension is

A. 256 Hz

B. 251 Hz

C. 261 Hz

D. 253 Hz

Answer: B

Watch Video Solution

13. The level of sound is attenuated by 30 dB by a sound absorber. The intensity of sound will decrease by a factor of

A. 100

B. 1000

C. 2000

D. 30

Answer: B

Watch Video Solution

14. A tuning fork A of frequency 512 Hz sounded with another tuning fork B gives 5 beats/sec. On loading B with a piece of wax, and on sounding, again 5 beats/sec are produced. Calculate the frequency of fork B.

A. 517 Hz

B. 500 Hz

C. 600 Hz

D. 567 Hz

Answer: A

Watch Video Solution

15. A train moving with a velocity of 18 km/hr blows a whistle which is heard by a motor cyclist driving with speed of 6 km/h with the frequency received as 200 cps. The actual frequency when train and motor cyclist are moving in opposite directions and approaching towards each other will be (Speed of sound is 340 m/s, cps is cycle per second)

A. 150 cps

B. 180.5 cps

C. 196 cps

D. 200 cps

Answer: C

Watch Video Solution

16. The fundamental frequency of a closed organ pipe is equal to frequency of 2^{nd} overtone of an open organ pipe. What will be the length of open pipe if length of closed pipe is 20 cm ?

A. 40 cm

B. 80 cm

C. 120 cm

D. 100 cm

Answer: C

Watch Video Solution

17. The tension produced in a sonometer wire is 60 N and the length between two bridges is 40 cm. The length of wire is 1 m and the mass of the wire is 2g. The speed of transverse waves produced in the wire is

A. 100 m/s

B. 173.2 m/s

C. 200 m/s

D. 150 m/s

Answer: B

Watch Video Solution

18. Which of the following is incorrect for a vibrating string, in n^{th} harmonic mode of vibration

A. The number of nodes are (n + 1)

B. The number of antinodes are n

C. The frequency of vibration in vn

D. The number of nodes are n.

Answer: D

Watch Video Solution

19. If tension in a sonometer wire is increased by 50% then fundamental frequency of the wire will be increased by 10 Hz. Assuming length as invariable, the frequency of the wire will be

A. 45.4 Hz

B. 55.4 Hz

C. 65.4 Hz

D. 70 Hz

Answer: A

Watch Video Solution

20. A closed organ pipe in 3^{rd} harmonic and an open organ pipe in 5^{th} harmonic mode are in resonance with a tuning fork P. The ratio of lengths of closed to open organ pipe will be

A. $3:10$

B. $10:3$

C. $5:4$

D. $10:5$

Answer: A

Watch Video Solution

21. Two points are located at a distance of $10m$ and $15m$ from the source of oscillation. The period of oscillation is 0.05s and the velocity of the wave is $300m/s$. What is the phase difference between the oscillation of two points?

A. $\frac{2\pi}{3}$

B. π

C. $\frac{\pi}{6}$

D. $\frac{\pi}{3}$

Answer: A

Watch Video Solution

22. The fundamental frequency in an open organ pipe is equal to the third harmonic of a closed organ pipe. If the length of the closed organ pipe is 20 cm, the length of the open organ pipe is

A. 12.5 cm

B. 8 cm

C. 13.2 cm

D. 16 cm

Answer: C

Watch Video Solution

23. A wave in a string has an amplitude of $2cm$. The wave travels in the $+ve$ direction of x axis with a speed of $128ms^{-1}$ and it is noted that 5 complete waves fit in $4m$ length of the string. The equation describing the wave is

A. $y = (0.02)\sin(15.7x - 2010t)$

B. $y = (0.02)\sin(15.7x + 2010t)$

C. $y = (0.02)\sin(7.85x - 1005t)$

D. $y = (0.02)\sin(7.85x + 1005t)$

Answer: C

Watch Video Solution

24. Each of the two strings of length $51.6cm$ and $49.1cm$ are tensioned separately by $20N$ force. Mass per unit length of both the strings is same and equal to $1g/m$. When both the strings vibrate simultaneously, the number of beats is

A. 7

B. 8

C. 3

D. 5

Answer: A

Watch Video Solution

25. A transverse wave is represented by $y = A\sin(\omega t - kx)$. For what value of the wavelength is the wave velocity equal to the maximum particle velocity?

A. $2A\pi$

B. A

C. $\pi A/2$

D. πA

Answer: A

Watch Video Solution

26. A tuning fork vibrating at frequency 800 Hz produces resonance in a resonance column tube. The upper end is open and the lower end is closed bythe water surface which can be varied. Successive resonances are observed at lengths 9.75 cm, 31.25 cm and 52.75 cm. Calculate the speed of sound in air from these data.

A. 172 m/s

B. 500 m/s

C. 156 m/s

D. 344 m/s

Answer: D

Watch Video Solution

27. The driver of a car travelling with speed $30ms^{-1}$ towards a hill sounds a horn of frequency 600 Hz. If the velocity of sound in air is $330ms^{-1}$, the frequency of reflected sound as heard by driver is

A. 555.5 Hz

B. 720 Hz

C. 500 Hz

D. 550 Hz

Answer: B

Watch Video Solution

28. Two waves are represented by the equations

$y_1 = a\sin(\omega t + kx + 0.57)m$ and

$y_2 = a\cos(\omega t + kx)$m,

where x is in metres and t is in seconds. The phase difference between them is

A. 1.0 radian

B. 1.25 radian

C. 1.57 radian

D. 0.57 radian

Answer: A

Watch Video Solution

29. Sounds waves travel at $350m/s$ through a warm air and at $3500m/s$ through brass. The wavelength of a $700Hz$. Acoustic wave as it enters brass from warm air

A. decreases by a factor 10

B. increases by a factor 20

C. increases by a factor 10

D. decreases by a factor 20

Answer: C

Watch Video Solution

30. When a string is divided into three segments of lengths l_1, l_2 and l_3 the fundamental frequencies of these three segments are v_1, v_2 and v_3 respectively. The original fundamental frequency (v) of the string is

