PHYSICS

BOOKS - KUMAR PRAKASHAN KENDRA PHYSICS (GUJRATI ENGLISH)

WAVES

Section A Question Answer

1. What are called waves ? Mention their importance.

Watch Video Solution

2. Describe classification of waves in detail with examples.

Watch Video Solution

3. When did scientific study of waves begin? Give names of those scientists who had studied physics of waves.

Watch Video Solution

4. A current of 2A flows in a wire offering a resistance of 10ohm. Calculate the energy dissipated by the wire in 0.5 hours.

A. 72Wh

B. 72kJ

C. 7200J

D. 72kJh

Answer:

Watch Video Solution

5. Explain propagation of sound waves in air.

Watch Video Solution

6. Explain propagation of sound waves in solids.

Watch Video Solution

7. Explain the types of waves on the basis of direction of oscillations of particles of medium.

Watch Video Solution

8. (a) Give reason why transverse waves can be propagated in solids,

(b) Give reason why longitudinal waves can be propagated through all the three types of media - solids, liquids and gases.

(c) Describe in brief about two types of waves that can be propagated on the free surface of water.

Watch Video Solution

9. What is called one dimensional wave? What are called progressive or travelling waves ? What are called harmonic waves ? What is called wave equation ? Write wave equation for progressive harmonic transverse wave propagating along + X-axis. Also explain it by drawing some graphs.

Watch Video Solution

10. Explain about amplitude and phase of wave.

Watch Video Solution

11. Give difinition, equation and unit for waveength and wave number for wave.

Watch Video Solution

12. Give definition, SI unit and dimensional formula of time period, angular frequency and frequency of wave.

Watch Video Solution

13. Write equation of displacement of an element of medium in harmonic wave,

Watch Video Solution

14. Write difinition of wave speed and derive $v = \frac{\omega}{k}$.

Watch Video Solution

15. Write difinition of wave speed and derive $v = \frac{\omega}{k}$.

Watch Video Solution

16. Explain which properties are necessary to understand the speed of mechanical waves.

Watch Video Solution

17. Obtain the equation of speed of transverse wave on tensed (stretched) string.

Watch Video Solution

18. By obtaining the equation of speed of sound wave, obtain equations of sound wave in different medium.

Watch Video Solution

19. Why the speed oof sound is more in solid and liquid as compared to gases ?

Watch Video Solution

20. Obtain the equation of speed of sound wave in air and give the error in this equations.

Watch Video Solution

21. Write the equation of speed of sound wave of Newton and explain the correction by Laplace.

Watch Video Solution

22. Write principle of superposition and explain.

Watch Video Solution

23. Obtain the resultant wave of more than two wave functions by representing the superposition principle mathematically.

Watch Video Solution

24. Obtain the equation of resultant displacement of two progressive harmonic waves on a stretched string.

Watch Video Solution

25. Given noticeable points, about the amplitude of resultant waves of two harmonic progressive waves on stretached string.

Watch Video Solution

26. What is intereference ? Define its types.

Watch Video Solution

27. Explain reflection and refraction of waves.

Watch Video Solution

28. Explain the reflection of wave at rigid support.

Watch Video Solution

29. Explain the reflection of wave at free support.

Watch Video Solution

30. What are stationary waves ? Obtain its equation.

Watch Video Solution

31. Write the equation of stationary wave and obtain the equations of nodes and anti-nodes by defining them.

Watch Video Solution

32. Obtain the equation of frequency of oscillations in string tied at both ends.

Watch Video Solution

33. What is harmonic of oscilation (mode)? Give explanation of different harmonic (modes).

Watch Video Solution

34. Discuss stationary waves in pipe and explain types of pipes.

Watch Video Solution

35. Give explanation of stationary waves produced in closed pipe and obtain equations of natural frequency (normal modes).

Watch Video Solution

36. Obtain the equation of frequency of stationary wave propuced in open pipe and show that all harmonics are possible in it.

