PHYSICS

AAKASH INSTITUTE ENGLISH

WAVES

Example

1. What kind of mechanical waves exist

(a) Inside water?

(b) On the surface of water?

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2. The equation of a progressive wave is $y=1.5\sin(328t-1.27x)$. Where y and x are in cm and t is in second. Calcualte the amplitude,

frequency, time period and wavelength of the wave.

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3. The frequency of a tuning fork is 150 Hz and distance travelled by the sound, produced in air is 20 cm in one vibration. Calculate the speed of sound in air.

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4. Calculate the velocity of the transverse wave in a string which is stretched by a load of 15kg. The mass of the string is $3 \times 10^{-2} kg$ and its length is 2m.

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5. Calculate the speed of longitudinal wave in steel. Young's modulus for steel is $3 \times 10^{10} N/m^2$ and its density $1.2 \times 10^3 kg/m^3$

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6. If the speed of longitudinal mechanical waves in water is $1400 m/s$ then calculate the bulk modulus of elasticity of water. (given density of water is $1 g/cm^3$)

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7. The speed of sound in air at NTP is 332 m/s. Calculate the percentage error in speed of sound as calculated from newton's formula. Given that the density of air is $1.293 kg/m^3$.

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8. Calculate the speed of sound in hydrogen at N.T.P., if density of hydrogen at N.T.P. is $1/16^{th}$ of air. Given that the speed of sound in air is 332 m/s.

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9. The pressure variation in a sound wave is given by $\Delta P = 8\cos\left(4.00x - 3000t + \frac{\pi}{4}\right)$

Find its displacement amplitude. The density of the medium is $10^3 \ \text{kg} \ m^{-3}$.

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10. Two waves represented by $y = a \ \sin(\omega t - kx)$ and $y = a \ \sin\left(\omega t - kx + \frac{2\pi}{3}\right)$ are superposed. What will be the amplitude of the resultant wave?

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11. The echo of a gunshot is heard 5 seconds after it is fired. Calculate the distance of the surface which reflects the sound. The velocity of sound is 332m/s.

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12. A long wire PQR is made by joining two wires PQ and QR of equal radii. PQ has a length 4.8m and mass 0.06 kg. QR has length 2.56 m and mass 0.2 kg. The wire PQR is under a tension of 80N. A sinusoidal wave pulse of amplitude 3.5 cm is sent along the wire PQ from the end P. No power is dissipated during the propagation of the wave pulse. Calculate:

(a) The time taken by the wave pulse to reach the other end R.

(b) The amplitude of the reflected and transmitted wave pulse after the incident wave pulse crosses the joint Q.

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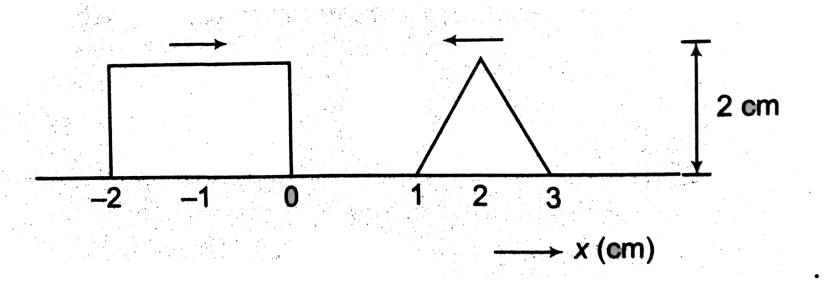
13. Figure shows a rectangular pulse and triangular pulse approaching towards each other. The pulse speed is 0.5 cm/s. Sketch the resultant pulse at t=2 s.



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14. In a stationary wave pattern that forms as a result of reflection pf waves from an obstacle the ratio of the amplitude at an antinode and a node is $\beta = 1.5$. What percentage of the energy passes across the obstacle ?

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15. Two sinusoidal waves travelling in opposite directions interfere to produce a standing wave described by the equation $y = (1.5)m\sin(0.200x)\cos(100t)$, where x is in metres and t is in seconds. Determine the wavelength, frequency and speed of the interfering waves.

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16. The equation given below represents a stationary wave set-up in a medium

$y = 12\sin(4\pi x)\sin(4\pi t)$

where y and x are in cm and t is in second. Calculate the amplitude, wavelength and velocity of the component waves.

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17. A string 50 cm long is under a tension of 20N force. Caculate the frequency of fundamental mode given that mass of the string is 1 g.

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18. Find the fundamental frequency and the frequency of the third overtone of a pipe 45 cm long. If the pipe is open at both ends (use $V = 344m / s$)

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19. The air column in a pipe closed at one end is made to vibrate in its second overtone by a tuning fork of frequency 440 Hz. The speed of sound in air is 330 m/s. find the length of air column.

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20. The glass tube of a resonance tube apparatus is held vertically and the length of the air column in it can be adjusted by adjusting the water level in the tube using a pipe and funnel arrangement. A tuning fork, of frequency v is sounded above the air column in the tube while the length of the air column is slowly increased, starting with a small value. whenever resonance occurs, it is indicated by a loud sound. the two successive lengths at which resonance occurs are l_1 and l_2. find the speed of sound in air and the end correction for this pipe.

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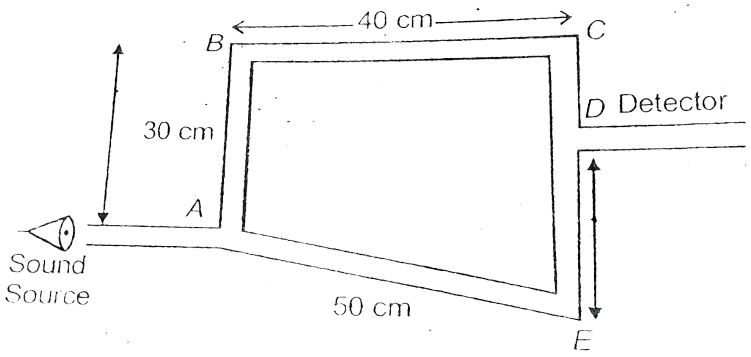
21. In the shown figure ABCDE is a tube which is open at A and D. A soruce of sound A is placed in front of A. if frequency of the source can be varried from 2000 Hz to 4000 Hz. Find frequencies at which a detector placed in front of D receives a maxima of intensity.

(Given speed of sound $= 340m/s$)



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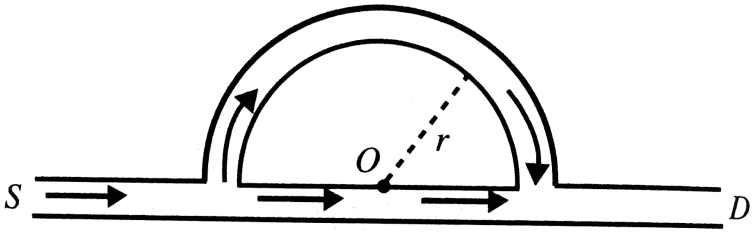
22. A sound wave of wavelength $0.40m$ enters the tube at S. The smallest radius r of the circular segment to hear minimum at detector D must be



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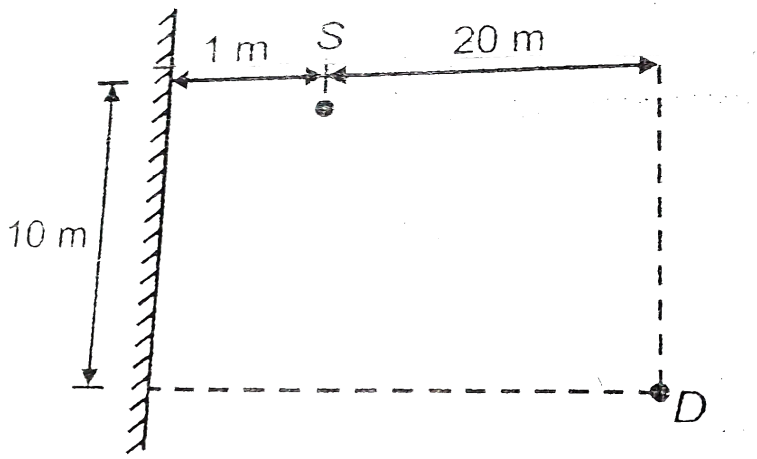
23. A sound source capable of producing sound of variable frequencies is located at a distance of 1 m from a reflecting wall as shown in the figure. A detector D is lying at a point shown in the figure. The various distances are also indicated. If the speed of sound in air is $340 \quad ms^{-1}$, find the frequencies of sound within the audible range, which will have maximum intensity at detector?



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24. Calculate the velocity off sound in a gas in which two wavelength 204 cm and 208 cm produce 20 betas in 6 sec.

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25. Calculate the fundamental frequency of a closed organ pipe of length 66.4 cm at $0^\circ C$, if the velocity of sound at $0^\circ C$ is 332m/s.

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26. Calculate the frequency of 2^{nd} harmonic in an open organ pipe of length 34 cm if the velocity of sound is 340m/s.

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27. Compare the length of a closed organ pipe and an open organ pipe, if the second overtone of the open pipe is unison with the second overtone of the closed organ pipe.

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28. What is the beat frequency, when two waves of frequency 450 Hz and 456 Hz are superposed?

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29. A tuning fork produces 4 beats per second when sounded togetehr with a fork of frequency 364 Hz. When the first fork is loaded with a little wax ten the number of beats becomes two per second. What is the frequency of the first fork?

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30. A listener is at rest and a police siren is moving away from the listerner at 60m/s. what frequency does the listerner hear given that the velocity of sound in air is 340m/s and frequency os siren is 500Hz?

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31. A plice siren emits a sound wave of frequency 440 Hz. The speed of sound is 332 m/s. if the siren is moving away from the listerner with a speed of 18 m/s relative to the air and the listerner is moving towards the siren with a speed of 68 m/s relative to the air, then what frequency does the listern hear?

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32. A man is travelling in a train towards the station with a speed of 50 m/s. calculate the apparent frequency heard by him of whistle which is blown at the station with a frequency 200 Hz. Velocity of sound in air is 350 m/s.

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33. $x(x,t) = \dfrac{0.8}{\left[(4x+5t)^2+5\right]}$, represents a moving pulse where x and y are in metre and t is in second. Find

(i) The direction of wave propagation.

(ii) The wave speed.

(iii) The maximum displacement from the mean position (i.e., the aplitude of the wave).

(iv). Whether the wave pulse is symmetric or not.

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34. A uniform string of length 'L' is suspended from a point on the ceiling. A small wave pulse is now introduced at its lowest end and it starts moving up towards the ceiling.

(i) What will be the speed of the wave pulse when it has moved up a distance x?

(ii) How much time does this wave pulse take to reach the ceiling?

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35. A uniform rope of length 10 cm and mass 4 kg hangs vertically from a rigid support. A block of mass 2 kg is attached to the free end of the rope. A transverse pulse of wavelength 0.06 m is produced at the lower end of the rope, what is the wavelength of the pulse when it reaches the top of the rope?

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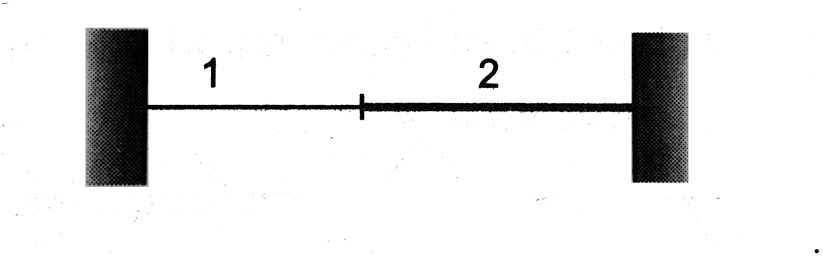
36. Two strings 1 and 2 are taut between two fixed supports (as shown in figure) such that the tension in both strings is same. Mass per unit length of 2 is more than that of 1. Explain which string is denser for a transverse travelling wave.



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

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38. The velocity of sound in hydrogen at STP is $1400 ms^{-1}$. Find the velocity of sound in a mixture with 3 parts by volume of oxygen and 2 parts by volume of hydrogen at $819^\circ C$?

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39. For aluminium the bulk modulus and modulus of rigidity are $7.5 \times 10^{10} Nm^{-2}$. Find the velocity of longitudinal waves in the medium. Density of aluminium is $2.7 \times 10^3 kgm^3$.