A. $\frac{1}{\sqrt{n}} = \frac{1}{\sqrt{n_1}} + \frac{1}{\sqrt{n_2}} + \frac{1}{\sqrt{n_3}}$

B. $\sqrt{n} = \sqrt{n_1} + \sqrt{n_2} + \sqrt{n_3}$

C. $n = n_1 + n_2 + n_3$

D. $\frac{1}{n} = \frac{1}{n_1} + \frac{1}{n_2} + \frac{1}{n_3}$

Answer: D

Watch Video Solution

31. Two sources of sound placed closed to each other, are emitting progressive waves given by

$y_1 = 4\sin 600\pi t$

and $y_2 = 5\sin 608\pi t$

An observer located near these two sources of sound will hear

A. 4 beats per second with intensity ratio 81 : 1 between waxing and waning

B. 4 beats per second with intensity ratio 25 : 16 between waxing and waning

C. 8 beats per second with intensity ratio 25 : 16 between waxing and waning

D. 8 beats per seconds with intensity ratio 81 : 1 between waxing and waning.

Answer: A

Watch Video Solution

32. The number of possible natural oscillations of air column in a pipe closed at one end of length 85 cm whose frequencies lie below 1250 Hz are (velocity of sound $= 340ms^{-1}$).

A. 4

B. 5

C. 7

D. 6

Answer: D

Watch Video Solution

33. A speed ign motorcyclist sees traffic ham ahead of him. He slows doen to $36km/h$ He finds that traffic has eased and a car moving ahead of him at $18km/h$ is honking at a frequency of 1392 Hz. If the speed of sound is $343m/s$, the frequency of the honk as heard by him will be

A. 1332 Hz

B. 1372 Hz

C. 1412 Hz

D. 1454 Hz

Answer: C

Watch Video Solution

34. The fundamental frequency of a closed organ pipe of length $20cm$ is equal to the second overtone of an organ pipe open at both the ends. The length of organ pipe open at both the ends is

A. 80 cm

B. 100 cm

C. 120 cm

D. 140 cm

Answer: C

Watch Video Solution

35. The equation of a simple harmonic wave is given by

$$y = 3\sin\frac{\pi}{2}(50t - x)$$

where x and y are in meters and x is in second .The ratio of maximum particle velocity to the wave velocity is

A. $\frac{2}{3}\pi$

B. 2π

C. $\frac{3}{2}\pi$

D. 3π

Answer: C

Watch Video Solution

36. Two car moving in opposite directions approach each other with speed of $22m/s$ and $16.5m/s$ respectively. The driver of the first car blows a horn having a frequency $400Hz$. The frequency heard by the driver of the second car is [velocity of sound $340m/s$].

A. 350 Hz

B. 361 Hz

C. 411 Hz

D. 448 Hz

Answer: D

Watch Video Solution

37. The two nearest harmonics of a tube closed at one end and open at other end are 220 Hz and 260 Hz. What is the fundamental frequency of the system?

A. 10 Hz

B. 20 Hz

C. 30 Hz

D. 40 Hz

Answer: B

Watch Video Solution

38. A tuning fork is used to produce resonance in glass tuve. The length of the air column in the tube can be adjusted by a variable piston. At room temperature of $27^{\circ}C$ two succesive resonance are produced at 20 cm and 73 cm column length. If the frequency of the tuning fork is 320 Hz. the velocity of sound is air at $27^{\circ}C$ is

A. 350 m/s

B. 339 m/s

C. 330 m/s

D. 300 m/s

Answer: B

Watch Video Solution

39. If we study the vibration of a pipe open at both ends, then the following statements is not true

A. open end will be antinode

B. Odd harmonic of the fundamental freqency will be generated

C. All harmonics of the fundamental frequency will be generated

D. Pressure change will be maximum at both ends

Answer: D

Watch Video Solution

40. A source of unknown frequency gives 4 beats//s, when sounded with a source of known frequency 250 Hz. The second harmonic of the source of unknown frequency gives five beats per second, when sounded with a source of frequency 513 The unknown frequency is

A. 254 Hz

B. 246 Hz

C. 240 Hz

D. 260 Hz

Answer: A

Watch Video Solution

41. A train moving at a speed of $220ms^{-1}$ towards a stationary object emits a sound of frequency 1000 Hz. Some of the sound reaching the object gets reflected back to the train as echo. The frequency of the echo

as detected by the driver of the train is (speed of sound in air is $330ms^{-1}$)

A. 3000 Hz

B. 3500 Hz

C. 4000 Hz

D. 5000 Hz

Answer: D

Watch Video Solution

42. A siren emitting a sound of frequency 800 Hz moves away from an observer towards a cliff at a speed of $15ms^{-1}$. Then the frequency of sound that the observer hears in the echo reflected from the cliff is (Take velocity of sound in air $= 330ms^{-1}$)

A. 800 Hz

B. 838 Hz

C. 885 Hz

D. 765 Hz

Answer: B

Watch Video Solution

43. When two tuning forks (fork 1 and fork 2) are sounded simultaneously, 4 beats per second are heard. Now some tape is attached on the prong of the fork 2. When the tuning fork are sounded again, 6 beats per second are heard. If the frequency of fork 1 is $200Hz$, then what was the original frequency of fork 2 ?

A. 204 Hz

B. 196 Hz

C. 202 Hz

D. 200 Hz

Answer: B

Watch Video Solution

44. A stationary source of sound is emitting sound of frequency $500Hz$. Two observers A and B lying on the same line as the source, observe frequencies $480Hz$ and $530Hz$ respectively. The velocity of A and B respectively are (in m/s), speed of sound $= 300m/s$.