Watch Video Solution

37. From which conditioon, the normal modes for the case of small hand drums are decided ?

Watch Video Solution

38. What is beat? Obtain the equation of no. of beats produced in unit time.

Watch Video Solution

39. Drw graphs of beat produced by two harmonic waves of frequency 11 Hz and 9 Hz.

Watch Video Solution

40. What is doppler effect ? Write its example and how its analysis can be done ?

Watch Video Solution

41. Which pre-assumptions are used for Doppler effect ?

Watch Video Solution

42. Obtain the equation of frequency observed by stationary observer and moving source.

Watch Video Solution

43. Obtain the equation of frequency observed by moving observer and stationary source.

Watch Video Solution

44. Obtain the equatin of frequency observed by observer for moving source and moving observer at different velocities.

Watch Video Solution

Section A Try Your Self

1. What are called waves ? Mention their importance.

Watch Video Solution

2. What is carried by the waves ? Mass, velocity or energy?

Watch Video Solution

3. What are called mechanical waves ? Give its examples.

Watch Video Solution

4. What are called non-mechanical waves ? Give its examples.

Watch Video Solution

5. What are called matter waves ? write any tow characteristics of it.

Watch Video Solution

6. What is called compression or condensation ? Which type of changes in density & pressure take place in it?

Watch Video Solution

7. What is called rarefaction ? Which type of changes in density and pressure take place in it?

Watch Video Solution

8. Are the waves propagating in solids transverse, longitudinal or both ?

Watch Video Solution

9. What is called a transverse wave ?

Watch Video Solution

10. What is called a longitudinal wave ?

Watch Video Solution

11. What are called mechanical waves ? Give its examples.

Watch Video Solution

12. Which coefficient of elasticity is responsible fo propagation of wave in a string ?

Watch Video Solution

13. Which type of waves can propagate in solids ?

Watch Video Solution

14. Why speeds of transverse and longitudinal wave are different even in the same medium ?

Watch Video Solution

15. What is progressive wave ?

Watch Video Solution

16. What is wave equation ?

Watch Video Solution

17. Write definition, unit and dimensional formula of amplitude.

Watch Video Solution

18. Explain phase in wave.

Watch Video Solution

19. Give difinition, equation and unit for waveength and wave number for wave.

Watch Video Solution

20. Write definition and SI unit of angular wave number.

Watch Video Solution

21. Write definition of time period of wave.

Watch Video Solution

22. Give definition, SI unit and dimensional formula of time period, angular frequency and frequency of wave.

Watch Video Solution

23. Give definition, SI unit and dimensional formula of time period, angular frequency and frequency of wave.

Watch Video Solution

24. Write equation of relation between time period and frequency.

Watch Video Solution

25. Write equation which represents relation between time period and angular frequency

Watch Video Solution

26. Write difinition of wave speed and derive $v = \frac{\omega}{k}$.

Watch Video Solution

27. Write equation of relation between wave speed, angular frequency and angular wave number.

Watch Video Solution

28. Write difinition of wave speed and derive $v = \frac{\omega}{k}$.

Watch Video Solution

29. How the motion of the point having constantphase is measured ?

Watch Video Solution

30. Write equation of relation between wave speed, wavelength and time period.

Watch Video Solution

31. Write equation of relation between wave speed, angular frequency and angular wave number.

Watch Video Solution

32. Write equation of wave speed in terms of wavelength and frequency.

Watch Video Solution

33. Write definition and dimensional formula of linear mass density of string.

Watch Video Solution

34. Obtain the equation of speed of transverse wave on tensed (stretched) string.

Watch Video Solution

35. Obtain the equation of speed of sound wave in air and give the error in this equations.

Watch Video Solution

36. Write equation of speed of sound wave in metals.

Watch Video Solution

37. Write equation of speed of sound wave in ideal gas.

Watch Video Solution

38. Explain the correction given by Laplace for speed of sound wave in air.

Watch Video Solution

39. Write the equation of speed of sound wave of Newton and explain the correction by Laplace.

Watch Video Solution

40. Write principle of superposition and explain.

Watch Video Solution

41. Write equation of displacement of resultant wave for two superposed wave of initial phase difference.

Watch Video Solution

42. Write definition of constructive intereference.

Watch Video Solution

43. Write definition of destructive intereference.

Watch Video Solution

44. What is intereference ? Define its types.

Watch Video Solution

45. What will be the change in phase of wave due to reflection from rigid support?

Watch Video Solution

46. What will be the change in phase of wave dueto reflection from free support?

Watch Video Solution

47. What is refracted wave ?

Watch Video Solution

48. What are stationary waves ? Obtain its equation.

Watch Video Solution

49. Write the amplitude and phase difference for all particles of same interval for stationary waves.

Watch Video Solution

50. What will be the phase difference of particles in successive intervals of stationary waves ?

Watch Video Solution

51. What are node and anti-node ?

Watch Video Solution

52. Give values of amplitude at node and anti-node.

Watch Video Solution

53. "Stationary waves conduct energy". True or False?

Watch Video Solution

54. Which is the most important property of stationary wave?

Watch Video Solution

55. What are called normal modes of oscillation of system?

Watch Video Solution

56. What is fundamental mode?

Watch Video Solution

57. What are closed pipe and open pipe ?

Watch Video Solution

58. Give equation of normal mode of vibration for closed pipe.

Watch Video Solution

59. What kind of figures are possible for closed pipe ?

Watch Video Solution

60. Give distance between consecutive nodes and antinodes in terms of wavelength.

Watch Video Solution

61. Write definition of beat.

Watch Video Solution

62. What is beat frequency?

Watch Video Solution

63. What should be the frequency of beat so that it can be heard clearly in case of sound ?

Watch Video Solution

Section B Numericals Numerical From Textual Illustrations

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

(a) Motion of a kink in a longitudinal spring produced by displacing one end of the spring sideways.

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

(c) Waves produced by a motorboat sailing in water.

(d) Ultrasonic waves in air produced by a vibrating quartz crystal.

Watch Video Solution

2. A wave travelling along a string is discribed by.

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

in which the numerical constants are in SI units $\left(0.005m, 80.0radm^{-1}, \text{ and } 3. -0radsec^{-1}\right)$. Calculate (a) the amplitude, (b) the wavelength, and (c) the period and frequency of the wave. Also, calculate the displacement y of the wave at a distance x = 30.0 cm and t = 20 s ?

Watch Video Solution

3. One string wave is given by $y(x, y) = 0.1 \sin\{\pi(5x - 2t)\}$ with all the values in SI units. Find (a) amplitude (b) wave length (c) periodic time, frequency and displacement of this wave at $x = 3$ m and $t = 2s$.

Watch Video Solution

4. A steel wire 0.72 m long has a mass of $5.0 \times 10^{-3} kg$. If the wire is under a tension of 60 N, what is the speed of transvers waves on the wire ?

Watch Video Solution

5. One steel wire of mass $4.0 \times 10^{-3} kg$ and length $0.64m$ is kept under 60 N tension. Find the speed of transverse wave, propagating on this wire.

Watch Video Solution

6. Estimate the speed of sound in air at standard temperature and pressure. The mass of 1 mole of air is $29.0 \times 10^{-3} kg$.

Watch Video Solution

7. A pipe, 30.0 cm long. Is open at both ends. Which harmonic mode of the pipe resonates a 1.1 kHz 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

8. 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 the 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 ?

Watch Video Solution

9. Two sitar wires A and B producing the note "Dha" are slightly out of tune and produce 5 beats per second. When the tension in the wire B is slighly increased, the beat frequency decreases to 3 Hz. If frequency of A is 512 Hz, what should be original and final frequency of B ?

Watch Video Solution

10. Tuning fork A has frequency 256 Hz. It produces 4 beats per second with fork B. When the prongs of fork B are rubbed little, it produces 2 beats per second with A. Find out frequencies of foek B, before and after rubbing its prongs.

Watch Video Solution

11. When tuning forks A and B are sounded together, 20 beats are produced in 8 second between them. (i.e. beat frequency is $\frac{20}{8} = 2.5Hz$). Now, when some wax is applied on one of these tuning forks, 32 beats are produced in 8 s. If frequency of that fork on which wax is not applied is 512 Hz then find frequency of another tuning fork, before and after applying wax.

Watch Video Solution

12. A rocket is moving at a speed of $200ms^{-1}$ 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 (1)

the frequency of the sound as detected by the target and (2) the frequency of the echo as detected by the rocket.

Watch Video Solution

13. A car moving on a straight path with a speed of 54 km/h, passes by a stationary listener, playing hrn with a frequency 500 Hz. If velocity of sound in air is 340 m/s, find out the differenfce in frequencies of sound of horn, heard by stationary listener when car approaches him and recedes from him.

Watch Video Solution

14. One engine moves with a speed 10 m/s towards a cliff (high hill). It blows a whistle with frequency 660 Hz. Find the frequency of an echo (from cliff), heard by driver of this engine. Speed of sound in air is 340 m/s.

Watch Video Solution

Section B Numericals Numerical From Textual Exercise

1. A string of mass $2.50kg$ is under a tension of 200 N. The length of the stretched string is 20.0 m. 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 pond near the base of the tower. When is the splash heard at the top givne that the speed of sound in air is $340ms^{-1}$? $\left(g = 9.8ms^{-2}\right)$

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 is so that speed of a transverse wave on the wire equals the speed of sound in dry air is 343 ms ^(-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 one dimension is represented by a function $y = f(x, t)$ where x and t must appear in the combination $x - vt$ or $x +$ or $v + vt, i.e. y = f(x \pm vt)$. Is the converse ture ? Examine if the following functions for y can possibly represent a travelling wave:

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

(b) $\log\left[\frac{(x+v_t)}{x_0}\right]$

(c) $\frac{1}{(x+vt)}$

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 $340ms^{-1}$ and in water $1486ms^{-1}$.

Watch Video Solution

7. A hospital uses an ultrasonic scanner to locate tumours in a tissure. What is the wavelength of sound in the tissure

in which the speed of sound is $1.7 kms^{-1}$? The operating frequency of the scanner is 4.2 MHz.

Watch Video Solution

8. A transverse harmonic wave on a string is described 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 origin ?

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

Watch Video Solution

9. For the wave discribed in Exercise 15.8, plot 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 travelling wave differ from one point to another: amplitude, frequency or phase ?

Watch Video Solution

10. For the travelling harmonic wave

$$y(x, t) = 2.0 \cos 2\pi(10t - 0.0080x + 0.35)$$

where x and y in cm and t in s. Calculate the phase difference between oscillatory motion of two points seperated by a distance of

(a) 4 m,

(b) 0.5 m,

(c) $\lambda/2$,

(d) $3\lambda/4$

Watch Video Solution

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

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

where x and y are in m and t in s. The length of the string is 1.5 m and its mass is $3.0 \times 10^{-2} kg$.