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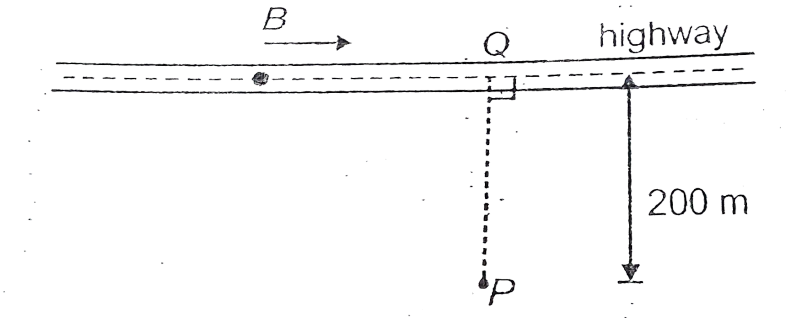
40. A person P is standing at a perpendicular distance of 200m from point Q on a highway. A bus B is moving with a speed of $42.43ms^{-1}$ towards point Q on the highway. The driver of the bus blows a horn of frequency 1300 Hz. What is the frequency of sound received by the person P, when the bus is distant 200 m from Q. speed of sound in air is $330ms^{-1}$



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41. A van is moving with a speed of $3ms^{-1}$ towards a large wall. A person standing on the line of motion of the van observes the van to be moving away from him. The horm of the van is now blown. The frequency of the sound produced by the horn is 600 Hz. what is

(i) The frequency of sound heard by the person for the sound produced directly by the horn?

(ii) The freuquency of sound reflected by the wall.

(iii) The baat frequency heard by the driver. the speed of sound in air is $330ms^{-1}$?

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49. What is the intensity of sound of 70 decibel ? (Given the reference intensity $I_0 = 10^{-12}$ watt $/m^2$)

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Try Yourself

1. Explain why transver waves cannot be propagated through fluids?

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2. What is common in mechanical longitudinal and transverse waves?

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3. Write down the equation of progressive wave travelling along the negative X-axis and having an amplitude of 0.21m frequency of 225 Hz nd a wavelength of 0.6 m.

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4. The equation of progressive wave is given by $y = 10\sin\left[300\pi\left(t - \frac{x}{480}\right)\right]$ where x and y are in metre and t is in second. Calculate the amplitude frequency time period and wavelength of the wave.

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5. The frequency of a mechanical wave is 256 Hz. Calculate its wavelength when its speed is 512m/s.

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6. A mechanical wave has a velocity of 330 m/s. calculate its frequency if its wavelength is 130m.

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7. A steel wire 100 cm long has a mass of 10 gm. If the wire is under a tension of 400 N, what is the speed of transverse waves in the wire?

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8. What is the speed of a transverse wave in a rope of length 10 m and mass 80 gm under a tension of 80 N?

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9. Calculate the speed of longitudinal sound wave in a liquid. The bulk modulus for the liquid is $20 \times 10^9 N/m^2$ and its density is $9.5 \times 10^3 kg/m^3$.

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10. The speed of longitudinal mechanical wave in a material is 4300 m/s. young's modulus of the material is $15 \times 10^9 N/m^2$. What is the density of the material?

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11. The speed of sound waves in air at 300K is 332 m/s. At what temperature will the speed be 574 m/s

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12. The velocity of sound in air at $20^\circ C$ is $340 ms^{-1}$. Keeping the temperature constant, what will be the velocity of sound in air when the pressure of the gas is doubled?

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13. What is the dimensional formula of loudness?

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14. Two waves represented by $y_i = 3\sin(200x - 150t)$ and $y_2 = 3\cos(200x - 150t)$ are superposed where x and y are in metre and t is in second. Calculate the amplitude of resultant wave

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15. What is the phase difference between two waves of equal amplitude having same angular frequency with equal wavelength to give.

(i) Maximum amplitude?

(ii) Minimum amplitude?

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16. A man fires a gun while standing between two parallel hills. If he hears the first echo after 2 s and the second echo 3 s after the first echo, then calculate the distance between the hills the velocity of sound is 330 m/s.

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17. The equation of a transverse wave travelling along a string is

$y(xt) = 0.3\sin(200x - 0.5t)$

what is the equation of the reflected wave when it is reflected by

(i) A rigid boundary?

(ii) A free end?

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18. The equation of a stationary wave is represented by

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

Where y and x are in metre and t is in second. Calculate amplitude, frequency, wavelength and velocity of the component waves whose superposition has produced these vibrations.

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19. A sonometer wire is under a tension of 10 N and the length between the bridges is 2m. A metre long wire of sonometer has mass of 1.0 gm. Deduce the speed of transverse wave and the frequency of 1st hormonic.

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20. The constituent waves of a stationary wave have amplitude frequency and velocity as 8 cm, 25 Hz and 150 cm s^{-1} respectively.

What is the amplitude of the stationary wave at x=2cm

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21. The distance between any two adjacent nodes in a stationary wave is 15 cm. if the speed of the wave is 294 ms/, what is its frequency?

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22. An open organ pipe is excited to vibrate in the third overtone. It is observed that there are

A. Three nodes and three antinodes

B. Three nodes and four antinodes

C. Four nodes and five antinodes

D. Four nodes and four antinodes

Answer:

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23. What is the fundamental frequency of an open organ pipe of length 42.5 cm, if the velocity of sound in air is 340 m/s?

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24. Calculate the frequency of fifth harmonic of a closed organ pipe of length 50cm, if the velocity of sound in air is 330 m/s.

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25. What should be the minimum length of an open pipe of producing a note of 110Hz? The speed of sound is $330ms^{-1}$

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26. How is the fundamental frequency of an open pipe related to the fundamental frequency of a closed pipe of half the length?

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27. Velocity of sound in a medium is 490m/s. two waves of wavelength 98 cm and 100 cm are superposed. Calculate the beat frequency.

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28. Two waves of frequency 500 Hz and 498 Hz are produced simultaneously. Calculate the time interval between successive maxima.

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29. The ptich of the whistle of an engine appears to rise to 1,2 times the original value when it approaches a stationary observer. Calculate

the speed of the engine if the speed of sound in air is 330 m/s.

$$v' = \left(\frac{V}{V - V_S}\right)v$$

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30. The frequency of the whistle of a train is observed to drop from 280 Hz to 260 Hz as the train moves away from a stationary listerner on the platform. Calculate the speed of the train, if speed of sound in air is 340 m/s.

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31. A rocket is moving at a speed of 220 ms^{-1} towards a stationary target. While moving, it emits a wave of frequency 500 Hz. What is the frequency of the sound as detected by the target?

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32. In the above problem, if some of the sound reaching the target ges reflected back to the rocket as an echo, then what frequency of the echo is detected by the rocket?

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33. Explain the difference between the speed of a transverse wave travelling down a cord and the speed of a tiny piece of the cord.

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34. A body executing shm completes 120 oscillations per minute. If the amplitude of oscillations is 6 cm, find the velocity and acceleration of the particle when it is at a distance of 4 cm from the mean position?

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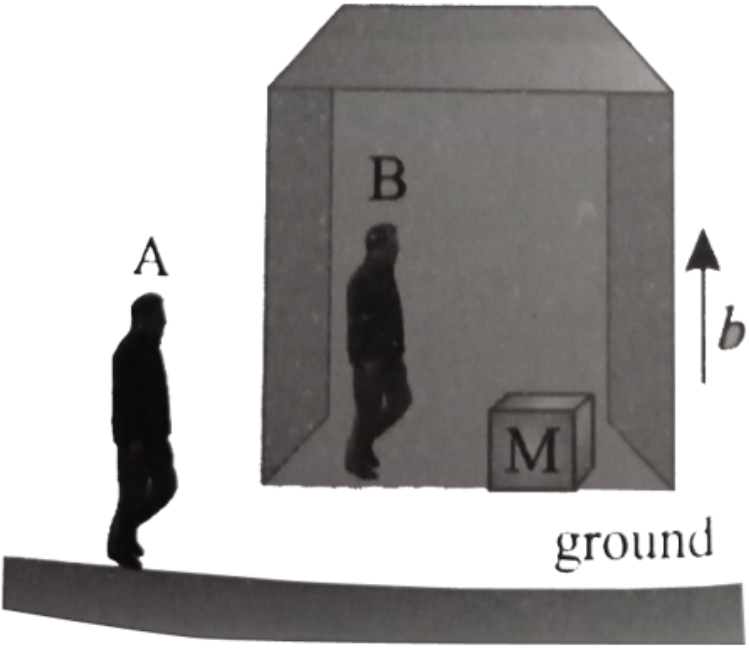

35.

A block of mass M is kept in elevator (lift) which starts moving upward with constant acceleration b as shown in figure. Initially elevator at rest. The block is observed by two observers A and B for a time interval $t = 0$ to $t = T$. Observer B is at rest with respect to elevator and observer A is standing on the ground.

Q. The observer A finds that the work done by gravity on the block is

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36. A rope of length L and mass m hangs freely from the ceiling. The velocity of transverse wave as a function of position x-along the rope is proportional to

A. x^0

B. $\sqrt{x}$

C. $\frac{1}{\sqrt{x}}$

D. x

Answer:

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37. Find the temperature at which the velocity of sound in air is double the velocity of sound in air at $0^\circ C$.

[Hint : Use $\frac{C}{C_0} = \sqrt{\frac{T}{T_0}}$]

A. $273^\circ C$

B. $546^\circ C$

C. $819^\circ C$

D. $1092^\circ C$

Answer:

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Assignment Section A

1. The types of mechanical wave we expect the exist in vacuum is

A. longitudnal wave

B. transverse wave

C. Transverse or longitudinal or both (separtely)

D. no wave

Answer: D

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2. mechanical waves transfer___from one place to the other.

A. energy

B. matter

C. both energy and matter

D. neither energy nor matter

Answer: A

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

A. wavelength

B. twice of wavelength

C. half of the wavelength

D. one fourth tof the wavelength

Answer: C

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4. Velocity of sound in vacuum is

A. 332 m/s

B. 1500 m/s

C. 5900 m/s

D. zero

Answer: D

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5. In a transverse wave, the particles of the medium

A. Perpendicular to the direction of wave propagation

B. along the direction of wave propagation

C. making an angle of 60° with the direction of wave propagation

D. none of these

Answer: A

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6. Waves of wavelength λ are generated on the water surface. The phase difference between two points at a distance of λ is

A. π radian

B. 2π radian

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

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

Answer: B

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7. Transverse mechanical waves cannot be propagated through

A. solids

B. liquids

C. gases

D. Both (2) and (3)

Answer: D

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8. $y(xt) = a\sin(kx - \omega t + \phi)$ represents a

A. wave travelling in the negative direction of x-axis

B. Wave travelling in the positive direction of x-axis

C. stationary wave

D. combination of two stationary waves

Answer: B

Watch Video Solution

9. The phase difference between the waves $y = a\cos(\omega t + kx)$ and $y = a\sin\left(\omega t + kx + \frac{\pi}{2}\right)$ is

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

B. π radian

C. zero

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

Answer: C

Watch Video Solution

10. The equation of a plane progressive wave is given by

$$y = 2\cos\left(100\pi t - \frac{\pi x}{20}\right)$$

where x and y are in cm and t is in second. The wavelength of the wave is

A. 20 cm

B. 100 cm

C. 40 cm

D. $\frac{\pi}{20}$ cm

Answer: C

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11. The equation of a plane progressive wave is given by

$$y = 2\sin\left(100\pi t - \frac{\pi x}{20}\right)$$

where x and y are in cm and t is in second. The amplitude and the initial phase of the wave are respectively.