A. 12, 16

B. 12, 18

C. 16, 14

D. 8, 18

Answer: B

Watch Video Solution

45. The equation of a wave on a string of linear mass density $0.04kgm^{-1}$ is given by $y = 0.02(m)\sin\left[2\pi\left(\frac{t}{0.04(s)} - \frac{x}{0.50(m)}\right)\right]$. The tension in

the string is :

A. 6.25 N

B. 4.0 N

C. 12.5 N

D. 0.5 N

Answer: A

Watch Video Solution

46. Two cars A and B are moving away from each other in opposite directions. Both the cars are moving with a speed of $20ms^{-1}$ with respect to the ground. If an observer in car A detects a frequency 2000 Hz of the sound coming from car B, what is the natural frequency of the sound source in car B? (Speed of sound in air $=340ms^{-1}$)

A. 2250 Hz

B. 2060 Hz

C. 2300 Hz

D. 2150 Hz

Answer: A

Watch Video Solution

47. A heavy ball is mass M is suspended from the ceiling of a car by a light string of mass $m(m << M)$. When the car is at rest, the speed of transverse waves in the string is $60ms^{-1}$. When the car has acceleration a, the wave-speed increases to $60.5ms^{-1}$. The value of a, in terms of gravitational acceleration g, is closest to:

A. $\frac{g}{30}$

B. $\frac{g}{20}$

C. $\frac{g}{5}$

D. $\frac{g}{10}$

Answer: C

Watch Video Solution

48. A musician using and open flute of length 50 cm produces second harmonic sound waves. A person runs towards the musician from another end of a hall at a speed of 10 km/h. If the wave speed is 330 m/s, the frequency heard by the running person shall be close to :

A. 333 Hz

B. 753 Hz

C. 666 Hz

D. 500 Hz

Answer: C

Watch Video Solution

49. A tuning fork vibrats with frequnecy $256Hz$ and gives one beat per seond with the third normal mode of vibration of an open pipe. What is

the length of the pipe (Speed of sound in air is $340ms^{-1}$)

A. 220 cm

B. 200 cm

C. 190 cm

D. 180 cm

Answer: B

Watch Video Solution

50. The end correction of a resonance column is 1 cm. If the shortest length resonating with the tunning fork is 10 cm, the next resonating length should be :

A. 32 cm

B. 40 cm

C. 28 cm

D. 36 cm

Answer: A

Watch Video Solution

51. Two sitar strings A and B playing the note 'Dha' are slightly out of tune and produce beats of frequency 5 Hz. The tension of string B is slightly increased and the beat frequency is found to decrease to 3 Hz. What is the original frequency of B, if the frequency of A is 427 Hz?

A. 428 Hz

B. 430 Hz

C. 422 Hz

D. 420 Hz

Answer: D

Watch Video Solution

52. A motor cycle starts from rest and accelerates along a straight path at $2m/s^2$. At the starting point of the motor cycle there is a stationary electric siren. How far has the motor cycle gone when the driver hears the frequency of the siren at 94% of its value when the motor cycle was at rest ? (Speed of sound = $330ms^{-2}$)

A. 147 m

B. 196 m

C. 49 m

D. 98 m

Answer: D

Watch Video Solution

53. While measuring the speed of sound by performing a resonance column experiment, a student gets the first resonance condition at a column length of $18cm$ during winter. Repeating the same experiment

during summer, she measures the column length to be xcm for the second resonance. Then

A. $18 > y$

B. $y > 54$

C. $54 > y > 36$

D. $36 > y > 18$

Answer: B

Watch Video Solution

54. The transverse displacement $y(x, t)$ of a wave on a string is given by $y(x, t) = e^{-\left(ax^2+bt^2+2\sqrt{(ab)}xt\right)}$. This represents a :

A. Wave moving in -x direction with speed $\sqrt{\frac{b}{a}}$

B. Standing wave of frequency $\sqrt{b}$

C. Standing wave of frequency $\frac{1}{\sqrt{b}}$

D. Wave movinb in +x direction with speed $\sqrt{\frac{a}{b}}$

Answer: A

Watch Video Solution

55. A travelling wave represented by

$y = A\sin(\omega t - kx)$

is superimposed on another wave represented by

$y = A\sin(\omega t + kx)$. The resultant is

A. A wave travelling along +x direction

B. A wave travelling along -x direction

C. A standing wave having nodes at $x = \frac{n\lambda}{2}$, n = 0, 1, 2.....

D. A standing wave having nodes at $x = \left(n + \frac{1}{2}\right)\frac{\lambda}{2}$, n = 0, 1, 2...

Answer: C

Watch Video Solution

56. A granite rod of 60 cm length is clamped at its middle point and is set into longitudinal vibrations. The density of granite is $2.7 \times 10^3 kg/m^3$ and its Young's modulus is 9.27×10^{10} Pa. What will be the fundamental frequency of the longitudinal vibrations ?

A. 10 kHz

B. 7.5 kHz

C. 5 kHz

D. 2.5 kHz

Answer: C

Watch Video Solution

57. A sonometer wire of length $1.5m$ is made of steel. The tension in it produces an elastic strain of 1%. What is the fundamental frequency of steel if density and elasticity of steel are $7.7 \times 10^3 kg/m^3$ and $2.2 \times 10^{11} N/m^2$ respectively ?

A. 178.2 Hz

B. 200.5 Hz

C. 770 Hz

D. 188.5 Hz

Answer: A

Watch Video Solution

58. A string 2.0 m long and fixed at its ends is driven by a 240 Hz vibrtor. The string vibrates in its third harmonic mode. The speed of the wave and its fundamental frequency is :

A. 320 m/s, 80 Hz

B. 320 m/s, 120 Hz

C. 180 m/s, 80 Hz

D. 180 m/s, 120 Hz

Answer: A

Watch Video Solution

59. A train is moving on a straight track with speed $20ms^{-1}$. It is blowing its whistle at the frequency of $1000Hz$. The percentage change in the frequency heard by a person standing near the track as the train passes him is (speed of sound $= 320ms^{-1}$) close to :

A. 0.12

B. 0.18

C. 0.24

D. 0.06

Answer: A

Watch Video Solution

60. A uniform string of length $20m$ is suspended from a rigid support. A short wave pulse is introduced at its lowest end. It starts moving up the string. The time taken to reach the support is :

(take $g = 10ms^{-2}$)

A. 2s

B. $2\sqrt{2}s$

C. $\sqrt{2}s$

D. $2\pi\sqrt{2}s$

Answer: B

Watch Video Solution

61. A pipe open at both ends has a fundamental frequency f in air. The pipe is dipped vertically in water so that half of it is in water. The fundamental frequency of the air column is now :