Answer the following :

(a) Does the function represent a travelling wave or a stationary wave?

(b) Interpret the wave as a superposition of two waves travelling in opposite directions. What is the wavelength, frequency , and speed of each wave ?

(c) Determine the tension in the string.

Watch Video Solution

12. (i) For the wave on a string described in Exercise 15.11. 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 0.375 m 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. Some 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 tits fndamental mode with a frequency of 45 Hz. The mass

of the wire is $3.5 \times 10^{-2} kg$ and its inear mass density is $4.0 \times 10^{-2} kgm^{-1}$. What is (a) the speed oa 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 movalble piston at the other end, shows resonance with a fixed frequency source (a tunning fork of frequency 340 Hz)when the tube length is 25.5 cm or 79.3 cm. Estimate the speed of sound in air at the temperature of the experiment. The edge effects may be neglected.

Watch Video Solution

16. A steel rod 100 cm long is clamped at its middle. The fundamental frequency of longitudinal vibraions of the rod are givne to be 2.53kHz. What is the speed of sound in steel ?

Watch Video Solution

17. A pipe 20 cm long is closed at one end. Which harmonic mode of the pipe is resonantly excited by a 430 Hz source ? Will the same source be in resonane with the pipe if both end are open ? (speed of sound in air is $340ms^{-1}$).

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 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 sizes of the 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, and

(e) the shape of a 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) recedes 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 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 $10ms^{-1}$. What are the frequency wavelength and speed of sound for an observer standing on the station's platform? Is the situation exactly identical the case when the air is still and the observer runs towards the yard at a speed of $10ms^{-1}$? The speed of sound in still air can be taken as $340ms^{-1}$

Watch Video Solution

Section B Numericals Additional Exercise

1. A travelling harmonic wave on a string is described by $y(x, t) = 7.5 \sin(0.005x + 12t + \pi/4)$ (a) what are the displacement and velocity of oscillation of a point at x=1 cm, and t=1s? Is this velocity equal to the velocity of wave propagation?

(b) Locate the points of the string which have the same transverse displacements and velocity as the x=1 cm 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) frequency (ii) wavelength (iii) speed of propagation? (b) If the pulse rate is 1 after every 20s. (that

is the whistle is blown for a split of second after every 20s), is the frequency of the note produced by the whistle equal to 1/20 or 0.05Hz?

Watch Video Solution

3. One end of a long string of linear mass density $8.0 \times 10^{-3} kgm^{-1}$ is connected to an electrically driven tuning fork of frequency 256Hz. The other end passes over a pulley and is tied to a pan containing a mass of 90kg. 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 describes 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 $360kmh^{-1}$. What is the frequency of sound reflected by the submarine ? Take the speed of sound in water to be $1450ms^{-1}$.

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 wave. Typical the speed of S wave is about $4.0kms^{-1}$, and that of P wave is $8.0kms^{-1}$. A seismograph records P and S waves from an earthquake. The first P wave arrives 4min before the first S wave. Assuming the waves travel in straight line, at what distance 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

Section B Numericals Numerical From Darpan Based On Textbook

1. For a wave described by $y = 0.5\sin(x - 60t)cm$, find (i) amplitude (ii) wave-vector (iii) wavelength (iv) angular frequency and frequency (v) periodic time (vi) speed of wave.

Watch Video Solution

2. By joining two wires PQ and QR, having lengths 4.8 m and 2.56 m, having masses 0.06 kg and 0.2 kg having same radii of cross section, a single wire PQR is prepared. When

this wire has a tension of 80 N, find time taken by a pulse produced at P to reach at R.

Watch Video Solution

3. The resistance of pure metals _____

A. Increases with an increase in temperature

B. Decreases with an increase in temperature

C. Remains the same with an increase in temperature

D. Becomes zero with an increase in temperature

Answer:

Watch Video Solution

4. Speed of sound in dry air at STP is 332 m/s. Assume that volume of air has nitrogen in 4 parts and oxygen in 1 part. If ratio of density of N_2 to that of O, is 14:16, then find speed of sound in oxygen.

Watch Video Solution

5. Stationary waves produced in a string of length 60 cm is described by $y = 4\sin\left(\frac{\pi x}{15}\right)\cos(96\pi t)$ (where x and y are in cm and is in s). Find (1) position of nodes (il) positions of antinodes (iii) maximum displacement of a particle at * 5 cm (iv) equations of component waves of given stationary wave.

Watch Video Solution

6. If second overtone of closed pipe and third overtone of open pipe are equal, then find ratio of lengths of both the pipes.

Watch Video Solution

7. When tuning forks A and B are sounded together, 20 beats are produced in 8 second between them. (i.e. beat frequency is $\frac{20}{8} = 2.5Hz$). Now, when some wax is applied on one of these tuning forks, 32 beats are produced in 8 s. If frequency of that fork on which wax is not applied is 512 Hz then find frequency of another tuning fork, before and after applying wax.

Watch Video Solution

8. During the propagation of one progressive harmonic wave having amplitude 10 m, displacements and particles at 2 m and 16 m at respectively 2s and 8 s are 5 m and $5\sqrt{3}$ m respectively. Find angular frequency and wave vector for this wave.

Watch Video Solution

9. At which temperature, velocity of sound in H_2 gas will be same as that in O_2 at $1200^\circ C$ temperature ? Density of O, is 16 times density of H_2.

Watch Video Solution

10. For one wire tied at both the ends with a tension of 450 N, linear density of mass is 0.05 g/cm. It sounds resonantly for two consecutive frequencies 420 Hz and 490 Hz. Find length of this wire.

Watch Video Solution

11. Two consecutive harmonics in stationary waves produced in a string of length 100 cm have frequencies 300 Hz and 400 Hz. It has maximum amplitude 10 cm. Obtain equation of stationary waves in this string when it oscillates with fundamental frequency.

Watch Video Solution

12. A car moving on a straight path with a speed of 54 km/h, passes by a stationary listener, playing hrn with a frequency 500 Hz. If velocity of sound in air is 340 m/s, find out the differenfce in frequencies of sound of horn, heard by stationary listener when car approaches him and recedes from him.

Watch Video Solution

13. One engine moves with a speed 10 m/s towards a cliff (high hill). It blows a whistle with frequency 660 Hz. Find the frequency of an echo (from cliff), heard by driver of this engine. Speed of sound in air is 340 m/s.

Watch Video Solution

Section C Objective Questions Vsqs

1. Distance travelled by a travelling wave having wavelength λ and periodic time T, in one secons is ....

Watch Video Solution

2. Which properties of a medium are required for the propagation of mechanical wave ?

Watch Video Solution

3. How does speed os sound wave depend on the absolute temperature of ari ?

Watch Video Solution

4. If tension in a wire is made four times, then what will be the change in speed of wave propagationg in it ?

Watch Video Solution

5. When pressure on a gaseous medium is changed at constnat temperature, what will be effect on the speed of sound wave in it ?

Watch Video Solution

6. For a progressive wave, $y = 5\sin(0.01x - 2t)$ (where x and y are in cm and t is in s). What will be its speed od propagation ?

Watch Video Solution

7. What will be the change in phase of wave due to reflection from rigid support?

Watch Video Solution

8. Give values of amplitude at node and anti-node.

Watch Video Solution

9. In one stationary wave if distance between consecutive node and antinode is 5 cm then find distance between two consecutive antinodes.