A. 2 cm and zero-radian

B. 1 cm and π-radian

C. 2 cm and π-radian

D. 2 cm and $\frac{\pi}{2}$ radian

Answer: A

Watch Video Solution

12. The maximum displacement of the constituents of the medium from their equilibrium positions is called

A. wavelength

B. frequency

C. amplitude

D. angular wave number

Answer: C

Watch Video Solution

13. SI unit of angular wave number or propagation constant is

A. rad m^{-1}

B. m^{-1}

C. rad

D. $rad^{-1}m^{-1}$

Answer: A

Watch Video Solution

14. The relation between wavelength (λ) and angular wave number (k) of a wave is

A. $k = 2\pi\lambda$

B. $k = \frac{\lambda}{2\pi}$

C. $k = \frac{1}{\lambda}$

D. $k = \frac{2\pi}{\lambda}$

Answer: D

Watch Video Solution

15. What is the time period of a wave having angular frequency (ω) equal to $0.5s^{-1}$?

A. 0.2 s

B. 5 s

C. 5.8 s

D. 12.56 s

Answer: D

Watch Video Solution

16. What will be the speed of sound in a perfectly rigid rod?

A. 332 m/s

B. les than 332 m/s

C. Infinite

D. Zero

Answer: C

Watch Video Solution

17. Velocity of sound in a gaseous medium at constant temperature is independent of

A. pressure

B. elasticity

C. humidity

D. density

Answer: A

Watch Video Solution

18. Velocity of transverse waves in strings is given by the formula $V = \sqrt{\frac{T}{\mu}}$, where and μ are respectively

A. Time period, coefficient of friction

B. tension, mass

C. tension, mass per unit length

D. Time period, mass of per unit length

Answer: C

Watch Video Solution

19. With the increase in humidity, the velocity of sound in air

A. increases

B. decreases

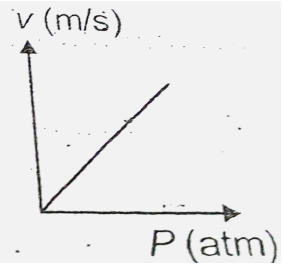
C. first increases and then decreases

D. becomes infinite

Answer: A

Watch Video Solution

20. Graph between speed v of sound in air and pressure P at a constant temperature is given by

A. 

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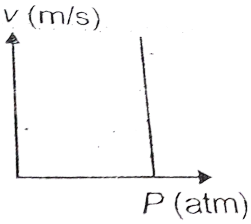

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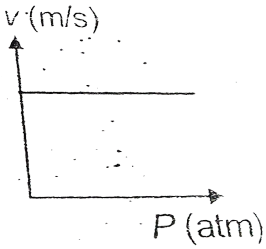

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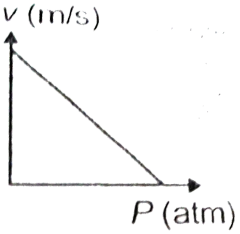

Answer: C

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21. The number of compressions and rarefactions which pass an observer in 5 minutes, if the velocity of sound wave is 330 m/s and the

wavelength of the wave is 30 cm, is

A. 3300

B. 3.3×10^4

C. 3.3×10^5

D. 3.3×10^2

Answer: C

Watch Video Solution

22. The wavelength of the sound emitted by a tuning fork in air is 3m. Speeds of sound in air and in water are 330 m/s and 1400 m/s respectively. Wavelength of this sound in water is

A. 1m

B. 1.2 m

C. 110 m

D. 12.72 m

Answer: D

Watch Video Solution

23. The temperature at which the speed of sound in air becomes double of its value at $27^\circ C$ is

A. $819^\circ C$

B. $927^\circ C$

C. $6127^\circ C$

D. $4095^\circ C$

Answer: B

Watch Video Solution

24. A wave of frequency 20 Hz is propagatinig is space with speed 200 m/s. the phase difference of the two points of wave separated by a distance 5 m is

A. 2π radian

B. π radian

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

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

Answer: B

Watch Video Solution

25. The velocity of sound in air at $27^\circ C$ is 330 m/s. the velocity of sound when the temperature of the gas is raised to $227^\circ C$ is

A. 330 m/s

B. 660 m/s

C. 426 m/s

D. 213 m/s

Answer: C

Watch Video Solution

26. if the velocity of sound in helium at room temperature is 330 m/s, then the velocity of sound in hydrogen is

A. 330 m/s

B. 427.7 m/s

C. 1500 m/s

D. 5900 m/s

Answer: B

Watch Video Solution

27. A tuning fork of frequency 100 Hz emits a wave of wavelength 4m. What is the temperature of the atmosphere, if the velocity of sound at $27^\circ C$ is 330m/s?

A. $0^\circ C$

B. $100^\circ C$

C. $167^\circ C$

D. $227^\circ C$

Answer: C

Watch Video Solution

28. Distance travelled by the sound produced by a tuning fork of frequency 50 Hz completing 200 vibrations is, (the velocity of sound in air is 330 m/s)

A. 1100 m

B. 3300 m

C. 660 m

D. 1320 m

Answer: D

Watch Video Solution

29. Two sounds are heard at the end of an iron rod 5 km long at an interval of 14 seconds, when a source of sound is placed at the other end of the rod. The velocity of sound in air is 330 m/s. the velocity of sound in iron is aproximately

A. 4348 m/s

B. 1500 m/s

C. 2200 m/s

D. 330 m/s

Answer: A

Watch Video Solution

30. if tension of a wire is increased to 3 times, the wave speed becomes___the initial speed.

A. 3 times

B. 9 times

C. $\frac{1}{3}$ times

D. $\sqrt{3}$ times

Answer: D

Watch Video Solution

31. At room temperature $(27^\circ C)$ the velocity of sound in air is 330 m/s. the increase in velocity of sound when temperature is increased by $1^\circ C$ is

A. 2 m/s

B. 1 m/s

C. 10 m/s

D. 0.55 m/s

Answer: D

Watch Video Solution

32. Assuming the temperatature to be constant, as we go up in the atmosphere, the velocity of sound

A. increases

B. decreases

C. remains constant

D. first increases and then decreases

Answer: C

Watch Video Solution

33. The wavelength of the note emitted by a tuning fork of frequency 100 Hz is 3.32 m. if the density of air at STP is 1.29 kg/m^3, the γ for air is

A. 1.57

B. 2.3

C. 1.41

D. 1.732

Answer: C

Watch Video Solution

34. The change in phase if a wave is reflected from a rigid surface is

A. zero

B. π radian

C. 2π radian

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

Answer: B

Watch Video Solution

35. The echo of a gunshot is heard 10 seconds after it is fired. If the velocity of sound is 330 m/s, the distance of the surface which reflects the sound is

A. 33 m

B. 3300 m

C. 135 m

D. 1650 m

Answer: D

Watch Video Solution

36. For constructive interference, the phase difference between the two interfering waves is

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

B. 2 radian

C. zero

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

Answer: C

Watch Video Solution

37. The periodic waves of amplitude 5 m and 2m respectively, pass together through a region. The difference in the maximum and the minimum resultant amplitude possible is

A. 5 m

B. 2 m

C. 4 m

D. 1 m

Answer: C

Watch Video Solution

38. Two waves of same amplitude a and frequency v and having a phase difference of $\pi/2$ radian, are superposed. The amplitude of resultant wave is

A. 2a

B. a

C. $\frac{a}{\sqrt{2}}$

D. $\sqrt{2}a$

Answer: D

Watch Video Solution

39. Two waves of equal amplitude when superposed, give a resultant wave having an amplitude equal to that of either wave. The phase difference between the two waves is

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

B. zero

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

D. $\frac{2\pi}{3}$ radian

Answer: D

Watch Video Solution

40. The change in phase, if a wave is reflected at a less dense surface, is

A. zero

B. π radian

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

D. $\frac{2\pi}{3}$ radian

Answer: A

Watch Video Solution

41. Two waves of equation

$y_1 = a\cos(\omega t + kx)$ and $y_2 = a\cos(\omega t - kx)$ are superimposed upon each other. They will produce

A. Stationary wave

B. Beats

C. Constructive interference

D. Destructive interference

Answer: A

Watch Video Solution

42. The equation of a stationary a stationary wave is represented by

$y = 4\sin\left(\frac{\pi}{6}x\right)(\cos 20\pi t)$

when x and y are in cm and t is in second.

Wavelength of the component waves is

A. 4 cm

B. 20 cm

C. 12 cm

D. 6 cm

Answer: C

Watch Video Solution

43. The wavelength of the fundamental note produced by a pipe of length 2m, when its both ends are open is

A. 2 m

B. 4 m

C. 1 m

D. 8 m

Answer: B

Watch Video Solution

44. The ratio of fundamental frequencies of an open organ pipe and a cloed organ pipe of same length at same temperature is

A. $2:1$

B. $1:2$

C. $1:1$

D. $1:4$

Answer: A

Watch Video Solution

45. if the first overtone of a closed pipe of length 50 cm has the same frequency as the first overtone of an open pipe, then the length of the open pipe is

A. 100 cm

B. 200 cm

C. 66.6 cm

D. 33.3 cm

Answer: C

Watch Video Solution

46. Two waves of frequencies 6 Hz and 10 hz are superposed. The beat frequency produced is

A. 6Hz

B. 10 Hz

C. 16 Hz

D. 4 Hz

Answer: D

Watch Video Solution

47. Two waves of wavelengths 99 cm and 100 cm produce 4 beats per second. Velocity of sound in the medium is

A. 100 m/s

B. 90 m/s

C. 196 m/s

D. 396 m/s

Answer: D

Watch Video Solution

48. A tuning fork of unknown frequency produces 4 beats per second when sounded with another tuning fork of frequency 254 Hz. It gives the same number of beat/s when loaded with wax. The unknown frequency is

A. 252 Hz

B. 248 Hz

C. 254 Hz

D. 246 Hz

Answer: A

Watch Video Solution

49. Two waves of frequencies 50 Hz and 45 Hz are produced simultaneously, then the time interval between successive maxima of

the resulting wave is [maxima refers to the maximum intensity]

A. 0.2 s

B. 0.02 s

C. 0.04 s

D. 0.4 s

Answer: A

Watch Video Solution

50. A set of 10 tuning forks is arranged in series of increasing frequency. If each fork gives 3 beats with the preceding one and the last fork has twice the frequency of the first, then frequency of the first tuning fork is

A. 30 Hz

B. 27 Hz

C. 33 Hz

D. 15 Hz

Answer: B

Watch Video Solution

51. The displacement at a pont due to two waves are given by $y_1 = 2\sin(50\pi t)$ and $y_2 = 3\sin(58\pi t)$ number of beats produced per second is

A. 8

B. 4

C. 58

D. 50

Answer: B

Watch Video Solution

52. if the speed of a sound source is equal to the speed fo sound and the source is moving away from the observer, then the ratio of apparent frequency to the original frequency is

A. $1:2$

B. $2:1$

C. $1:4$

D. $4:1$

Answer: A

Watch Video Solution

53. The frequency of the whistle of an engine appears to drop to $\frac{2}{3}rd$ of its actual value when it passes a stationary observer. Velocity of sound in air is 330 m/s then the speed of engine is

A. 330 m/s

B. 165 m/s

C. 220 m/s

D. 110 m/s

Answer: B

Watch Video Solution

54. A listener and a source of sound are moving with the same speed in the same direction. The ratio of the frequency of the source and the frequency which is heard by the listerner is

A. $1:2$

B. $2:1$

C. $1:1$

D. $1:4$

Answer: C

Watch Video Solution

55. A man standing on a platform observes that the frequency of the sound of a whistle emitted by a train drops by 140 Hz. If the velocity of sound in air is 330 m/s and the speed of the train is 70 m/s, the frequency of the whistle is

A. 571 Hz

B. 800 Hz

C. 400 Hz

D. 260 Hz

Answer: B

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Assignment Section B

1. If consecutive freuquencies emitted from an organ pipe are 50 Hz, 75Hz, 100 Hz, 125 Hz, then the frequency of the 10^{th} overtone is

A. 200 Hz

B. 250 Hz

C. 275 Hz

D. 300 Hz

Answer: C

Watch Video Solution

2. Which of the following characteristics of sound help us in identifying two persons talking in a room without seeing them?