A. $\frac{3f}{4}$

B. 2f

C. f

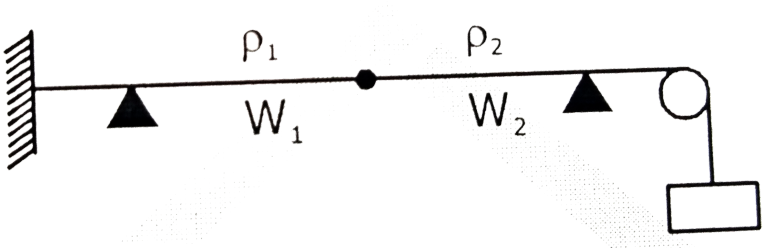
D. $\frac{f}{2}$

Answer: C

Watch Video Solution

62. Two wires $W_1 \text{and} W_2$ have the same radius r and respective densities $p_1 \text{and} p_2$ such that $p_2 = 4p_1$. They are joined together at the point O, as shown in the figure. The combination is used as a sonometer wire and kept udner tension T. The point O is midway between the two bridges. When a stationary waves is set up in the composite wire, the joint is found to be a node. The ratio of the number of antinodes formed in

$W_1 \text{to} W_2$ is-



A. $4:1$

B. $1:2$

C. $1:1$

D. $1:3$

Answer: B

Watch Video Solution

63. A standing wave is formed by the superposition of two waves travelling in the opposite directions. The transverse displacement is given by

$$y(x, t) = 0.5 \sin\left(\frac{5\pi}{4}x\right)\cos(200\pi t)$$

What is the speed of the travelling wave moving in the postive X direction ?

A. 160 m/s

B. 90 m/s

C. 180 m/s

D. 120 m/s

Answer: A

Watch Video Solution

64. In the experiment to determine the speed of sound using a resonance column,

A. prongs of the tuning fork are kept in a vertical plane.

B. prongs of the tuning fork are kept in a horizontal plane.

C. in one of the two resonances observed, the length of the resonating air column is close to the wavelength of sound in air.

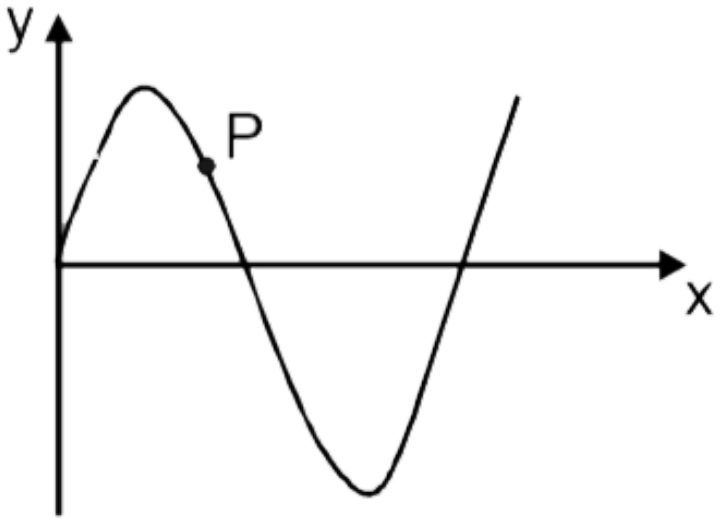
D. in one of the two resonances observed, the length of the resonating air column is close to half of the wavelength of sound in air.

Answer: A

Watch Video Solution

65. A transverse sinusoidal wave moves along a string in the positive x-direction at a speed of 10 cm/s. The wavelength of the wave is 0.5 m and its ampli- tude is 10 cm. At a particular time t, the snap-shot of the wave is shown in figure. The velocity of point P when its displacement is 5 cm is

Figure :



A. $\frac{\sqrt{3}\pi}{50}\hat{j}m/s$

B. $-\frac{\sqrt{3}\pi}{50}\hat{j}m/s$

C. $\frac{\sqrt{3}\pi}{50}\hat{i}m/s$

D. $-\frac{\sqrt{3}\pi}{50}\hat{i}m/s$

Answer: A

Watch Video Solution

66. A hollow pipe of length $0.8m$ is closed at one end. At its open end a $0.5m$ long uniform string is vibrating in its second harmonic and it resonates with the fundamental frequency of the pipe. If the tension in the wire is $50N$ and the speed of sound is $320ms^{-1}$, the mass of the string is

A. 5 grams

B. 10 grams

C. 20 grams

D. 40 grams

Answer: B

Watch Video Solution

67. A police car with a siren of frequency $8KHz$ is moving with uniform velocity $36Km/hr$ towards a ball building which reflects the sound

waves. The speed of sound in air is $320m/s$. The frequency of the siren heard by the car driver is

A. 8.50 kHz

B. 8.25 kHz

C. 7.75 kHz

D. 7.50 kHz

Answer: A

Watch Video Solution

68. There will be no change in frequency or no Doppler effect if

A. Both source and listener are at rest and the medium is moving

B. Source and listener move in same direction with same speed.

C. When source is at centre of a circle and listener is moving along that circle with uniform speed.

D. When listener is at centre of a circle and source is moving along the circle with uniform speed.

Answer: A::B::C::D

Watch Video Solution

69. Which of the following is correct ?

A. At altitudes, speed of sound decreases due to fall of pressure.

B. The beats are not formed for visible light waves.

C. Velocity of sound is greater in solids than in gases at NTP.

D. The standing waves on a string do not have well-defined nodes.

Answer: B::C::D

View Text Solution

70. Which of the following represents a stationary wave ? (a, b, c are constants in the equation)

A. $y = a\cos(2bx)\sin(ct)$

B. $y = a\sin(cx)\sin(2bt)$

C. $y = a\cos(bx + ct)$

D. $y = a\sin(bx - ct)$

Answer: A::B

Watch Video Solution

71. When a wave travels from one medium to another, the displacement of the particle is given as $y = a\sin 2\pi(mt - nx)$ m and n are constants.