Watch Video Solution

10. Fundamental frequency of one closed pipe is 300 Hz. What will be the frequency of its second overtone ?

Watch Video Solution

11. When wave propagating in one medium, enters another medium, which of the characteristic do remain constnat ?

Watch Video Solution

12. When source of sound moves away from stationary listener we obtian $f_L < f_S$. Why ?

Watch Video Solution

13. In case of beats, produced by the superposition of two waves of equal amplitudes, if maximum intensity is x times the intensity of superposing wave then x = ...

Watch Video Solution

14. When two violin wires with different fundamental frequencies are vibrated to play some music, can they produce resonance ?

Watch Video Solution

15. What will be the shape of speed of sound in air versus pressure at constant temperature ?

Watch Video Solution

16. What is the phase difference between consecutive crest and through ?

Watch Video Solution

17. Light waves are.... And .....

Watch Video Solution

18. Which order of harmonics is missing or absent in case of stationary sound waves produced in a closed pipe ?

Watch Video Solution

19. At constant pressure, out of H_2 and O_2 gas in which gas speed of sound is greater ?

Watch Video Solution

20. Mention the type of ultrasonic waves and its frequency.

Watch Video Solution

21. Mention the range of audible range for the humans.

Watch Video Solution

22. What is the distance between consecutive compression and rarefaction in longitudinal waves ?

Watch Video Solution

23. When a vibrating tuning fork moves towards a wall, why do we hear sound beats ?

Watch Video Solution

24. If tension in a wire is made four times, then what will be the change in speed of wave propagationg in it ?

Watch Video Solution

25. What will be shape of wave propagationg on sea when observed from sea shore ? Why ?

Watch Video Solution

26. When a steel pipe is hammered at one end, we hear two sounds at another end. Why ?

Watch Video Solution

27. Why the bells in temples and schools are mde up of metal and not of wood ?

Watch Video Solution

28. Why don't we experience beats in case of superposition of two sound waves with large difference in the frequencies ?

Watch Video Solution

29. When the tense wire of sitar is pulled slightly from the middle and then released which type of waves are produced ?

Watch Video Solution

30. Why can't we make any conversaton on the surface of Moon ?

Watch Video Solution

31. Out of hot moist air and dry cold air in which does sound travel faster ?

Watch Video Solution

32. Do waves carry momentum also along with energy ?

Watch Video Solution

33. What is the velocity of sound in perfectly rigid rod ? Why ?

Watch Video Solution

34. Find the wavelength of sound wave of frequency $4.2MHz$ travelling with a speed $1.7km/s$.

Watch Video Solution

35. Does an oscillating source always produce sound waves ?

Watch Video Solution

36. Newton's laws can be applied to mechanical waves, propagating in elastic media. Can they be applied to electromagnetic waves also ?

Watch Video Solution

Section C Objective Questions Vsqs True Or False

1. In case of propagation of longidudinal waves, angle between directions of velocity of particle and velocity of wave is 0° or 180°.

Watch Video Solution

2. In case of propagation of transverse waves, angle between directions of velocity of particle and velocity of wave is π rad.

Watch Video Solution

3. Along the direction of propagation of wave, distance between two particles, having same phaes is called

wavelength of wave.

Watch Video Solution

4. When a wave gets reflected from rarer medium its phase increases by amount π rad.

Watch Video Solution

5. Compared to moisture air speed of sound is greater in dry air.

Watch Video Solution

6. When prongs of a tuning fork are rubbed, its frequency decreases.

Watch Video Solution

7. In case of stationary wave, amplitudes of particles in any one loop are same.

Watch Video Solution

8. In case of stationary wave, amplitude of particle decreases from node to antinode.

Watch Video Solution

9. For humans, minimum wavelength of sound wave in the audible range is nearly.....

Watch Video Solution

10. Only .... Waves can be propagated by fluid medium.

Watch Video Solution

11. Distance travelled by a travelling wave having wavelength λ and periodic time T, in one secons is ....

Watch Video Solution

12. If fundamental frequency of a given closed pipe is 50 Hz, then frequency for second overtone is.....

Watch Video Solution

13. Speed of sound in air at STP is.....

Watch Video Solution

14. What should be the frequency of beat so that it can be heard clearly in case of sound ?

Watch Video Solution

Section C Objective Questions Vsqs Match Type Questions

1. The resistance of insulators _____

A. Increases with an increase in temperature

B. Decreases with an increase in temperature

C. Remains the same with an increase in temperature

D. Becomes zero with an increase in temperature

Answer:

Watch Video Solution

2. Which of the following statements are true about insulators?

A. Insulators have a positive temperature coefficient

B. Insulators have a negative temperature coefficient

C. Insulators have zero temperature coefficient

D. Insulators have infinite temperature coefficient

Answer:

Watch Video Solution

3. What is the unit of temperature coefficient?

A. ohm/centigrade

B. ohm-centigrade

C. centigradee^{-1}

D. centigrade

Answer:

Watch Video Solution

4. The temperature of a coil cannot be measured by which of the following methods?

A. Thermometer

B. Increase in resistance of the coil

C. Thermo-junctions embedded in the coil

D. Calorimeter

Answer:

Watch Video Solution

5. The rise or fall in resistance with the rise in temperature depends on _____

A. The property of the conductor material

B. The current in the metal

C. Property of material as well current in that material

D. Does not depend on any factor

Answer:

View Text Solution

6. Materials having resistance almost equal to zero is _____

A. Semi-conductor

B. Conductor

C. Superconductors

D. Insulators

Answer:

View Text Solution

Section C Objective Questions Vsqs Assertion Reason Type Questions

1. Assertion : Two persons can not conversant on Moon.

Reason: Moon does not have an atmosphere.

A. Assertin and reason both are correct and reason is the correct explantion of assertion.

B. Assertion and reason both area correct but reason is not the correct explanation of assertion.

C. Asserton is true but reaosn is false.

D. Both, assertion and reaosn are false.

Answer:

Watch Video Solution

2. Assertion : Progressive and transverse waves can not be produced in liquid or gas.

Reason: Light wave is progressive (travelling).

A. Assertin and reason both are correct and reason is the correct explantion of assertion.

B. Assertion and reason both area correct but reason is not the correct explanation of assertion.

C. Asserton is true but reaosn is false.

D. Both, assertion and reaosn are false.

Answer:

Watch Video Solution

3. Assertion : Change in pressure at constant temperature causes change in the speed of sound.

Reason : Speed of sound in air is directly proportional to square of pressure.

A. Assertin and reason both are correct and reason is the correct explantion of assertion.

B. Assertion and reason both area correct but reason is not the correct explanation of assertion.

C. Asserton is true but reaosn is false.

D. Both, assertion and reaosn are false.

Answer:

Watch Video Solution

4. Assertion : Compared to winter, sound travels faster in summer.

Reason: Speed of sound is proportional to square of absolute temperature of air.

A. Assertin and reason both are correct and reason is the correct explantion of assertion.

B. Assertion and reason both area correct but reason is not the correct explanation of assertion.

C. Asserton is true but reaosn is false.

D. Both, assertion and reaosn are false.

Answer:

Watch Video Solution

Watch Video Solution

5. Assertion : When a wave changes médium of propagation, its frequency remains constant but its wavelength changes.

Reason: Frequency is a property of source whereas wavelength is a property of medium.