A. Loudness

B. Pitch

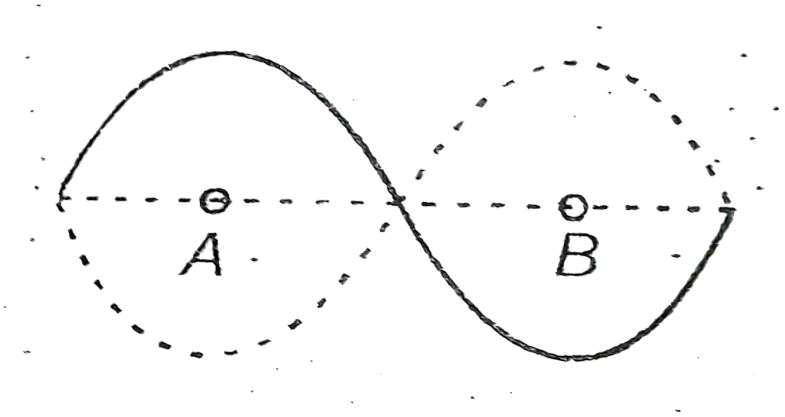
C. Quality

D. Intensity

Answer: C

Watch Video Solution

3. In a standing wave particles at the positions A and B, have a phase difference of



A. 0

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

C. $\frac{5\pi}{6}$

D. π

Answer: D

Watch Video Solution

4. The temperature at which the velocity of sound in air becomes double its velocity at $0^\circ C$ is

A. $435^\circ C$

B. $694^\circ C$

C. $781^\circ C$

D. $819^\circ C$

Answer: D

Watch Video Solution

Watch Video Solution

5. A tuning fork produces 2 beats per second when sounded with another tuning fork of frequency 250 Hz. It gives the same number of beats per second when loaded with wax. The initial frequency of 1^{st} tuning fork is

A. 252

B. 254

C. 250

D. Cant's determined

Answer: A

Watch Video Solution

6. A person carrying a whistle emitting continuously a note of $272Hz$ is runnig towards a reflecting surface with a speed of $18km/h$. The

speed of sound in air is $345ms^{-1}$ The number of beats heard by him is

A. 4

B. 6

C. 8

D. 0

Answer: C

Watch Video Solution

7. The equation of stationary wave along a stretched string is given by $y = 5\sin\left(\frac{\pi}{3}x\right)\cos 40\pi t$ where x and y are in centimetre and t in second. The separation between two adjacent nodes is :

A. 1.5

B. 3

C. 6

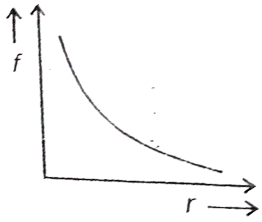
D. 4

Answer: B

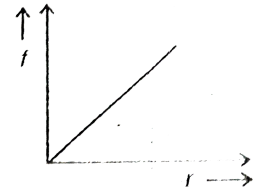
Watch Video Solution

8. Which of the followings represent the variation of frequency (f) with radius of cross section of a stretched string?

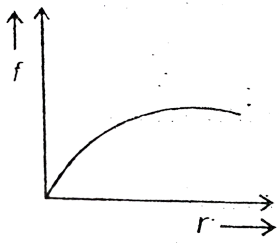
A.



B.



C.



D. none of these

Answer: A

Watch Video Solution

9. The string of a violin has a frequency of 440 cps , If the violin string is shortend by one fifth , its frequency will be changed to

A. 440 Hz

B. 880 Hz

C. 550 Hz

D. 2200 Hz

Answer: D

Watch Video Solution

10. The speed of sound in hydrogen at N.T.P. is 1270 metres per second. Thenthe speed in a mixture of hydrogen and oxygen containing hydrogen and oxygen in the ration $4:1$ by volume, will be

A. 635

B. 318

C. 158

D. 1270

Answer: A

Watch Video Solution

11. If you set up the seventh harmonic on a string fixed at both ends, how many nodes and antinodes are set up in it -

A. 8,7

B. 7,7

C. 8,9

D. 9,8

Answer: A

Watch Video Solution

12. The equation of a standing wave in a string fixed at both ends is given as $y = 2\sin kx \cos \omega t$

The amplitude and frequency of a particle vibrating at the mid of an antinode and a node are respecetively

A. $A, \frac{\omega}{2\pi}$

B. $\frac{A}{\sqrt{2}}, \frac{\omega}{2\pi}$

C. $A, \frac{\omega}{2\pi}$

D. $\sqrt{2}A, \frac{\omega}{2\pi}$

Answer: D

Watch Video Solution

13. An isotropic point source 'S' of sound emits constant power. Two points A and B are situated at distance x and 2x from S. the difference between the loudness of points A and B is about (log 2=0.3)

A. 3 dB

B. 2 dB

C. 6 dB

D. 12 dB

Answer: C

Watch Video Solution

14. A sinusoidal wave is given by y=A sin (kx-ωt). The ratio of its maximum particle velocity to wave velocity is

A. 1

B. ω

C. ωA

D. kA

Answer: D

Watch Video Solution

15. A stretched string is fixed at both its ends. Three possible wavelengths of stationary wave patterns that can be set up in the string are 90 cm, 60 cm and 45 cm. the length of the string may be

A. 80 cm

B. 120 cm

C. 90 cm

D. 45 cm

Answer: C

Watch Video Solution

16. For an organ pipe, four of the six harmonics of frequency less than 1000 Hz are 300, 600, 750 and 900 Hz. The two missing harmonics are

A. 75 Hz, 150 Hz

B. 150 Hz, 450 Hz

C. 400 Hz, 800 Hz

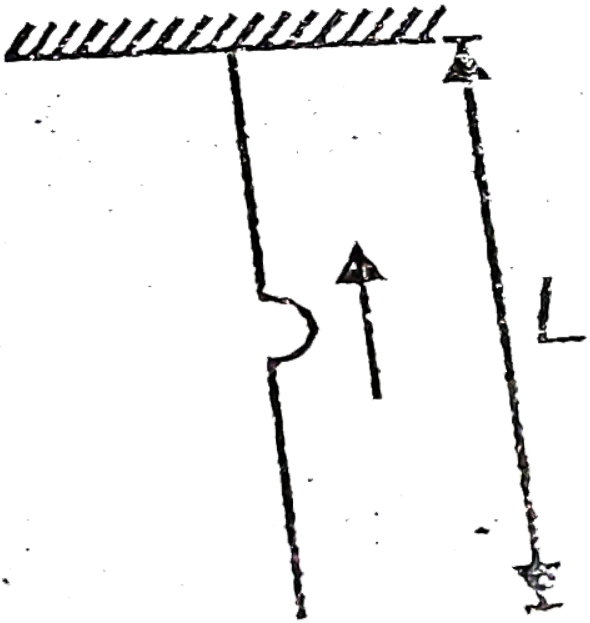
D. 250 Hz, 400 Hz

Answer: B

Watch Video Solution

Watch Video Solution

17. A thick uniform rope of length L is hanging from a rigid support. A transverse wave of wavelength λ_0 is set up in the middle of the rope. The wavelength of the wave as it reaches the top most point is



A. $2\lambda_0$

B. $\sqrt{2}\lambda_0$

C. $\frac{\lambda_0}{\sqrt{2}}$

D. λ_0

Answer: B

Watch Video Solution

18. Third overtone of a closed organ pipe is in unison with fourth harmonic of an open organ pipe. Find the ratio of lengths of the two pipes.

A. $\frac{7}{8}$

B. $\frac{4}{5}$

C. $\frac{7}{10}$

D. $\frac{4}{10}$

Answer: C

Watch Video Solution

19. The string of a violin emits a note of 205 Hz when its tension is correct. The string is made slightly more taut and it produces 6 beats in 2 seconds with a tuning fork of frequency 205 Hz. The frequency of the note emitted by the taut string is

A. 211 Hz

B. 199 Hz

C. 208 Hz

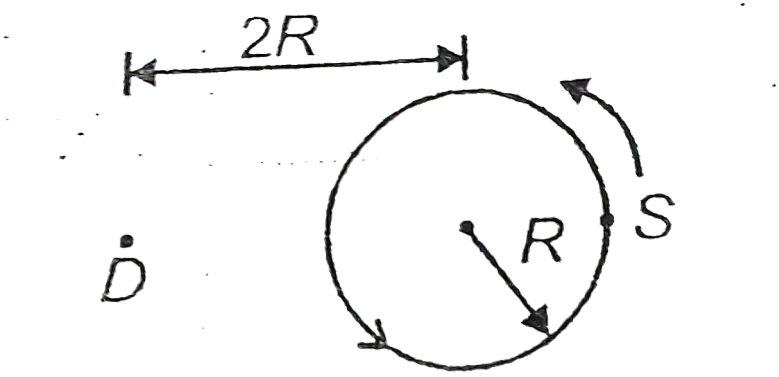
D. 202 Hz

Answer: C

Watch Video Solution

20. A whistle 'S' of frequency v revolves in a circle of radius R at a constant speed v. what is the ratio of the largest and smallest frequency detected by a detector D, at rest, at a distance 2 R from the

centre of the circle as shown in the figure? (take speed of sound in air as c)



A. a. $\frac{c+V}{c-V}$

B. b. $\sqrt{2}\left(\frac{c+V}{c-V}\right)$

C. c. $\sqrt{2}$

D. d. $\frac{c+V}{\sqrt{2}c}$

Answer: A

Watch Video Solution

21. Two sinusoidal waves given below as superposed

$$y_1 = A\sin\left(kx - \omega t + \frac{\pi}{6}\right)$$

A. $\frac{A}{\sqrt{3}}\sin(kx - \omega t)$

B. $A\sqrt{3}\sin(kx - \omega t)$

C. $A\sqrt{3}\sin\left(kx - \omega t - \frac{\pi}{3}\right)$

D. $\frac{A}{\sqrt{3}}\sin\left(kx - \omega t - \frac{\pi}{2}\right)$

Answer: B

Watch Video Solution

22. Two vibrating tuning forks producing waves given by $y_1 = 27\sin 600\pi t \text{and} y_2 = 27\sin 604\pi t$ are held near the ear of a person, how many beats will be heard in three seconds by him ?

A. 4

B. 2

C. 6

D. 12

Answer: C

Watch Video Solution

23. In a stationary wave, all particles of the medium cross the mean position with (

A. different speeds at different instants

B. different speeds at the same instant

C. same speed at different instant

D. same speed at the same instant

Answer: B

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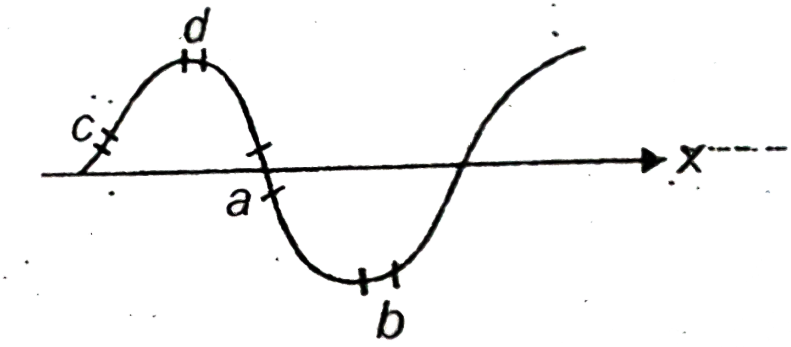


24.

The figure shows the snapshot of a travelling sine wave in a string. Four elemental portions a,b,c and d are indicated on the string. The elemental portion with maximum potential energy is/are

A. a

B. b

C. c

D. b and d

Answer: A

Watch Video Solution

25. A wave moves with a certain speed in a stretched string. The percentage change in tension required to increase the velocity by 1 %, is approximately

A. 1% increase

B. 1% decrease

C. 2% increase

D. 2% decrease

Answer: C

Watch Video Solution

26. The ratio of intensities of two waves is 2. the ratio of intensities of maxima and minima when these waves interfere is approximately

A. 9

B. 8

C. 34

D. 36

Answer: C

Watch Video Solution

27. n identical coherent waves each with the same initial phase arrive at a point with identical path length. The intensity produced at this point is l_1. If the waves are all incoherent, the intensity produced is l_2. The ratio $\frac{l_1}{l_2}$ is

A. $\sqrt{n}$

B. n

C. n^3

D. n^2

Answer: B

Watch Video Solution

28. What is the phase difference between particles being on either side of a node?

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

B. π

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

D. 2π

Answer: B

Watch Video Solution

29. The amplitude of a wave represented by the equation $y = 3\sin(5x - 0.5t) + 4\cos(5x - 0.5t)$, is

A. 7

B. 4

C. 3

D. 5

Answer: D

Watch Video Solution

30. The difference between the frequencies of the third and fifth harmonic of a closed organ pipe is 100 Hz. Its fundamental frequency is

A. 100 Hz

B. 50 Hz

C. 25 Hz

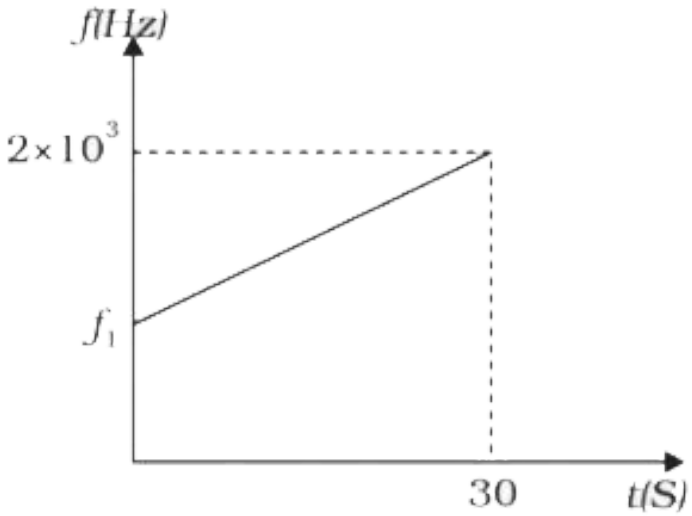
D. 12.5 Hz

Answer: B

Watch Video Solution

31. A source of sound of frequency f_1 is placed on the ground. A detector placed at a height is released from rest on this source. The observed frequency f(Hz) is plotted against time t(sec). The speed of

sound in air is 300m/s. find $f_1\left(g = 10m/s^2\right)$.