A. The velocity of wave is $\frac{m}{n}$

B. The frequency of wave is m.

C. The maximum particle velocity is thrice the wave velocity if $n = \frac{1}{5\pi a^2}$

D. The wavelength of the wave is 1/n

Answer: A::B::D

Watch Video Solution

72. In an experiment to measure the speed of sound by a resonating air column, a tuning fork of frequency 500 Hz is used. The length of the air column is varied by changing the leavel of water in the resonance tube. Two successive resonances are heard at air columns of length 50.7 cm and 83.9 cm. Which of the following statements is (are) true?

A. The speed of sound determined from this experiment is 332 ms^{-1}

B. The end correction in this experiment is 0.9 cm

C. The wavelength of the sound wave is 66.4 cm

D. The resonance at 50.7 cm corresponds to the fundamental harmonic

Answer: A::C

Watch Video Solution

73. The force constant of a simple harmonic oscillator is $3 \times 10^6 N/m$, amplitude 0.02 m has a total energy of 1250 J

A. Maximum potential energy is 650 J

B. Maximum kinetic energy is 600 J

C. Maximum kinetic energy is 700 J

D. Maximum potential energy is 450 J

Answer: B

Watch Video Solution

74. Apparent frequency will increase if

A. Source is at rest, listener is moving towards source.

B. Source and listener are moving towards each other.

C. Source is moving towards listener at rest.

D. Source and listener are moving in same direction and with same velocity

Answer: A::B::C

Watch Video Solution

75. Which of the following is an example of transverse wave motion ?

A. Light waves coming from Sun to Earth.

B. When a spring is pulled sidewaves, the kink moves 90° to the length of spring.

C. Movement of the membrane of tabla.

D. Vibrations of air column above the surfave of water in a resonance tube.

Answer: A::B::C

Watch Video Solution

76. The pitch of a tuning fork

A. is directly proportional to the square of length of prongs.

B. is directly proportional to square root of Young's modulus of elasticity of material.

C. is directly proportional to thickness of prongs.

D. is inversely proportional to square root of density of material

Answer: B::C::D

Watch Video Solution

77. Which of the following are incorrect ?

A. Presence of moisture in air decreases density of air.

B. Sound heard in CO_2 is more intense than that heard in air.

C. Mechanical waves transfer energy and matter from one point to another.

D. The distance between a node and and adjoining antinode in a stationary wave is $\frac{\lambda}{2}$.

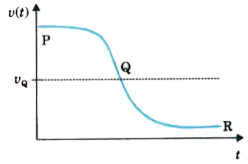
Answer: C::D

Watch Video Solution

78. Two loudspeaker M and N are located $20m$ apart and emit sound at frequencies $118Hz$ and $121Hz$, respectively. A car is intially at a point P, $1800m$ away from the midpoint Q of the line MN and moves towards Q constantly at $60km/hr$ along the perpendicular bisector of MN. It crosses Q and eventually reaches a point R, $1800m$ away from Q. Let $v(t)$

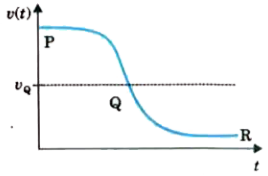
represent the beat frequency measured by a person sitting in the car at time t. let v_P, v_Q and v_R be the beat frequencies measured at locations P ,Q and R, respectively. The speed of sound in air is $330ms^{-1}$. Which of the following statement (s) is (are) true regarding the sound heard by the person?

A. The plot below represents schematically the variation of beat frequency with time.



B. $V_P + V_R = 2V_Q$

C. The plot below represents schematically the variation of beat frequency with time



D. The rate of change in beat frequency is maximum when the car passes through Q

Answer: A::B::D

Watch Video Solution

79. The distance between two consecutive antinodes is

A. $\lambda/2$

B. $\lambda/4$

C. $\lambda/8$

D. $\lambda/6$

Answer: A

Watch Video Solution

80. Nodes are the points of

A. zero displacement

B. maximum displacement

C. maximum amplitude

D. maximum acceleration

Answer: A

Watch Video Solution

81. Amplitude of vibrations can change in

A. a progressive wave

B. A transverse wave

C. in a stationary wave

D. a longitudinal wave

Answer: A:B:D

Watch Video Solution

82. When wax is attached to one of the prongs of a tuning fork, frequency of the fork will

A. decrease

B. increase

C. remains unchanged

D. may increase or decrease

Answer: A

Watch Video Solution

83. When one of the prong of a tuning fork is waxed a little then frequency of the fork will

A. decrease

B. increase

C. remains unchanged

D. may increase or decrease

Answer: A

Watch Video Solution

84. Which of the following is incorrect ?

A. To hear distinct beat the difference in the frequencies of two sources should be less than 10.

B. There is alternate variation in the intensity of sound during beat formation.

C. To hear distinct beats the difference in the frequencies of two sources should be more than 10.

D. Beat frequency is the difference between the frequencies of two sources

Answer: C

Watch Video Solution

85. When two sounds of frequencies 512 Hz and 516 Hz reach our ear simultaneously then number of beats formed are

A. 4

B. 2

C. 6

D. 8

Answer: A

Watch Video Solution

86. Two trains A and B moving with speeds $20m/s$ and $30m/s$ respectively in the same direction on the same straight track, with B ahead of A. The engines are at the front ends. The engine of train A blows a long whistle.

Assume that the sound of the whistle is composed of components varying in frequency from $f_1 = 800Hz$ to $f_2 = 1120Hz$, as shown in the figure. The spread in the frequency (highest frequency - lowest frequency) is thus $320Hz$. The speed of sound in still air is $340m/s$.

(4) The speed of sound of the whistle is

A. 340 m/s for passengers in A and 310 m/s for passengers in B

B. 360 m/s for passengers in A and 310 m/s for passengers in B

C. 310 m/s for passengers in A and 360 m/s for passengers in B

D. 340 m/s for passengers in both the trains.

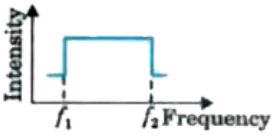
Answer: B

Watch Video Solution

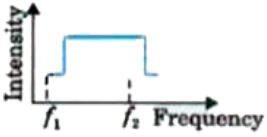
87. Two trains A and B moving with speeds $20m/s$ and $30m/s$ respectively in the same direction on the same straight track, with B ahead of A. The engines are at the front ends. The engine of train A blows a long whistle.