A. Assertin and reason both are correct and reason is the correct explantion of assertion.

B. Assertion and reason both area correct but reason is not the correct explanation of assertion.

C. Asserton is true but reaosn is false.

D. Both, assertion and reaosn are false.

Answer:

Watch Video Solution

6. Assertion : In the phenomenon called "Beats", intensity of sound becomes maximum $2(f_1 \sim f_2)$ times in a unit time.

Reason: No. of beats per unit time is $(f_1 \sim f_2)$

A. Assertin and reason both are correct and reason is the correct explantion of assertion.

B. Assertion and reason both area correct but reason is not the correct explanation of assertion.

C. Asserton is true but reaosn is false.

D. Both, assertion and reaosn are false.

Answer:

Watch Video Solution

7. Assertion : In Doppler's effect, when source moves towards listener, wavelength decreases and when source moves away from listener, wavelength increases.

Reason: In both the cases, there is a relative motion between source of sound and listener.

A. Assertin and reason both are correct and reason is the correct explantion of assertion.

B. Assertion and reason both area correct but reason is not the correct explanation of assertion.

C. Asserton is true but reaosn is false.

D. Both, assertion and reaosn are false.

Answer:

Watch Video Solution

Section D Ncert Exemplar Solution Multiple Choice Questions Mcqs

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

A. neither longitudinla nor transvere.

B. both longitudinal and transverse.

C. only logitudinal.

D. only transverse.

Answer: B

Watch Video Solution

2. Sound waves of wavelength λ travelling in a medium with a speed of v m/s enter into another medium where its speed is 2v m/s. 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 wave 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 propagation of longitudinal waves through a medium, the quantity transmitted is

A. matter

B. energy

C. energy and matter

D. energy, matter and 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 rarefaction. In consecutive compressions and rarefactions.

A. (a)denisty remains constant.

B. (b) Boyle's law is obeyed.

C. (c) bulk modulus of air oscillates.

D. (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 $\frac{2}{3}$ 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 of 200 N. The length of the stretched string is 20.0 m. If the transverse jerk is struck at one end of the string, how long does the disturbance take to reach the other end ?

A. one second

B. 0.5 second

C. 2 second

D. data given is insufficient.

Answer: B

Watch Video Solution

10. If the temperature is increased in semi-conductors such that the resistance incessantly falls, it is termed as.

A. 

B. 

C. 

D. 

Answer: C

View Text Solution

Section D Ncert Exemplar Solution Multiple Choice Questions More Than One Options

1. A transverse harmonic wave on a string is described 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 origin ?

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

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 $5.7Hz$.

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

Answer: A::B::C

Watch Video Solution

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

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

where x and y are in m and t in s. The length of the string is 1.5 m and its mass is $3.0 \times 10^{-2} kg$.

Answer the following :

(a) Does the function represent a travelling wave or a stationary wave?

(b) Interpret the wave as a superposition of two waves travelling in opposite directions. What is the wavelength, frequency , and speed of each wave ?

(c) Determine the tension in the string.

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 superopostion 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

3. Speed of sound wave in a fluid depends upon.....

A. directly on density of the medium.

B. square of Bulk modulus of the medium.

C. inversely on the square root of density.

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

Answer: C::D

Watch Video Solution

4. During propagation of a plane progressive mechanical wave .....

A. all the paricles are vibrating in the same phase.

B. amplitudes of all the particles are equal.

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

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

Answer: A::B::C

Watch Video Solution

Watch Video Solution

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

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

where x and y are in m and t in s. The length of the string is 1.5 m and its mass is $3.0 \times 10^{-2} kg$.

Answer the following :

(a) Does the function represent a travelling wave or a stationary wave?

(b) Interpret the wave as a superposition of two waves travelling in opposite directions. What is the wavelength, frequency , and speed of each wave ?

(c) Determine the tension in the string.

A. same frequency

B. same phase

C. same energy

D. different amplitude

Answer: A::B::D

Watch Video Solution

6. 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 $10ms^{-1}$. What are the frequency wavelength and speed of sound for an observer standing on the station's platform? Is the situation exactly identical the case when the air is still and the observer runs towards the yard at a speed of

$10ms^{-1}$? The speed of sound in still air can be taken as $340ms^{-1}$

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

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

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

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

C. (C) All the particle are oscillating with same amplitude.

D. (D) There is no net transfer of energy across any plane.

Answer: A::B::D

Watch Video Solution

Section D Ncert Exemplar Solution Very Short Answer Type Questions

1. A sonometer wire is vibrating in 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 is resonance with the wire?

Watch Video Solution

2. An organ pipe of length L open at both ends is found to vibrate in its first harmonic when sounded with a tuning fork of 480 Hz. 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

3. A tuning fork A, marked 512 Hz, produces 5 beats per second, where 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 the tuning fork B when not loaded ?

Watch Video Solution

4. 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

5. 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

6. At what temperatures (in $0^\circ C$) will the speed of sound in air be 3 times its value at $0^\circ C$?

Watch Video Solution

7. When two waves of almost equal frequencies n_1 and n_2 reach at a point simultaneously, what is the time interval between successive maxima ?

Watch Video Solution

Section D Ncert Exemplar Solution Short Answer Type Questions

1. A steel wire has a length of $12.0m$ and a mass of $2.10kg$. What should be the tension in the wire is so that speed of a transverse wave on the wire equals the speed of sound in dry air is 343 ms ^(-1).`

Watch Video Solution

2. A pipe 20 cm long is closed at one end. Which harmonic mode of the pipe is resonantly excited by a 430 Hz source ? Will the same source be in resonane with the pipe if both end are open ? (speed of sound in air is $340ms^{-1}$).

Watch Video Solution

3. 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) recedes 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

4. 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

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

(a) Calculate the time at which the second curve is plotted.

(b) Mark nodes and antinodes on the curve.

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

View Text Solution

6. A tuning fork vibrating with a frequency of 512 Hz is kept close to the open end of a tube filled with water. The water level in the tube is gradually lowered. When the water level is 17 cm below the open end, maximum Intensity of sound is 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 ?

View Text Solution

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

Watch Video Solution

Section D Ncert Exemplar Solution Long Answer Type Questions

1. The earth has a radius of 6400 km. The inner core of 1000 km radius is solid. Outside it, there is a region from 1000 km to a radius of 3500 km which is in molten state. Then again from 3500 km to 6400 km the earth is solid. Only

longitudinal (P) waves can travel inside a liquid. Assume that the P wave has a speed of 8 kms^{-1} in solid parts and of $5kms^{-1}$ in liquid parts of the earth. An earthquake occurs at some place close to the surface of the earth. Calculate the time after which it will be recorded in a seismometer at a diametrically opposite point on the earth if wave travels along diameter ?

Watch Video Solution

2. If c is rms speed of molecules in a gas and v is the speed of sound waves in the gas, show that $\frac{c}{v}$ is constant and independent of temperature for all diatomic gases.

Watch Video Solution

3. Given below are some functions of x and to represent the displacement of an elastic wave.

(i) $y = 5\cos(4x)\sin(20t)$

(ii) $y = 4\sin\left(5x - \frac{t}{2}\right) + 3\cos\left(5x - \frac{t}{2}\right)$

(iii) $y = 10\cos\{(252 - 250)\pi t]\cos\{(252 + 250)\pi t]$

(iv) $y = 100\cos(100\pi t + 0.5x)$

State which of these represent

(a) a travelling wave along-x direction

(b) a stationary wave

(c) beats

(d) a travelling wave along + x direction. Give reasons for your answers.