A. $0.5 \times 10^3 Hz$

B. $1 \times 10^3 Hz$

C. $0.25 \times 10^3 Hz$

D. $0.2 \times 10^3 Hz$

Answer: B

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32. A whistle of frequency 500 Hz tied to the end of a string of length 1.2 m revolves at 400 rev / min . A listener standing some distance away in the plane of rotation of whistle hears frequencies in the range (speed of sound = 340 m / s)

A. 436 to 586

B. 426 to 574

C. 426 to 584

D. 436 to 674

Answer: A

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33. The ratio of intensities between two coherent sound sources is $4:1$ the difference of loudness in decibels between maximum and minimum intensities, when they interfere in space, is

A. 10 log (2)

B. 20 log (3)

C. 10 log (3)

D. 20 log (2)

Answer: D

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34. In travelling waves, the relation between particle velocity V_p, wave velocity V wave shape slope m is given by

A. $V_p = -v \times m$

B. $V_p = V \times m$

C. $V = -V_p \times m$

D. $V = V_p \times m$

Answer: A

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35. Assertion : The interference of two identical waves moving in same direction produces standing waves.

Reason : Various elements of standing waves do not remain in constant phase.

A. All particle between two consecutive nodes vibrate in same phase

B. particles on opposite side of a node vibrate in same phase

C. frequency of oscillation of all particles (except nodes) is same

D. formation of standing waves is a special type of interference phenomana.

Answer: B

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Assignment Section C

1. A transverse sinusoidal wave of amplitude A, wavelength λ and frequency f is travelling along a stretch string. The maximum speed of any point on the string is $\frac{v}{10}$, where, V is the velocity of wave propagation. If $A = 10^{-3}m,$ and $V = 10ms^{-1}$, then λ and f are given by

A. $\lambda = 2\pi \times 10^{-2}m$

B. $\lambda = 10^{-2}m$

C. $f = \frac{10^3}{2\pi}Hz$

D. $f = 10^4 Hz$

Answer: A::C

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2. Two identical straight wires are stretched so as to products $6 beats / s$ when vibrating simultaneously. On changing the tension slightly in one of them, the beat frequency remains unchanged. Denoting by , T_1 the higher and T_2 the lower, initial tensions in the strings, then it could be said that that while making the above changes in tension

A. T_2 was decreased

B. T_2 was increased

C. T_1 was increased

D. T_1 ws decreased

Answer: B::D

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3. As a wave propagates

A. the wave intensity remains constant for a plane wave

B. the wave intensity decreases with the inverse of the distance from the source for a speherical wave

C. The wave intensity decreases as the inverse of the square of the distance from the source for a spherical wave

D. the total energy of the spherical wave incident over any spherical surface centred at the source remains constant at all times.

Answer: A::C::D

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4. The velocity of sound in air is $340ms^{-1}$. A pipe closed at one end has a length of 170 cm. neglecting the end correction, the frquencies at which the pipe can resonate are

A. 50 Hz

B. 100 Hz

C. 150 hz

D. 200 Hz

Answer: A::C

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5. The equation of wave, giving the displacement y is given by $y = 10^{-3}\sin(120t = 3x)$

Where, x and y are in metre and t is in second. This equation represents a wave.

A. Travelling with a velocity of $40ms^{-1}$

B. Or wavelength $\frac{2\pi}{3}m$

C. of frequency $\frac{60}{\pi}Hz$

D. of amplitude $10^{-3}m$, travelling along negative x direction

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

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6. A wave is described by $y = A\sin(\omega t - kx)$. The speeds of which of the following particles in the medium are increasing at time t=0?

A. $a.\ x = 0$

B. $x = \frac{\pi}{4k}$

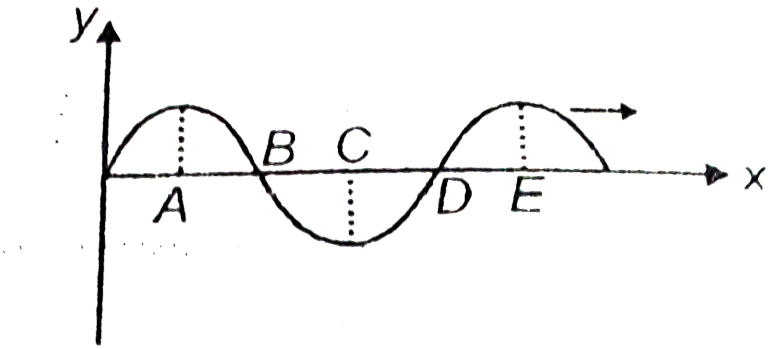
C. c.$x = \frac{\pi}{2k}$

D. d.$x = \frac{3\pi}{4k}$

Answer: B::C

Watch Video Solution

7. The string shown in the figure has a sinusoidal wave travelling towards right. The frequency of the wave is n. the correct statement (s) is/are.



A. The speed of the wave is 4n(AB)

B. The medium particle at 'A' will be in the same phase as particle 'D' after time equal to $\frac{4}{3n}$

C. The phase difference between B and E is $\frac{3\pi}{2}$

D. particle A and C are in the same phase

Answer: A::C

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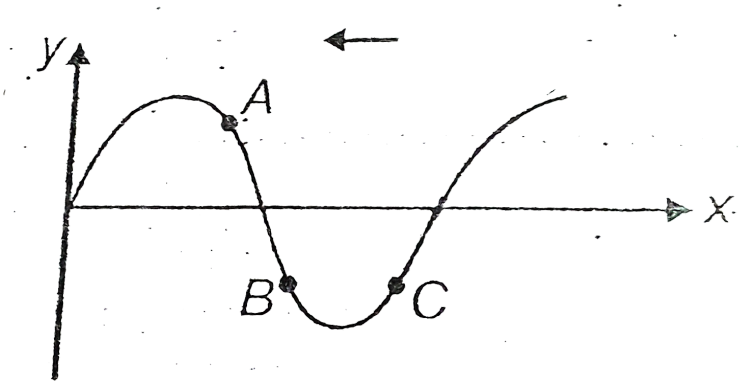
8.



The figure shows a transverse wave travelling in a string in negative x-axis direction. Three points A, B and C are indicated on the string at the instant shown

The correct statement(s) is/are.

A. Point A is moving in negative y direction

B. Point B and C are moving in the same direction

C. Point A and C are moving in opposite directions

D. Point B and C are moving in opposite directions.

Answer: A::C::D

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9. Two waves, whose equations are

$y_1 = 4\sin\left(20t - \frac{x}{3}\right)m$ and $y_2 = 3\sin\left(20t - \frac{x}{3}\right)$ m,

are superposed in a medium. Now,

A. The amplitude of the resultant wave is 5m

B. the amplitude of the resultant wave is 7m

C. the resultant wave is a travelling wave

D. the resultant wave is a stationary wave

Answer: B::C

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10. The waves, whose equations are

$y_1 = 4 \times 10^{-3}\sin\left(308\pi x - \frac{x}{50}\right)$ and $y_2 = 1 \times 10^{-3}\sin\left(302\pi t - \frac{x}{50}\right)$

ar superposed in a medium. Now,

A. Beats are produced with a frequency 3Hz

B. Beats are produced with a frequency 6 Hz

C. The ratio of maximum to minimum intensity is 25:9

D. The ratio of maximum to minimum amplitude is 2:1

Answer: A::C

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11. A sound wave of frequency f travels horizontally to the right . It is teflected from a larger vertical plane surface moving to left with a speed v. the speed of sound in medium is c

(a) The number of waves striking the surface per second is $\frac{f(c+v)}{c}$

(b) The wavelength of reflected wave is $\frac{c(c-v)}{f(c+v)}$

(c) The frequency of the reflected wave is $\frac{f((c+v))}{(c+v)}$

(d) The number of beats heard by a stationary listener to the left of the reflecting surface is $\frac{vf}{c-v}$

A. Thee number of wave striking the surface per second is $\frac{f((v+c))}{c}$

B. the wavelength of reflected wave is $\frac{c(c-v)}{f(c+v)}$

C. The frequency of reflected wave is $\frac{f(c+v)}{c-v}$

D. The number of beats heard by a stationary listener to the left of the reflecting surface is $\frac{vf}{c-v}$

Answer: A::B::C

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Assignment Section D

1. Earthquakes generate sound waves inside the earth. In case of the earth, both transverse (S) and longitudinal (P) waves can propagate. Typically, the speed of S waves is about 4.5 km s^{-1} and that of P waves is 8.0 km s^{-1}. A seismograph records both P and S waves from an

earthquake. this difference helps us to find the distanec of the point of origin of the earthquake. this point is called the epicenter.

Q. if at the location of a seismograph the P waevs arrive 2 minute earlier, the distance of the epicenter from the location of the seismograph is

A. 3541.2 km

B. 1234.3 km

C. 2468.6 km

D. 3702.9 km

Answer: B

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2. Earthquakes generate sound waves inside the earth. In case of the earth, both transverse (S) and longitudinal (P) waves can propagate. Typically, the speed of S waves is about 4.5 km s^{-1} and that of P waves

is 8.0 km s^{-1}. A seismograph records both P and S waves from an earthquake. this difference helps us to find the distanec of the point of origin of the earthquake. this point is called the epicenter.

Q. The reading of the time lag between the arrival of S and P waves gives us the distance of the epicenter from the location of a seismograph. the readings of what minimum number of seismographs would be necessary to pinpoint the location of an epicenter?

A. 1

B. 2

C. 3

D. 4

Answer: C

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3. Earthquakes generate sound waves inside the earth. In case of the earth, both transverse (S) and longitudinal (P) waves can propagate. Typically, the speed of S waves is about 4.5 km s^{-1} and that of P waves is 8.0 km s^{-1}. A seismograph records both P and S waves from an earthquake. this difference helps us to find the distanec of the point of origin of the earthquake. this point is called the epicenter.

Q. If only 2 seismograph readings are available, how may probable locations of an epicentre could be detected?

A. a. 1

B. b. 2

C. c. 3

D. d. 4

Answer: B

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4. A string has a linear mass density μ. The ends of the string are joined to form a closed loop and is given the shape of a circular ring of radius R. this ring is now rotated about its axis with an angular velocity ω

Q. The tension developed in the string is

A. $\mu\omega R^3$

B. $2\mu\omega^2 R^2$

C. $\mu\omega^2 R^2$

D. $\mu^2\omega^2 R^2$

Answer: C

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5. A string has a linear mass density μ. The ends of the string are joined to form a closed loop and is given the shape of a circular ring of radius R. this ring is now rotated about its axis with an angular velocity

ω

Q. The velocity of a transverse wave set up in the string, with respect to the string is

A. ωR

B. $2\omega R$

C. $3\omega R$

D. $4\omega R$

Answer: A

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6. A string has a linear mass density μ. The ends of the string are joined to form a closed loop and is given the shape of a circular ring of radius R. this ring is now rotated about its axis with an angular velocity ω

Q. The velocity of the transverse wave set up in the string, with respect to an observer at the centre of

A. a.ωR

B. b.$2\omega R$

C. c.$3\omega R$

D. d.$4\omega R$

Answer: B

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7. Two plane harmonic sound waves are expressed by the equations

$$y_1(x,t) = A\cos\left(\frac{\pi}{2}x - 100\pi t\right)$$

$$y_2(x,t) = A\cos\left(\frac{46\pi}{100}x - 92\pi t\right)$$

All quantities taken in MKS.