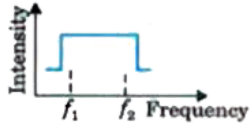
Assume that the sound of the whistle is composed of components varying in frequency from $f_1 = 800Hz$ to $f_2 = 1120Hz$, as shown in the figure. The spread in the frequency (highest frequency - lowest frequency) is thus $320Hz$. The speed of sound in still air is $340m/s$.

(4) The speed of sound of the whistle is

A. 

B. 

C. 

D. 

Answer: A

Watch Video Solution

88. Two trains A and B moving with speeds $20m/s$ and $30m/s$ respectively in the same direction on the same straight track, with B ahead of A. The engines are at the front ends. The engine of train A blows a long whistle.

Assume that the sound of the whistle is composed of components varying in frequency from $f_1 = 800Hz$ to $f_2 = 1120Hz$, as shown in the figure. The spread in the frequency (highest frequency - lowest frequency) is thus $320Hz$. The speed of sound in still air is $340m/s$.

(4) The speed of sound of the whistle is

A. 310 Hz

B. 330 Hz

C. 350 Hz

D. 290 Hz

Answer: A

Watch Video Solution

Assertion Reason Type Questions

1. Assertion : Sound waves travel in the form of compressions and rarefactions in air.

Reason : Because crests and troughs cannot be sustained in air, therefore, sound waves cannot travel through air in the form of transverse waves.

A. If both assertion and reason are correct and reason is a correct explanation of the assertion.

B. If both assertion and reason are correct but reason is not the correct explanation of assertion.

C. If assertion is correct but reason is incorrect

D. If assertion is incorrect but reason is correct.

Answer: A

Watch Video Solution

2. Assertion : In a stationary sound wave, a displacement node is a pressure antinode and vice versa.

Reason : Nodes and antinodes are the points of maximum displacement.

A. If both assertion and reason are correct and reason is a correct explanation of the assertion.

B. If both assertion and reason are correct but reason is not the correct explanation of assertion.

C. If assertion is correct but reason is incorrect

D. If assertion is incorrect but reason is correct.

Answer: C

View Text Solution

3. Assertion : Doppler effect is not observed in case of supersonic waves.

Reason : Waves produced by supersonic sources are shock waves which

produce a sound.

A. If both assertion and reason are correct and reason is a correct explanation of the assertion.

B. If both assertion and reason are correct but reason is not the correct explanation of assertion.

C. If assertion is correct but reason is incorrect

D. If assertion is incorrect but reason is correct.

Answer: A

Watch Video Solution

4. Assertion : A person wil hear no sound if he is moving away from the source of sound with the speed of sound.

Reason : Because the relative velocity of the sound waves with respect to the person is infinite.

A. If both assertion and reason are correct and reason is a correct explanation of the assertion.

B. If both assertion and reason are correct but reason is not the correct explanation of assertion.

C. If assertion is correct but reason is incorrect

D. If assertion is incorrect but reason is correct.

Answer: C

Watch Video Solution

5. Assertion : Beats can be formed when the diffference in freqencies of two sources is greater than 10.

Reason : Time interval between two beats should be less than 1/10 seconds to hear distinct beats.

A. If both assertion and reason are correct and reason is a correct explanation of the assertion.

B. If both assertion and reason are correct but reason is not the correct explanation of assertion.

C. If assertion is correct but reason is incorrect

D. If both assertion and reason are incorrect

Answer: C

Watch Video Solution

6. Assertion : The thunder of lightning can be heard some moments earlier before the flash in seen.

Reason : Because the speed of sound is greater than the speed of light.

A. If both assertion and reason are correct and reason is a correct explanation of the assertion.

B. If both assertion and reason are correct but reason is not the correct explanation of assertion.

C. If assertion is correct but reason is incorrect

D. If both assertion and reason are incorrect

Answer:

Watch Video Solution

7. Assertion : Longitudinal waves are also known as pressure waves.

Reason : Because propagation of these waves in air causes changes in pressure and volume of the air.

A. If both assertion and reason are correct and reason is a correct explanation of the assertion.

B. If both assertion and reason are correct but reason is not the correct explanation of assertion.

C. If assertion is correct but reason is incorrect

D. If assertion is incorrect but reason is correct.

Answer: A

Watch Video Solution

8. Assertion : A tuning fork is made up of material whose elasticity does not change.

Reason : A tuning for is made up of an alloy of steel, nickel and chromium.

A. If both assertion and reason are correct and reason is a correct explanation of the assertion.

B. If both assertion and reason are correct but reason is not the correct explanation of assertion.

C. If assertion is correct but reason is incorrect

D. If assertion is incorrect but reason is correct.

Answer: B

View Text Solution

9. Assertion : The apparent frequency will remain same as the frequency of source of sound if source and listener move at right angles to each other.

Reason : Apparent frequency will always increase whether source is moving towards the listener or listener is moving towards the source.

A. If both assertion and reason are correct and reason is a correct explanation of the assertion.

B. If both assertion and reason are correct but reason is not the correct explanation of assertion.

C. If assertion is correct but reason is incorrect

D. If assertion is incorrect but reason is correct.

Answer: D

Watch Video Solution

10. Assertion : The fundamental frequency of a stretched string is directly proportional to the square root of the tension in the string if length and mass of the string are constant.

Reason : There are n nodes and n antinodes forms when standing waves are formed in a stretched string.

A. If both assertion and reason are correct and reason is a correct explanation of the assertion.

B. If both assertion and reason are correct but reason is not the correct explanation of assertion.

C. If assertion is correct but reason is incorrect

D. If assertion is incorrect but reason is correct.

Answer: C

Watch Video Solution

11. Statement-1: Two longitudinal waves given by equation $y_1(x,t) = 2a\sin(\omega t - kx)$

and $y_2(x,t) = a\sin(2\omega t - 2kx)$

will have equal intensity.