Watch Video Solution

4. in the given progressive wave

$y = 5\sin(100\pi t - 0.4\pi x)$ where y and x are in metre, t is in second. What is the

(a) amplitude

(b) wave length

(c) frequency

(d) wave velocity

(e) particle velocity amplitude,

Watch Video Solution

5. For the travelling harmonic wave

$y(x, t) = 2.0\cos 2\pi(10t - 0.0080x + 0.35)$

where x and y in cm and t in s. Calculate the phase difference between oscillatory motion of two points

seperated by a distance of

(a) 4 m,

(b) 0.5 m,

(c) $\lambda / 2$,

(d) $3\lambda / 4$

Watch Video Solution

Section E Multiple Choice Questions Mcqs Mcqs Asked In Gujarat Board And Competitive Exams

1. The phase difference between two waves, represented by

$y_1 = 10^{-65} \sin[100t + (x / 50) + 0.5]m$

$y_2 = 10^{-6} \cos[100t + (x / 50)]m$

(where x is expressed in metres and t is expressed in seconds is approximately .....

A. 15 radian

B. 1.07 radian

C. 2.07 radian

D. 0.5 radian

Answer: B

Watch Video Solution

2. Two vibrating tuning forks produce progressive waves given by y, $y_1 = 4\sin 500\pi t$ and $y_2 = 2\sin 506\pi t$. Number of beats produced per minute is .....

A. 360

B. 180

C. 60

D. 3

Answer: B

Watch Video Solution

3. A point source emits sound equally in all directions in a non-absorbing medium. Two points P and Q are at distance of 2 m and 3 m respectively from the source. The ratio of the intensities of the waves at P and Q is .....

A. $3:2$

B. $2:3$

C. $9:4$

D. $4:9$

Answer: C

Watch Video Solution

4. Two sound waves with wavelengths 5.0 m and 5.5 m respectively, each propagate in a gas with velocity 330 m/s. We expect the following number of beats per second

A. 0

B. 1

C. 6

D. 12

Answer: C

Watch Video Solution

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

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

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

C. π

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

Answer: B

Watch Video Solution

6. Each of the two strings of length 51.6 cm and 49.1 cm are tensed separately by 20 N force. Mass per unit length of both the strings is same and equal to 1 g/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

Watch Video Solution

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

B. πA

C. $2\pi A$

D. A

Answer: C

Watch Video Solution

8. A tuning fork of frequency 512 Hz makes 4 beats per second with the vibrating string of a piano. The beat frequency decreases to 2 beats per sec. when the tension in the piano string is slightly increased. The frequency of the piano string before increasing the tension was

A. (A) 510 Hz

B. (B) 514 Hz

C. (C) 516 Hz

D. (D) 508 Hz

Answer: D

Watch Video Solution

9. 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 meter and t in sec. 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

10. Sound waves travel at 350 m/s through a warm air and at 3500 m/s through brass. The wavelength of a 700 Hz acoustic wave as it enters brass from warm air ...

A. decreases by a factor 10

B. increases by a factor 20

C. increases by factor 10

D. decreases by a factor 20

Answer: C

Watch Video Solution

11. Two identical piano wires kept under the same tension T have a fundamental frequency of 600 Hz. The fractional increase in the tension of one of the wires which will lead to occurrence of 6 beats/s when both the wires oscillate together would be .....

A. 0.02

B. 0.03

C. 0.04

D. 0.01

Answer: A

Watch Video Solution

12. A wave travelling in the +ve X-direction having maximum displacement along Y-direction as 1 m, wavelength 2π m and frequency $\frac{1}{\pi}$ and initial phase zero is represented by .....

A. $y = \sin(2\pi x 02\pi t)$

B. $y = \sin(10\pi x - 20\pi t)$

C. $y = \sin(2\pi x + 2\pi t)$

D. $y = \sin(2t - x)$

Answer: D

Watch Video Solution

13. If $n_1, n_2, \text{ and } n_3$ are the fundamental frequencies of three segments into which a string is divided, then the original fundamental frequency n of the string is given by ...

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

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

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

D. $n = n_1 + n_2 + n_3$

Answer: A

Watch Video Solution

14. The fundamental frequency of a closed organ pipe of length 20 cm 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

15. A source of sound S emitting waves of frequency 100 Hz and an observer 0 are located at some distance from each other. The source is moving with a speed of $19.4ms^{-1}$ at an angle of 60° with the source observer line as shown in the figure. The observer is at rest. The apparent frequency observed by the observer (velocity of sound in air 330 ms^{-1}) is .....

A. 97 Hz

B. 100 Hz

C. 103 Hz

D. 106 Hz

Answer: C

Watch Video Solution

16. For a string, tied with two fixed rigid supports, scparated by 75 cm has two consecutive harmonics at 315 Hz and 420 Hz. Find its minimum frequency.

A. 105 Hz

B. 155 Hz

C. 205 Hz

D. 10.5 Hz

Answer: A

Watch Video Solution

17. 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

18. For one resonance tube, a tuning fork produces resonance when air column in it has minimum length 50 cm. Now, next length of air column when resonance is produced again is

A. 100 cm

B. 150 cm

C. 200 cm

D. 66.7 cm

Answer: B

Watch Video Solution

19. A uniform rope of length L and mass m, hangs vertically from a rigid support. A block of mass m_2 is attached to the free end of the rope. A transverse pulse of wavelengthλ_1 is produced at the lower end of the rope. The wavelength of the pulse when it reaches the top of the rope is λ_2. . The ratio λ_2 / λ_1 is .....

A. $\sqrt{\frac{m_1 + m_2}{m_2}}$

B. $\sqrt{\frac{m_2}{m_1}}$

C. $\sqrt{\frac{m_1 + m_2}{m_1}}$

D. $\sqrt{\frac{m_1}{m_2}}$

Answer: A

Watch Video Solution

20. The second overtone of an open organ pipe has the same frequency as the first overtone of a closed pipe L meter long. The length of the open pipe will be

A. $\frac{L}{2}m$

B. $4Lm$

C. Lm

D. 2L m

Answer: D

Watch Video Solution

21. Three sound waves of equal amplitude have frequencies (n-1), n, (n + 1). They superimpose to give beats. The number of beats produced per second will be ?

A. 3

B. 2

C. 1

D. 4

Answer: B

Watch Video Solution

22. When I m long metallic rod is vertically dropped it strikes the solid metallic floor and 1.2 kHz. Find speed of this sound wave in the rod.

A. $600m/s$

B. $2400m/s$

C. $1800m/s$

D. $1200m/s$

Answer: B

Watch Video Solution

23. When two organ pipes with fundamental frequencies n_1 and n_2 are connected in series, what will be the resultant fundamental frequency?

A. $(n_1 + n_2)$

B. $\frac{n_2 + n_2}{2}$

C. $\sqrt{n_1 n_2 + n_2^2}$

D. $\frac{n_2 n_2}{n_1 + n_2}$

Answer: D

Watch Video Solution

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

A. $300m/s$

B. $330m/s$

C. $350m/s$

D. $339m/s$

Answer: D

Watch Video Solution

25. Fundamental frequency of one open pipe is equal to third harmonic of closed pipe of length 20 cm. Find length of open pipe.