Q. how many times does an observer hear maximum intensity in one second?

A. 4

B. 10

C. 6

D. 8

Answer: A

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8. Two plane harmonic sound waves are expressed by the equations

$$y_1(x,t) = A\cos\left(\frac{\pi}{2}x - 100\pi t\right)$$

$$y_2(x,t) = A\cos\left(\frac{46\pi}{100}x - 92\pi t\right)$$

All quantities taken in MKS.

Q. What is the speed of the sound?

A. 200 m/s

B. 180 m/s

C. 192 m/s

D. 96 m/s

Answer: A

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9. Two plane harmonic sound waves are expressed by the equations.

$y_1(x, t) = A\cos(0.5\pi x - 100\pi t), y_2(x, t) = A\cos(0.46\pi x - 92\pi t)$

(All parameters are in MKS) :

At x=0 how many times the amplitude of $y_1 + y_2$ is zero in one second

:-

A. a. 4

B. b. 2

C. c. 1

D. d. 3

Answer: B

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Assignment Section E Assertion Reason

1. A uniform rope of mass m hangs from a ceiling and a block of mass m is attached to the free end of rope.

Statement-1: The speed of a transverse wave in rope is different at different points.

Statement-2: The tension in the rope is different at diferent points.

A. Statement-1 is true, statement-2 is true, statement-2 is a correct explanation for statement-1

B. Statement-1 is true, statement-2 is true, statement-2 is not a correct explanation for statement-1

C. statement-1 is true, statement-2 is false

D. statement-1 is false, statement-2 is true

Answer: A

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2. Statement-1: The change in pitch of sound depends on speed of source and detector relative to each other and not on the distance between them.

Statement-2: The pitch of sound depends on intensity of sound which is independent of distance between source and detector.

A. Statement-1 is true, statement-2 is true, statement-2 is a correct explanation for statement-1

B. Statement-1 is true, statement-2 is true, statement-2 is not a correct explanation for statement-1

C. statement-1 is true, statement-2 is false

D. statement-1 is false, statement-2 is true

Answer: C

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3. Statement-1: When a transverse wave is reflected from a denser medium, the trough is reflected as crest and vice-versa.

Statement-2: in case of reflection from a denser medium, there is inversion of the reflected wave.

A. Statement-1 is true, statement-2 is true, statement-2 is a correct explanation for statement-1

B. Statement-1 is true, statement-2 is true, statement-2 is not a correct explanation for statement-1

C. statement-1 is true, statement-2 is false

D. statement-1 is false, statement-2 is true

Answer: A

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4. Statement-1: In stationary waves nodes are permanently at rest, so no energy is transmitted across them. And Statement-2: Nodes are points of maximum pressure.

A. Statement-1 is true, statement-2 is true, statement-2 is a correct explanation for statement-1

B. Statement-1 is true, statement-2 is true, statement-2 is not a correct explanation for statement-1

C. statement-1 is true, statement-2 is false

D. statement-1 is false, statement-2 is true

Answer: B

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5. Statement-1: Waves on a string are always transverse in nature. Statement-2: The velocity of a transverse wave propagating along a string is independent of the frequency of the propagating wave.

A. Statement-1 is true, statement-2 is true, statement-2 is a correct explanation for statement-1

B. Statement-1 is true, statement-2 is true, statement-2 is not a correct explanation for statement-1

C. statement-1 is true, statement-2 is false

D. statement-1 is false, statement-2 is true

Answer: B

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6. Statement-1: The fundamental frequency of an organ pipe remains unchanged, if the ratio of speed of sound in it to its length remains constant.

Statement-2: Fundamental frequency of an organ pipe is proportional to $\frac{V}{l}$, v=speed of sound, l=length of pipe.

A. Statement-1 is true, statement-2 is true, statement-2 is a correct explanation for statement-1

B. Statement-1 is true, statement-2 is true, statement-2 is not a correct explanation for statement-1

C. statement-1 is true, statement-2 is false

D. statement-1 is false, statement-2 is true

Answer: A

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7. Statement-1: Doppler formula is not applicable, when detector is moving away from source with speed greater than that of sound.

Statement-2: There is always a decrease in pitch of sound if detector moves towards source.

A. Statement-1 is true, statement-2 is true, statement-2 is a correct explanation for statement-1

B. Statement-1 is true, statement-2 is true, statement-2 is not a correct explanation for statement-1

C. statement-1 is true, statement-2 is false

D. statement-1 is false, statement-2 is true

Answer: C

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8. Statement-1: Standing waves can not be obtained in air if the interfering waves are of diffeerent amplitudes.

Statement-2: In a stationary wave, different particles in a loop have different amplitudes but same phase.

A. Statement-1 is true, statement-2 is true, statement-2 is a correct explanation for statement-1

B. Statement-1 is true, statement-2 is true, statement-2 is not a correct explanation for statement-1

C. statement-1 is true, statement-2 is false

D. statement-1 is false, statement-2 is true

Answer: D

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9. Statement-1: If a wave is mechanical it may or may not be longitudinal.

Statement-2: if a wave is transverse it may or may not be non-mechanical.

A. Statement-1 is true, statement-2 is true, statement-2 is a correct explanation for statement-1

B. Statement-1 is true, statement-2 is true, statement-2 is not a correct explanation for statement-1

C. statement-1 is true, statement-2 is false

D. statement-1 is false, statement-2 is true

Answer: B

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10. Statement-1: On moon you cannot hear your friend standing at some distance from you

Statement-2: There is vacuum on moon.

A. Statement-1 is true, statement-2 is true, statement-2 is a correct explanation for statement-1

B. Statement-1 is true, statement-2 is true, statement-2 is not a correct explanation for statement-1

C. statement-1 is true, statement-2 is false

D. statement-1 is false, statement-2 is true

Answer: A

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11. Assertion: Mechanical transverse waves can't travel in gaseous medium.

Reason : They do no possess modulus of rigidity.

A. Statement-1 is true, statement-2 is true, statement-2 is a correct explanation for statement-1

B. Statement-1 is true, statement-2 is true, statement-2 is not a correct explanation for statement-1

C. statement-1 is true, statement-2 is false

D. statement-1 is false, statement-2 is true

Answer: A

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12. Assertion : Sound level increases linearly with intensity of sound.

Reason : If intensity of sound is doubled, sound level increases approximatel $3dB$.

A. Statement-1 is true, statement-2 is true, statement-2 is a correct explanation for statement-1

B. Statement-1 is true, statement-2 is true, statement-2 is not a correct explanation for statement-1

C. statement-1 is true, statement-2 is false

D. statement-1 is false, statement-2 is true

Answer: D

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Assignment Section F Match The Column

1. Column-II lists some equations and arrangements of string. They are either corresponding to stationary wave or progressive wave match

the entries of column-I with all possible entries in column-II

Column-I	Column-II
(A) Fundamental frequency of a closed organ pipe is 100 Hz	(p) Frequency of second harmonic is 300 Hz
(B) The fundamental frequency of a vibrating string with fixed ends is 150 Hz	(q) Frequency of first overtone is 300 Hz
(C) The fundamental frequency of an open organ pipe is 150 Hz	(r) Frequency of second overtone is 500 Hz
	(s) Frequency of third harmonic is 450 Hz
	(t) Frequency of third overtone is 600 Hz

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2. Transverse waves are produced in a stretched wire. Both ends of the string are fixed. Let us compare between second overtone mode (in numerator) and fifth harmonic, mode (in denominator).

match the following column-I with column-II

Column-I	Column-II
(A) Frequency ratio	(p) $\frac{2}{3}$
(B) Number of nodes ratio	(q) $\frac{4}{5}$
(C) Number of antinodes ratio	(r) $\frac{3}{5}$
(D) Wavelength ratio	(s) $\frac{5}{3}$

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Assignment Section G Integer Type

1. The equation of a plane progressive wave is $y = A\sin\left(\pi t - \frac{x}{3}\right)$. Find the value of A for which the wave speed is equal to the maximum particle speed.

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2. Two open organ pipes vibrating I their fundamental mode produces 5 beats per second. Find the number of beats produced per second if the temperature of medium is made 2.56 times and the pipes still vibrate in their fundamental modes.

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3. In the resonance tube experment, the first and second states of resonance are observed at 20 cm and 670 cm. find the value of end correction (in cm).

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4. Three sound sources p,q and r have frequencies 400 Hz, 401 Hz and 402 Hz respectively. Calculate the number of beats nodes per second.

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Assignment Section H Mutiple True False Type Questions

1. Statement-1: The speed of sound in humid air is more than the speed of sound in dry air keeping pressure constant.

Statement-2: Speed of sound in air with respect to air remains

constant at a given temperature.

Statement-3: Transverse waves cannot be polarised.

A. TTT

B. TFT

C. TTF

D. FTT

Answer: C

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2. Statement-1: A string of length 4 m is vibrating in its fourth overtone. The wavelength of the wave is 80 cm.

Statement-2: Doppler's effect is applicable only when source or observer moves with constant speed.

Statement-3: For a wave travelling along positive x-axis the

displacement of a particle x at time t is same as that of the particle at origin at time (t-x/v) where v is the wave speed.

A. FFF

B. FFT

C. FTF

D. TTF

Answer: B

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3. Assertion: Stationary waves are so called because particles are at rest in stationary waves.

Reason: They are formed by the superposition of two identical waves travelling in opposite directions.

A. FFF

B. FFT

C. FTF

D. TTF

Answer: C

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Assignment Section I Subjective Type Questions

1. A trasverse wave of amplitude $0.50mm$ and frequency $100Hz$ is produced on a wire stretched to a tension of $100N$. If the wave speed is $100m/s$. What average power is the source transmitting to the wire?

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2. A sonometer wire having a length of 1.50 m between the bridges vibrates in its second harmonic in resonance with a tuning fork of frequency 256 Hz. What is the speed of the transverse wave on the wire ?

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3. The equation of a standing wave, set up in a string is, y=0.8 sin[(0.314 cm^{-1})x]cos[(1200πs^{-1})t]. Calculate the smallest possible length of the living.

Watch Video Solution

4. The explosion of a fire cracker in the air at the a heigth of $40m$ produced a $100dB$ sound level at ground below. What is the instantaneous total radiated power? Assuming that it radiates as a point source.

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5. Two trains are travelling towards each other both at a speed of $90kmh^{-1}$. If one of the trains sounds a whistle at 500 Hz, what will be the apparent frequency heard in the other train ? Speed of sound in air $= 350ms^{-1}$.

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6. Calculate the beat frequency heard when two sound sources of wavelength 35cm and 35.2 cm are sounded together. The speed of sound in air is 330 ms^{-1}

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7. A string of length 105 cm produces fundamental frequency of 142 Hz. How much should its length be reduced to produce a fundamental

frequency of 213 Hz.

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8. Two ropes of length l and l/2 and mass per unit length μ and $\mu/4$ respectively are joined at B and hanged vertically with a heavy mass at its end C. A pulse is generated simultaneously at both ends A and C which travels along the ropes. Find the distance from the top at which pulses will cross each other.

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Assignment Section J Subjective Type Questions

1. A plane harmonic wave of frequency 440 Hz propagates in a medium in a direction that makes angle $60^\circ C$ with x-axis as well as y-axis, find the phase difference between the oscillation at the point of medium

whose coordinates are (1,1,2) and (2,3,1). the velocity of the wave in the medium is 220m/s.

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2. An isotropic point source kept at 'O' produces intensity l_0 at point A. find the mean energy flow rate through a ring centred at A and having its plane perpendicular to the line OA. The distance OA is x arid radius of ring is R.

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3. A string of mass m is fixed at both ends. The fundamental tone oscillations are excited with circular frequency ω and maximum displacement amplitude $a_{\max}$. Find :

(a) the maximum kinetic energy of the string,

(b) the mean kinetic energy of the string averaged over one oscillation period.