Statement-2 : Intensity of waves of given frequency in same medium is proportional to square of amplitude only.

A. If both assertion and reason are correct and reason is a correct explanation of the assertion.

B. If both assertion and reason are correct but reason is not the correct explanation of assertion.

C. If assertion is correct but reason is incorrect

D. If assertion is incorrect but reason is correct.

Answer:

Watch Video Solution

Matching Type Questions

1.

	List-I		List-II
P	Source and listener are moving in same direction with same velocity.	1.	Longitudinal waves
Q	Source and listener are moving away from each other.	2.	Apparent frequency
R	Source is moving towards the listener at rest	3.	No change in freque
S	Sound waves in air	4.	Apparent frequency

A.

P	Q	R	S
1	2	3	4

B.

P	Q	R	S
2	3	1	4

C.

P	Q	R	S
2	3	4	1

D.

P	Q	R	S
3	4	2	1

Answer: D

Watch Video Solution

2.

	List-I		List-II
P	Veloicty of sound	1.	Minimum amplitude
Q	Nodes	2.	Maximum amplitude
R	Antinodes	3.	Independent of pressure
S	Echo	4.	Reflection of sound waves

A.

P	Q	R	S
4	3	1	2

B.

P	Q	R	S
3	1	2	4

C.

P	Q	R	S
2	1	3	4

D.

P	Q	R	S
1	3	4	2

Answer: B

Watch Video Solution

3. A musical instrument is made using four different metal strings, 1, 2, 3 and 4 with mass per unit length

$\mu, 2\mu, 3\mu$ and 4μ respectively. The instrument is played by vibrating the strings by varying the free length in between the range

L_0 and $2L_0$. It is found that in string-1

(μ) at free length L_0 and tension T_0 the fundamental mode frequency is f_0.

List-I gives the above four strings while list-II lists the magnitude of some quantity.

List-I	List-II
(I) String - 1 (μ)	(P) 1
(II) String - 2 (2μ)	(Q) 1/2
(III) String - 3 (3μ)	(R) $1/\sqrt{2}$
(IV) String - 4 (4μ)	(S) $1/\sqrt{3}$
	(T) 3/16
	(U) 1/16

If the tension in each string is T_0, the correct match for the highest fundamental frequency in f_0 units will be -

A. $\begin{matrix} P & Q & R & S \\ 1 & 3 & 4 & 2 \end{matrix}$

B. $\begin{matrix} P & Q & R & S \\ 1 & 2 & 5 & 4 \end{matrix}$

C. $\begin{matrix} P & Q & R & S \\ 2 & 4 & 3 & 1 \end{matrix}$

D. $\begin{matrix} P & Q & R & S \\ 2 & 1 & 3 & 5 \end{matrix}$

Answer: A

Watch Video Solution

Matrix Match Type Questions

1.

	Column I		Column II
(A)	For a stationary wave	(p)	Vibrations are perpendicular to direct
(B)	For a longitudinal wave	(q)	Amplitude of vibrations changes with
(C)	For a transverse wave	(r)	Amplitude of vibration does not chang
(D)	For a progressive wave	(s)	Vibrations are along the direction of w
		(t)	Nodes and antinoes are formed

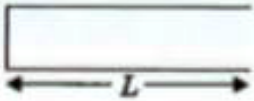
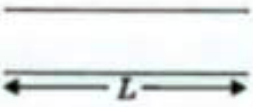
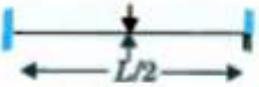
Watch Video Solution

2.

	Column I		Column II
(A)	A stretched string	(p)	n antinodes
(B)	Open organ pipes	(q)	n nodes
(C)	Closed organ pipe	(r)	$(\mathrm{n}+1)$ antinodes
(D)	A stationary wave produced in organ pipes may have	(s)	$(\mathrm{n}+1)$ nodes

Watch Video Solution

3. Column I shows four systems, each of the same length L, for producing standing waves. The lowest possible natural frequency of a system is called it fundamental frequency, whose wavelength is denoted as λ_t. Match each system with statements given in Column II describing the nature and wavelength of the standing waves.

Column I		Column II	
(A)	Pipe closed at one end 	(p)	Longitudinal waves
(B)	Pipe open at both ends 	(q)	Transverse waves
(C)	Stretched wire clamped at both ends 	(r)	$\lambda_t = L$
(D)	Stretched wire clamped at both ends at mid-point 	(s)	$\lambda_t = 2L$
		(t)	$\lambda_t = 4L$

View Text Solution

Integer Type Question

1. Two men are walking along a horizontal straight line in the same direction. The man in front walks at a speed 1.0 ms^{-1} and the man behind walks at a speed $2.0ms^{-1}$. A third mad is standing at a height 12m above the same horizontal line such that all three men are in a vertical plane. The two walking men are blowing identical whistles which emit a sound of frequency 1430 Hz. The speed of sound in air is 330 ms^{-1} . At the instant, when the moving men are 10 m apart, the stationary man is equidistant from them. The frequency of beats in Hz, heard by the stationary man at this instant, is

Watch Video Solution

2. A wire vibrates in fundamental mode with frequency of 50 Hz when stretched between two rigid supports. The linear mass density of wire is 3×10^{-2} kg/m and mass of wire is 4.5×10^{-2} kg. The tension developed

in wire is $x \times 135$ N. Find value of x.

$0 \quad 1 \quad 2 \quad 3 \quad 4 \quad 5 \quad 6 \quad 7 \quad 8 \quad 9$

Watch Video Solution

3. The speed of sound in hydrogen is $x \times 332$ m/s at NTP if density of hydrogen is $\frac{1}{4}$ the of that of air. Find the value of x if speed of sound in air is 332 m/s at NTP.