A. 16 cm

B. 13.2 cm

C. 12.5 cm

D. 8 cm

Answer: B

Watch Video Solution

26. An organ pipe closed at one end has fundamental frequency of 1500 Hz. The maximum number of overtones generated by this pipe which a normal person can hear is

A. 14

B. 13

C. 6

D. 9

Answer: C

Watch Video Solution

27. A stone thrown into still water, creates a circular wave pattern moving radially outwards. If r is the distance measured from the centre of the pattern, the amplitude of the wave varies as

A. $r^{-\frac{1}{2}}$

B. r^{-1}

C. r^{-2}

D. $r^{-\frac{3}{2}}$

Answer: A

Watch Video Solution

28. A boat at anchor is rocked by waves whose crests are 100 m apart and velocity is 25 m/sec. The boat bounces up once in every

A. 2500 s

B. 75 s

C. 4 s

D. $0.25a$

Answer: C

Watch Video Solution

29. When a guitar string is sounded with a 440 Hz tuning fork, a beat frequency of 5 Hz is heard. If the experiment is repeated with a tuning fork of 437 Hz, the beat frequency is 8 Hz. The string frequency (Hz) is ....

A. 445

B. 435

C. 429

D. 448

Answer: A

Watch Video Solution

30. A siren emitting sound of frequency 800 Hz is going away from a static listener with a speed of 30 m/s. Frequency of the sound to be heard by the listener is (Take velocity of sound as 330 m/s)

A. $733.3Hz$

B. $481.2Hz$

C. $644.8Hz$

D. $286.5Hz$

Answer: A

Watch Video Solution

31. Two closed organ pipes of length 100 cm and 101 cm produce 16 beats in 20 sec. When each pipe is sounded in its fundamental mode calculate the velocity of sound in m/s.

A. 303

B. 332

C. 323.2

D. 330

Answer: C

Watch Video Solution

32. The second overtone of an open pipe has the same frequency as the first overtone of a closed pipe 2 m long. The length of the open pipe is

A. (A) 8m

B. (B) 4m

C. (C) 2m

D. (D) 1m

Answer: B

Watch Video Solution

33. What is your observation when two sources are emitting sound with frequency 499 Hz and 501 Hz ?

A. (A) Frequency of 500 Hz is heard with change in intensity take place twice.

B. (B) Frequency of 500 Hz is heard with change in intensity take place once.

C. (C) Frequency of 2 Hz is heard with change in intensity take place once.

D. (D) Frequency of 2 Hz is heard with change in intensity take place twice.

Answer: A

Watch Video Solution

34. If man were standing unsymmetrically between parallel cliffs, claps his hands and starts hearing a series of echoes at intervals of 1 s. If speed of sound in air is 340 ms-1, the distance between two cliffs would be .....

A. (A) 340 m

B. (B) 510 m

C. (C) 170 m

D. (D) 680 m

Answer: B

Watch Video Solution

35. A uniform string is vibrating with a fundamental frequency 'f. The new frequency, if radius and length both are doubled would be.....

A. 2f

B. 3f

C. $\frac{f}{4}$

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

Answer: C

Watch Video Solution

36. Five sinusoidal waves have the same frequency 500 Hz but their amplitudes are in the ratio $2:\frac{1}{2}:\frac{1}{2}:1:1$and

their phase angles $0, \frac{\pi}{6}, \frac{\pi}{3}, \frac{\pi}{2}$ and π respectively. The phase angle of resultant wave obtained by the superposition of these five waves is

A. 30°

B. 45°

C. 60°

D. 90°

Answer: B

Watch Video Solution

37. Mention the range of audible range for the humans.

A. $0Hz - 30Hz$

B. $20Hz - 20kHz$

C. $20kHz - 20,000kHz$

D. $20kHz - MHz$

Answer: B

Watch Video Solution

38. Among following media, sound has its maximum velocity in .....

A. air

B. water

C. vacuum

D. steel

Answer: D

Watch Video Solution

39. What should be minimum distance between listener and reflecting surface ?

A. 28m

B. 18m

C. 19m

D. $16.6m$

Answer: D

Watch Video Solution

40. Equation of a wave propagating on a string is $y = 3\cos\{\pi(100t - x)\}$ (Where x is in cm and t is in s). Find its wavelength.

A. 100 cm

B. 2 cm

C. 5 cm

D. None of these

Answer: B

Watch Video Solution

41. Path different between waves

$$y_1 = A_1 \sin\left(\omega t - \frac{2\pi x}{\lambda}\right) \text{ and } y_2 = A_2 \cos\left(\omega t - \frac{2\pi x}{\lambda} + \phi\right)$$

at the point of superpositon is :

A. $\frac{\lambda}{2\pi}\phi$

B. $\frac{\lambda}{2\pi}\left(\phi + \frac{\pi}{2}\right)$

C. $\frac{2\pi}{\lambda}\left(\phi \sim \frac{\pi}{2}\right)$

D. $\frac{2\pi}{\lambda}\phi$

Answer: B

Watch Video Solution

42. Reason for increase in the intensity of sound during night time is .....

A. greater density of air

B. smaller density of air

C. lower temperature

D. None of these

Answer: A

Watch Video Solution

43. If resultant wave of two waves, each of amplitude A is also A then, phase difference between those two waves is

A. 60°

B. 90°

C. 120°

D. 180°

Answer: C

Watch Video Solution

44. Magnitude of wave vector of an e.m.wave with frequency 150 MHz is ..... rad/s.

A. π

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

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

D. $\frac{3\pi}{4}$

Answer: A

Watch Video Solution

45. For stationary waves produced in a string of length I wavelength in the n^{th} mode is .....

A. $\frac{n^2}{2l}$

B. $\frac{t^2}{2n}$

C. $\frac{2l}{n}$

D. $2\,\mathrm{ln}$

Answer: C

Watch Video Solution

46. When two waves $y_1 = A\sin\left(\omega t + \frac{\pi}{6}\right)$ and $y_2 = A\cos(\omega t)$ superpose, find amplitude of resultant wave.

A. A

B. $\sqrt{2}A$

C. $\sqrt{3}A$

D. $2A$

Answer: C

Watch Video Solution

47. One source of sound moves towards stationary listener with a speed, $\frac{1}{10}$ times speed of sound. Ratio of frequency of sound heard by listener to that emitted from source is .....

A. $\frac{10}{9}$

B. $\frac{11}{10}$

C. $\left(\frac{11}{10}\right)^2$

D. $\left(\frac{9}{10}\right)^2$

Answer: A

Watch Video Solution

48. Wave equation for one progressive harmonic wave is $y = 10^{-4}\sin\left(600t - 2x + \frac{\pi}{3}\right)$ m and t is in s). Velocity of the wave would be ..... m/s

A. 300

B. 600

C. 1200

D. 200

Answer: A

Watch Video Solution

49. For a string, tied with two fixed rigid supports, scparated by 75 cm has two consecutive harmonics at 315 Hz and 420 Hz. Find its minimum frequency.

A. 1050 Hz

B. $10.5Hz$

C. $105Hz$

D. $1.05Hz$

Answer: C

Watch Video Solution

50. Velocity of sound in O_2 gas is 460 ms^{-1} at certain temperature. Velocity of sound in He gas at the same temperature would be .....

(Consider both the gases to be ideal).

A. $1419ms^{-1}$

B. $460ms^{-1}$

C. $500ms^{-1}$

D. $650ms^{-1}$

Answer: A

Watch Video Solution

51. One end of 85 cm long pipe is made closed. Now, normal modes of vibration are set up in the air column, inside this pipe. Find no. of harmonics having frequency less than 1250 Hz. (Velocity of sound in air is 340 m/s.)