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4. At low speeds, the drag force exerted by air is directly proportional to speed i.e., $F_{drag} = cv$. Here, c is the constant. To determine the value of c,a small ball shaped buzzer is dropped from a high tower and the frequency recorded. It is observed that the frequency of sound decreases from an initial value of 704 Hz and becomes constant 686 Hz. taking speed of sound in air as 343 m/s and $g = 10m/s^2$, determine the value of constant 'c' (in kg/s). the mass of buzzer is 1.8 kg.

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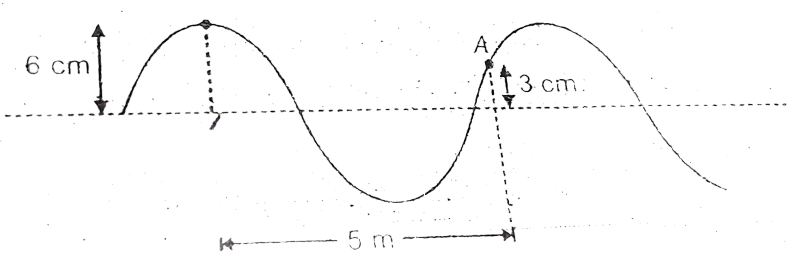
5. The following figure shows a wave propagating in a string. The speed of point A, which is 3 cm above the mean position is $7\sqrt{3}\pi cm/s$

at the moment shown. What is the speed of the wave in m/s?



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Assignment Section J Paragraph Type Questions

1. A string with tension T and mass per unit length μ is clamped down at x=0 and at x=L. at t=0, the string is at rest and displaced in the y-direction

$$y(x,0) = 2\sin\frac{2\pi x}{L} + 3\sin\frac{\pi x}{L}$$

Q. What is the total energy at t=0?

A. a. $\frac{25T\pi^2}{4L}$

B. b. $\frac{25T\pi^2}{8L}$

C. c. $\frac{25T\pi^2}{2L}$

D. d. $\frac{25T\pi^2}{16L}$

Answer: A

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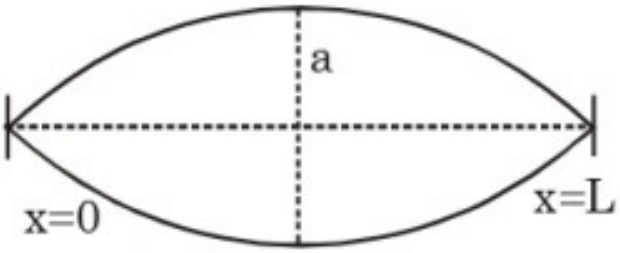
2. A string of mass per unit length μ is clamped at both ends such that one end of the string is at $x = 0$ and the other is at $x = L$. When string vibrates in fundamental mode, amplitude of the midpoint of string is a and tension in the string is F. Find the total oscillation energy (in J) stored in the string. (Use `L=1 m, F = 10N, a = 1/pi m).



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3. A string with tension T and mass per unit length μ is clamped down at x=0 and at x=L. at t=0, the string is at rest and displaced in the y-direction

$$y(x, 0) = 2\sin\frac{2\pi x}{L} + 3\sin\frac{\pi x}{L}$$

Q. What is the total energy at t=0?

A. a. $\frac{L}{2v}$

B. b. $\frac{L}{v}$

C. c. $\frac{2L}{v}$

D. d. $\frac{3L}{v}$

Answer: C

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4. A sounding source of frequency 500 Hz moves towards a stationary observed with a velocity of $30ms^{-1}$ If the velocity of sound in air is

$330ms^{-1}$, find frequency heard by the observer .

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Exercise

1. A plane progressive wave propagating along positive x-axis is

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

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

C. $y = A\sin(\omega t - ky)$

D. $y = A\sin\omega t\sin kx$

Answer: B

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2. The wave function of a pulse is given by $y = \frac{5}{(4x + 6t)^2}$ where x and y are in metre and t is in second :-

(i) Identify the direction of propagation

(ii) Determine the wave velocity of the pulse

A. $2m / s$

B. $6m / s$

C. $1.5m / s$

D. $3m / s$

Answer: C

Watch Video Solution

3. The equation of the progressive wave, where t is the time in second , x is the distance in metre is $y = A \cos 240\left(t - \frac{x}{12}\right)$. The phase difference (in SI units) between two position 0.5 m apart is

A. 40

B. 20

C. 10

D. 5

Answer: C

Watch Video Solution

4. A transversee wave propagating on the string can be described by the equation $y = 2\sin(10x + 300t)$, where x and y are in metres and t in second. If the vibrating string has linear density of $0.6 \times 10^{-3} g/cm$, then the tension in the string is

A. 5.4N

B. 0.054 N

C. 54 N

D. 0.0054 N

Answer: B

Watch Video Solution

5. A rope of length L and mass m hangs freely from the ceiling. The velocity of transverse wave as a function of position x from the bottom is proportional to

A. x^0

B. $\sqrt{x}$

C. $\frac{1}{\sqrt{x}}$

D. x

Answer: B

Watch Video Solution

6. The speed of sound in hydrogen at N.T.P. is 1270 metres per second. Thenthe speed in a mixture of hydrogen and oxygen containing hydrogen and oxygen in the ration $4:1$ by volume, will be

A. 635

B. 318

C. 158

D. 1270

Answer: A

Watch Video Solution

7. A copper wire is held at the two ends by rigid supports . At $50^\circ C$ the wire is just taut , with negligible tension . If $Y = 1.2 \times 10^{11} N/m^2, \alpha = 1.6 \times 10^{-5}/^\circ C$ and

$\rho = 9.2 \times 10^3 kg/m^3$, then the speed of transverse waves in this wire at $30^\circ C$ is

A. 64. 6 m/s

B. 16.2 m/s

C. 23.2 m/s

D. 32.2 m/s

Answer: A

Watch Video Solution

8. The wavelength of sound waves in hydrogen gas corresponding to the lower limit of audibility is (speed of sound in hydrogen gas is about 1350 m/s) .

A. 60 m

B. 67.5 m

C. 100 m

D. 500 m

Answer: B

Watch Video Solution

9. An iron block is dropped into a deep well. Sound of splash is heard after 4.23 s. If the depth of the well is 78. 4 m , then find the speed of sound in air $\left(g = 9.8m / s^2\right)$

A. 300 m/s

B. 320 m/s

C. 280 m/s

D. 340.8m/s

Answer: D

Watch Video Solution

10. If the intensity of sound is increased by a factor of 30, by how many decibels in the sound level increased :-

A. 12 dB

B. 14.77 dB

C. 10dB

D. 13dB

Answer: B

Watch Video Solution

11. Two superimposig waves are represented by equation $y_1 = 2\sin 2\pi(10t - 0.4x)$ and $y_2 = 4\sin 2\pi(20t - 0.8x)$. The ratio of $l_{\max}$ to $l_{\min}$ is

A. $36:4$

B. $25:9$

C. $1:4$

D. $4:1$

Answer: B

Watch Video Solution

12. A wave represented by the equation $y = a\cos(kx - \omega t)$ is superposed with another wave to form stationary wave such that the point x=0 is a node. The equation for the other wave is:

A. $a\sin(kx + \omega t)$

B. $-a\cos(kx + \omega t)$

C. $-a\cos(kx - \omega t)$

D. $-a\sin(kx - \omega t)$

Answer: B

Watch Video Solution

13. A wire of mass 5 gram is kept stretched by a force of 400 N. When plucked at a point, transverse waves travel along the wire with a speed of 400 m/s. The length of the wire is

A. 1 m

B. 2 m

C. 3 m

D. 1.5 m

Answer: B

Watch Video Solution

14. If the fundamental frequency of string is 220 cps , the frequency of fifth harmonic will be

A. 44 cps

B. 55 cps

C. 1100 cps

D. 440 cps

Answer: C

Watch Video Solution

15. Which of the following phenomenon is not shown by sound waves ?

A. Interference

B. Diffraction

C. Polarisation

D. Doppler's effect

Answer: C

Watch Video Solution

16. The fundamental frequency of a pipe closed at one end is 100Hz. If close end is open the fundamental frequency of same pipe wil be

A. 100 Hz

B. 200 Hz

C. 50 Hz

D. 400 Hz

Answer: B

Watch Video Solution

17. Two tuning fork A and B are sounded together gives 5 beats per second. If frequency of B is 260 Hz and after loading A with was the beat frequency increases the frequency of A is

A. 265 HZ

B. 255 Hz

C. 260 Hz

D. 250 Hz

Answer: B

Watch Video Solution

18. A policeman on duty detects a drop of 10% in the pitch of the horn of a moving car as it crosses him. If the velocity of sound is $330m/s$, the speed of the car will be

A. $17.4m/s$

B. $20.4 m / s$

C. $18.7 m / s$

D. $16.4 m / s$

Answer: A

Watch Video Solution

19. A locomotive approaching a crossing at a speed of 80 mi/h sounds a whistle of frequency 400 Hz when 1 mi from the crossing. There is no wind, and the speed of sound in air is 0.200mi/s. What frequency is heard by an observer 0.60 mi from the crossing on the straight road which crosses the railroad at right angles?

Watch Video Solution

20. Two sources A and B are sounding notes of frequency 660 Hz. A listener moves from A to B with a constant velocity u. If the speed is 330 m/s , what must be the value of u so that he hears 8 beats per second ?

A. 2.8 m/s

B. 2 m/

C. 3.0 m/s

D. 3.5 m/s

Answer: B

Watch Video Solution

Assignment Section A Objective Type Questions

1. The phenomenon which does not takes place in sound waves is

A. Polarisation

B. Refraction

C. Diffraction

D. Reflection

Answer: A

Watch Video Solution

2. The speed of sound in air is independent from its

A. Amplitude

B. frequency

C. Phase

D. All of these

Answer: D

Watch Video Solution

3. The waves which cannot travel without medium are

A. X-rays

B. Radio waves

C. Light waves

D. Sound waves

Answer: D

Watch Video Solution

4. When a wave propagating through a medium encounters a change in medium , then which of the following property remains same ?

A. Speed

B. Amplitude

C. Frequency

D. Wavelength

Answer: C

Watch Video Solution

5. A transverse wave travels along x-axis . The particles of medium move

A. Along x-axis

B. Along y-axis

C. Along z-axis

D. Either along y- axis or z-axis

Answer: D

Watch Video Solution

6. The phenomenon of sound propagation in air is

A. An isothermal process

B. An adiabatic process

C. An isobaric process

D. An isochoric process

Answer: B

Watch Video Solution

7. If at STP , velocity of sound in a gas $(\gamma = 1.5)$ is 600 m/s , the r.m.s. velocity of the gas molecules at STP will be

A. 400 m/s

B. 600 m/s

C. $600\sqrt{2}m/s$

D. $300\sqrt{2}m/s$

Answer: C

Watch Video Solution

8. In a stretched string.

A. Only transverse wave can exits

B. Only longitudinal waves can exist

C. Both transverse and longitudinal waves can exits

D. none of these

Answer: A

Watch Video Solution

9. Two strings of same material are stretched to the same tension . If their radii are in the ratio 1:2 , then respective wave velocities in them will be in ratio

A. $4:1$

B. $2:1$

C. $1:2$

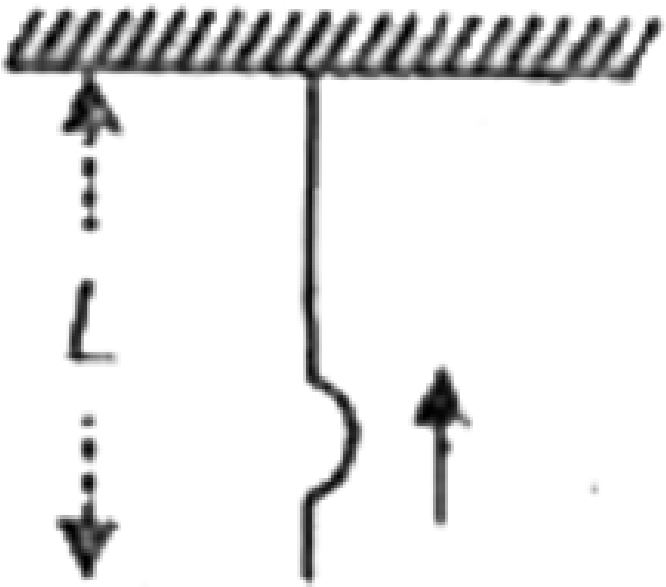
D. $1:4$

Answer: B

Watch Video Solution

10. A pulse is generated at lower end to a hanging rope of uniform density and length L. The speed of the pulse when it reaches the mid

point of rope is



A. $\sqrt{2gL}$

B. $\sqrt{gL}$

C. $\sqrt{\frac{gL}{2}}$

D. $\frac{\sqrt{gL}}{2}$

Answer: C

Watch Video Solution

11. Which of the following equations represent a transverse wave travelling along- y axis ?

A. $x = A\sin(\omega t - ky)$

B. $x = A\sin(\omega t + ky)$

C. $y_0 = A\sin(\omega t - kx)$

D. $y_0 = A\sin(\omega t + kx)$

Answer: B

Watch Video Solution

12. A wave is represented by $x = 4\cos\left(8t - \frac{y}{2}\right)$, wher x and y are in metre and t in second. The frenqency of the wave $\left(\text{in} s^{-1}\right)$ is