$0 \quad 1 \quad 2 \quad 3 \quad 4 \quad 5 \quad 6 \quad 7 \quad 8 \quad 9$

Watch Video Solution

4. 32 tuning forks are arranged in order of increasing frequency such that frequency of last fork is double than first. 6 beats per second are produced by each two consecutive forks. The frequency of last fork is $n \times 186$. Find the value of n.

$0 \quad 1 \quad 2 \quad 3 \quad 4 \quad 5 \quad 6 \quad 7 \quad 8 \quad 9$

Watch Video Solution

5. A transverse wave of frequency 250 Hz is travelling with a speed of 180 m/s. The path difference between any two point is $x \times 10^{-2}$ m. When two points are 30° out of phase. Find the value of x.

$0 \quad 1 \quad 2 \quad 3 \quad 4 \quad 5 \quad 6 \quad 7 \quad 8 \quad 9$

Watch Video Solution

6. The frequency of first overtone of an open organ pipe is equal to fundamanetal frequency of a closed organ pipe. What will be the length of closed organ pipe if the length of open organ pipe is 16 cm ?

$0 \quad 1 \quad 2 \quad 3 \quad 4 \quad 5 \quad 6 \quad 7 \quad 8 \quad 9$

Watch Video Solution

7. A car with a horn of frequency 16 kHz is moving with a velocity of 72 km/h towards a cliff. The reflected sound heard by the driver of the car has a frequency $x \times 2000$ Hz. Find the value of x if speed of sound in air is

340 m/s.

0 1 2 3 4 5 6 7 8 9

Watch Video Solution

8. The fundamental frequency of a closed organ pipe is 256 Hz. If the pipe is cut in two halves, then the difference in fundamental notes produced by two pipes is $x \times 128$ Hz. Find the value of x.

0 1 2 3 4 5 6 7 8 9

Watch Video Solution

9. The displacements of two travelling waves are represented by the equations as :

$y_1 = a\sin(\omega t + kx + 0.29)m$ and $y_2 = a\cos(\omega t + kx)m$ here x, a are in m and t in s, ω in rad. The path difference between two waves is $(x \times 1.28)\frac{\lambda}{\pi}$. Find the value of x.

`

Watch Video Solution

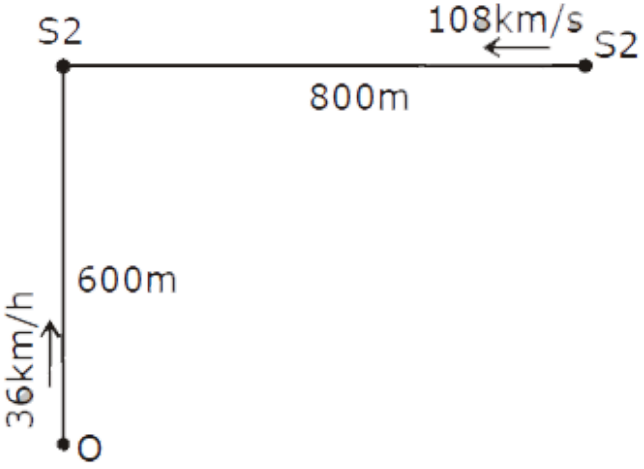
10. A 20 cm long string, having a mass of 1.0 g, is fixed at both the ends. The tension in the string is 0.5 N. The string is set into vibrations using an external vibrator of frequency 100 Hz. Find the separation (in cm) between the successive nodes on the string.

Watch Video Solution

11. A stationary source is emitting sound at a fixed frequency f_0, which is reflected by two cars approaching the source. The difference between the frequencies of sound reflected from the cars is $1.2\,\%$ of f_0. What is the difference in the speeds of the cars (in km per hour) to the nearest integer ? The cars are moving at constant speeds much smaller than the speed of sound which is $330 ms^{-1}$.

Watch Video Solution

12. A train S1, moving with a uniform velocity of 108 km/h, approaches another train S2 standing on a platform. An observer O moves with a uniform velocity of 36 km/h towards S2, as shown in figure. Both the trains are blowing whistles of same frequency 120Hz. When O is 600 m away form S2 and distance between S1 and S2 is 800 m, the number of beats heard by O is ..... [Speed of the sound = 330 m/s]



Watch Video Solution

13. A stationary source emits sound of frequncy f_0 = 492 Hz. The sound is reflected by a large car approaching the source with a speed of 2 ms^{-1}.

The reflected signal is received by the source and superposed with the original. What will be the beat frequency of the resulting signal in Hz ? (Given that the speed of sound in air is 330 ms^{-1} and the car reflects the sound at the frequency it has received.)

0 1 2 3 4 5 6 7 8 9

View Text Solution

Chapter Practice Test

1. What is the angle between the particle velocity and wave velocity in longitudinal waves and in transverse ?

Watch Video Solution

2. The density of nitrogen is 14 times than the density of hydrogen. What will be the ratio of speeds of nitrogen to hydrogen?

Watch Video Solution

3. What is the distance between two consecutive nodes and two consecutive antinodes ?

Watch Video Solution

4. In an open organ pipe, second harmonic is 200 Hz. Find the frequency of 5^{th} harmonic.

Watch Video Solution

5. The fundamental frequency of an open organ pipe is 512 Hz. What will be its value if one of its end is closed ?

Watch Video Solution

6. What is echo ? Why we cannot hear an echo in a small room ?

Watch Video Solution

7. On the basis of dimensional analysis, write the formula for speed of transverse waves on a stretched string.

Watch Video Solution

8. Show that the speed of sound is independent of the pressure.

Watch Video Solution

9. Distinguish between longitudinal waves and transverse waves.

Watch Video Solution

10. Bats have no eyes still they can travel during night. Why ?

Watch Video Solution

11. Show that the speed of sound increases by 61 cm/s for every degree rise of temperature.

Watch Video Solution

12. Calculate the ratio of length of an open organ pipe to closed organ pipe if the fourth overtone of open pipe is in unison with the sixth overtone of closed pipe.

Watch Video Solution

13. Write Newton's formula for speed of sound in air. What was the issue of the experiment ? Explain the correction done by Laplace.

Watch Video Solution

14. What do you mean by Doppler effect in sound ?

Watch Video Solution