A. 6

B. 4

C. 12

D. 8

Answer: A

Watch Video Solution

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

A. $6\ \%$

B. $12\ \%$

C. $18\ \%$

D. $24\ \%$

Answer: B

Watch Video Solution

53. A 60 cm long granite rod is fixed at its midpoint and then longitudinal waves are set up in it. Find fundamental frequency of these waves. Density of granite is 2.7×10^3 kg/m3 and its Young modulus is $9.27 \times 10^{10} Pa$.

A. (A) 5 kHz

B. (B) $2.5kHz$

C. (C) $10kHz$

D. (D) $7.5kHz$

Answer: A

Watch Video Solution

54. An organ pipe closed at one end has fundamental frequency of 1500 Hz. The maximum number of overtones generated by this pipe which a normal person can hear is

A. 5

B. 6

C. 4

D. 7

Answer: B

Watch Video Solution

Section F Questions From Module Sample Questions For Preparation Of Competitive Exams

1. In a standing wave formed by two atoms separated by 1.21Å,` there are 3 nodes and 2 antinodes. Find its wavelength.

A. $1.21Å$

B. $2.42Å$

C. $6.05Å$

D. $3.63Å$

Answer: A

Watch Video Solution

2. Relation between phase difference $(\Delta\phi)$ and path difference (Δx) is .....

A. $\Delta\phi = \frac{2\pi}{\lambda}\Delta x$

B. $\Delta\phi = 2\pi\lambda\Delta x$

C. $\Delta\phi = \frac{2\pi\lambda}{\Delta x}$

D. $\Delta\phi = \frac{2\Delta x}{\lambda}$

Answer: A

Watch Video Solution

3. Give distance between consecutive nodes and antinodes in terms of wavelength.

A. λ

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

C. $\frac{\lambda}{4}$

D. 2λ

Answer: C

Watch Video Solution

4. Velocity of a wave $y = 10^{-4}\sin\left(100t - \frac{x}{10}\right)m$ is .....m/s

A. 100

B. 4

C. 1000

D. 10

Answer: C

Watch Video Solution

5. Find wave speed in a string of length 7m, mass $0.035kg$ and having a tension of $60.5N$.

A. (A) 77 m/s`

B. (B) 102 m/s`

C. (C) 110 m/s

D. (D) 165 m/s`

Answer: C

Watch Video Solution

6. A source whistling a sound of frequency 450 Hz moves towards a stationary listener with a speed of 33 m/s. If velocity of sound is 333 m/s, then find frequency of sound heard by this listener.

A. 409

B. 429

C. 517

D. 500`

Answer: D

Watch Video Solution

7. For a stationary wave $y = 10\sin\left(\frac{\pi x}{4}\right)\cos(2\pi t)$ metre, distance between two consecutive nodes is ..... m.

A. 4

B. 2

C. 1

D. 8

Answer: A

Watch Video Solution

8. For a progressive wave $y = A\sin(kx - wt)$, ratio of maximum velocity of a particle to the velocity of wave is....

A. ωA

B. $\frac{1}{kA}$

C. $\frac{\omega}{K}$

D. KA

Answer: D

Watch Video Solution

9. Velocity of sound in O_2 gas is 460 ms^{-1} at certain temperature. Velocity of sound in He gas at the same temperature would be .....

(Consider both the gases to be ideal).

A. 1419

B. 460

C. 500

D. 650

Answer: A

Watch Video Solution

10. One car while moving towards a cliff, blows a horn with frequency f. If the driver hears an echo of frequency 2f then speed of car in terms of speed of sound is .....

A. (A) v/2`

B. (B) $\frac{v}{\sqrt{2}}$

C. (C) $\frac{v}{3}$

D. (D) $\frac{v}{4}$

Answer: C

Watch Video Solution

11. Phase difference between two waves $y_1 = A\sin(\omega t - kx)$ and $y_2 = A\cos(\omega t - kx)$ is .....

A. $\frac{\pi}{4}$

B. π

C. $\frac{\pi}{8}$

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

Answer: D

Watch Video Solution

12. When a wave passes through a given medium, which of following quantities does not depend on the rest ?

A. Velocity

B. Wavelength

C. Frequency

D. All depend mutually

Answer: C

Watch Video Solution

13. Two waves with wavelength λ have phase difference of 60^{o} at the point of superposition. Find path difference between them.

A. $\frac{\lambda}{6}$

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

C. 2λ

D. $\frac{\lambda}{4}$

Answer: A

Watch Video Solution

14. One rod vibrates with frequency 200 Hz. It produces a sound which travels in air with velocity 340 m/s. Find wavelength of this wave

A. $1.7cm$

B. $6.8cm$

C. $1.7m$

D. $6.8m$

Answer: C

Watch Video Solution

15. When some vehicle moves towards a stationary person, he finds difference in the frequency of horn by 2.5% of original frequency. If speed of sound is 320 m/s then, find speed of this vehicle.

A. $8m/s$

B. $800m/s$

C. $7m/s$

D. $80m/s$

Answer: A

Watch Video Solution

16. When two waves of amplitudes 3 unit and 5 unit superpose at some point, find ratio of maximum to minimum intensity.

A. $2:1$

B. $5:3$

C. $4:1$

D. $16:1$

Answer: D

Watch Video Solution

17. During earthquake at one place transverse wave (S) and longitudinal wave (P) are found to be moving towards seismograph with velocities 4.5 km/s and 8.0 km/s respectively. If first P wave is detected by seismograph earlier than S wave by 4 min then epicenter of earthquake must be located approximately at ..... distance from the seismograph.

A. 25 km

B. 250 km

C. 2500 km

D. 5000 km

Answer: C

Watch Video Solution

18. If temperature of weather changes then ..... will be affected for sound wave in it.

A. amplitude

B. frequency

C. velocity

D. wavelength

Answer: C

Watch Video Solution

19. For one closed pipe and one open pipe, frequencies of their first harmonics are same. Find ratio of their lengths.

A. $1:2$

B. $2:3$

C. $3:4$

D. $4:5$

Answer: A

Watch Video Solution

20. One person moves towards a stationary source of sound with a speed $\frac{1}{5}$ times the speed of sound. Sound

emitted from the source has wavelength λ and frequency f. Frequency and wavelength of sound heard by this person are respectively .....

A. $0.8f, 0.8\lambda$

B. $1.2f, 1.2\lambda$

C. $1.2f, \lambda$

D. $f, 1.2\lambda$

Answer: C

Watch Video Solution

21. Two open pipes have lengths l and $l + \triangle l$. Beat frequency in their first mode would be,

A. $\frac{v}{2l}$

B. $\frac{v}{4l}$

C. $\frac{v}{2l^2}(\Delta l)^2$

D. $\frac{v}{2l^2}\Delta l$

Answer: D

Watch Video Solution

22. Along the direction of propagation of one wave of frequency 120 Hz, phase difference between two particles separated by 1 m distance is 90°. Find velocity of this wave.

A. $180m/s$

B. $240m/s$

C. $480m / s$

D. $720m / s$

Answer: C

Watch Video Solution

23. Two open pipes with lengths 25 cm and 25.5 cm produce 10 beat/second when resonated in fundamental mode. Find speed of sound in them.

A. $225m / s$

B. $255m / s$

C. $350m / s$

D. None of these

Answer: B

Watch Video Solution