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

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

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

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

Answer: A

Watch Video Solution

13. A wave is represented by the equation $y = A\sin\left(10\pi x + 15\pi t + \frac{\pi}{6}\right)$ wher x is in metre and t in second. The expression represents

A. A wave travelling in negative x - direction with a velocity of 1.5 m/s

B. A wave travelling in positive x direction with a velocity of 1.5 m/s

C. A wave travelling in position x - direction with wavelength 0.2 m

D. A wave travelling in negative x-direction with a velocity of 150 m/s

Answer: A

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14. A travelling wave in a string is represented by $y = 3\sin\left(\frac{\pi}{2}t - \frac{\pi}{4}x\right)$. The phase difference between two particles separated by a distance 4 cm is (Take x and y in cm and t in seconds)

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

B. $\frac{\pi}{4}$ rad

C. π rad

D. 0

Answer: C

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15. A transverse wave is described by the equation $y = A\sin 2\pi(nt - x/\lambda_0)$. The maximum particle velocity is equal to 3 times the wave velocity if

A. $\lambda_0 = \frac{\pi A}{3}$

B. $\lambda = \frac{2\pi A}{3}$

C. $\lambda_0 = \pi A$

D. $\lambda_0 = 3\pi A$

Answer: B

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16. The relation between the particles velocity and wave velocity is -

A. $\vec{u}$ is perpendicular to $\vec{v}$

B. $\vec{u}$ is parallel to $\vec{v}$

C. $\left|\vec{u}\right|$ is equal to $\left|\vec{v}\right|$

D. $\left|\vec{u}\right|$ = (slope of wave from) $\left|\vec{v}\right|$

Answer: D

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17. In sine wave , minimum distance between 2 particles always having same speed is

A. $\lambda/4$

B. $\lambda/3$

C. $\lambda/2$

D. λ

Answer: D

Watch Video Solution

Watch Video Solution

18. The sound level at a point 5.0 m away from a point source is 40 dB. What will be the level at a point 50 m away from the source ?

A. 26 dB

B. 16dB

C. 23dB

D. 32dB

Answer: B

Watch Video Solution

19. The tones that are separated by three octaves have a frequency ratio of

A. 3

B. 6

C. 8

D. 16

Answer: C

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20. On the superposition of the two waves given as $y_1 = A_0 \sin(\omega t - kx)$ and $y_2 = A_0 \cos\left(\omega t - kx + \frac{\pi}{6}\right)$, the resultant amplitude of oscillations will be

A. $\sqrt{3}A_0$

B. $\frac{A_0}{2}$

C. A_0

D. $\frac{3}{2}A_0$

Answer: C

Watch Video Solution

21. Two waves of amplitude A_0 and xA_0 pass through a region . If $x > 1$, the difference in the maximum and minimum resultant amplitude possible is

A. $(x+1)A_0$

B. $(x-1)A_0$

C. $2xA_0$

D. $2A_0$

Answer: D

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22. Which of the following represents a standing wave ?

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

B. $A = Ae^{-bx}\sin(\omega t - kx + \alpha)$

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

D. $y = (ax + b)\sin(\omega t - kx)$

Answer: C

Watch Video Solution

23. The equation of stationary wave along a stretched string is given by $y = 5\sin\left(\frac{\pi}{3}x\right)\cos 40\pi t$ where x and y are in centimetre and t in second. The separation between two adjacent nodes is :

A. 1.5

B. 3

C. 6

D. 4

Answer: B

Watch Video Solution

24. In a stationary wave

A. Strain is maximum at nodes

B. Strain is minimum at nodes

C. Strain is maximum at antinodes

D. Amplitude is zero at all points

Answer: A

Watch Video Solution

25. Select the correct statement about the reflection and refraction of a wave at the interface between the medium 1 and 2 the

A. Reflected wave has a phase change of π

B. Wavelength of reflected wave is less than that of incident wave

C. Frequency of transmitted wave is same as that of incident wave

D. Frequency of wave changes as per nature of boundary .

Answer: C

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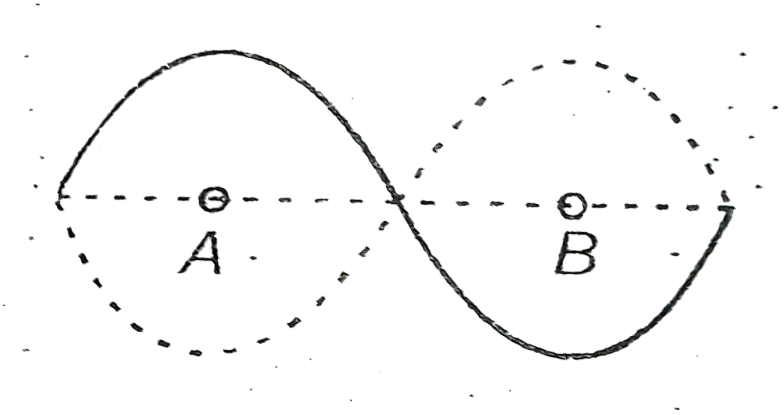
26. In a standing wave particles at the positions A and B, have a phase difference of



A. 0

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

C. $\frac{5\pi}{6}$

D. π

Answer: D

Watch Video Solution

27. A 12 m long vibrating string has the speed of wave 48 m/s . To what frequency it will increase .

A. 2 cps

B. 4 cps

C. 6 cps

D. All of these

Answer: D

Watch Video Solution

28. A certain string will resonante to several frequencies , the lowest of which is 200 cps. What are the next three higher frequencies to which it resonantes ?

A. 400 , 600 , 800

B. 300 , 400 , 500

C. 100 , 150 , 200

D. 200 , 250 , 300

Answer: A

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29. The tension in a wire is decreased by $19\ \%$ The percentage decrease in frequency will be

A. $0.19\ \%$

B. $10\ \%$

C. $19\ \%$

D. $0.9\ \%$

Answer: B

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30. The length of a sonometer wire is 0.75 m and density $9 \times 10^3 Kg/m^3$. It can bear a stress of $8.1 \times 10^8 N/m^2$ without exceeding the elastic limit . The fundamental that can be produced in the wire , is

A. 200 Hz

B. 150 Hz

C. 600 Hz

D. 450Hz

Answer: A

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31. An aluminum rod having a length 100 cm is clamped at its middle point and set into longitudinal vibrations. Let the rod vibrate in its fundamental mode. The density of aluminum is 2600 kg/m^3 and its Young's modulus is $7.8 \times 10^{10} N/m^2$. The frequency of the sound produced is :-

A. 1250 Hz

B. 2740 Hz

C. 2350 Hz

D. 1685Hz

Answer: B

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32. The string of a violin has a fundamental frequency of 440 Hz. If the violin string is shortend by one fifth, itd fundamental frequency will be changed to

A. 440 cps

B. 880 cps

C. 550 cps

D. 2200 cps

Answer: C

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33. A wire of length one metre under a certain initial tension emits a sound of fundamental frequency 256 Hz. When the tesnion is increased by 1 kg wt , the frequency of the fundamental node increases to 320 Hz. The initial tension is

A. $3/4kg$ wt

B. 4/3 kg wt

C. 16/9 kg wt

D. 20/9 kg wt

Answer: C

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34. In case of closed organ pipe, which harmonin the p^{th} overtone will be

A. 2p+1

B. 2p-1

C. p+1

D. p-1

Answer: A

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35. The pitch of an organ pipe is highest when the pipe is filled with

A. Air

B. Hydrogen

C. Oxygen

D. Carbon dioxide

Answer: B

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36. A cylindrical tube, open at the both ends, has a fundamental frequency f in air . The tube is dipped vertically in water so that half of it is in water . The fundamental frequency of the air column is now-

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

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

C. f

D. 2f

Answer: C

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37. For a certain organ pipe three successive resonance frequencies are observed at 425Hz, 595 Hz and 765Hz respectively. If the speed of sound air is 340m/s, then the length of the pipe is

A. 425

B. 170

C. 85

D. 245

Answer: C

Watch Video Solution

38. A closed pipe of length 10 cm has its fundamental frequency half that of the second overtone of an open pipe . The length of the open pipe .

A. 10 cm

B. 20 cm

C. 30 cm

D. 40 cm

Answer: C

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39. The vibrations of four air columns under identical conditions are represented in the figure below. The ratio of frequencies $n_p : n_q : n_r : n_s$ will be

A. 12:6:3:4

B. 1:2:4:3

C. 4:2:3:1

D. 6:2:3:4

Answer: B

Watch Video Solution

40. In resonance tube tube successive positions of resonance are obtained at 15 cm and 48 cm . If the frequency of the fork is 500 cps , the velocity of sound is

A. 330 m/s

B. 300 m/s

C. 1000 m/s

D. 360 m/s

Answer: A

Watch Video Solution

41. During superposition of two waves of nearly equal frequencies , beat frequency is defined as the

A. Sum of frequencies of interfering waves

B. Number of times the resultant intensity becomes maximum or minimum is one second

C. Average of frequencies of interfering waves

D. Number of times the resultant amplitude becomes maximum or minimum in one second .

Answer: B

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42. A tuning fork of unknown frequency produces 4 beats per second when sounded with another tuning fork of frequency 254 Hz. It gives the same number of beats per second when unknown tuning fork loaded with wax . The unknown frequency before loading with wax is

A. 258

B. 254

C. 250

D. Can't be determined

Answer: A

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43. Ten tuning forks are arranged in increasing order of frequency is such a way that any two nearest tuning forks produce $4be * /\sec$. The highest freqeuncy is twice of the lowest. Possible highest and the lowest frequencies are

A. 80 and 40

B. 100 and 50

C. 44 and 22

D. 72 and 36

Answer: D

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44. The displacement at a point due to two waves are $y_1 = 4\sin(500\pi t)$ and $y_2 = 2\sin(506\pi t)$. The result due to their superposition will be

A. 3 beats per second with intensity relation between maxima and minima equal to 2

B. 3 beats per second with intensity relation between maxima and minima equal to 9

C. 6 beats per second with intensity relation between maxima and minima equal to 2

D. 6 beats per second with intensity relation between maxima and minima equal to 9

Answer: B

Watch Video Solution

45. A tuning fork vibrating with a sonometer having 20 cm wire produces 5 beats per second. The beat frequency does not change if the length of the wire is changed to 21 cm. The frequency of the tuning fork (in Hertz) must be

A. 200 Hz

B. 210 Hz

C. 205 Hz

D. 215 Hz

Answer: C

Watch Video Solution

46. A column of air at $51^{\circ}C$ and a tuning fork produce 4 beats per second when sounded together. As the temperature of the air column

is decreased, the number of beats per second tends to decrease and when the temperature is $16^{\circ}C$ the two produce 1 beat per second. Find the frequency of the tuning fork.

A. $100Hz$

B. 75Hz

C. 150 Hz

D. 50 Hz

Answer: D

Watch Video Solution

47. A man standing on a platform observes that the frequency of the sound of a whistle emitted by a train drops by 140 Hz. If the velocity of sound in air is 330 m/s and the speed of the train is 70 m/s, the frequency of the whistle is

A. 571 Hz

B. 800 Hz

C. 400 Hz

D. 260 Hz

Answer: B

Watch Video Solution

48. A sound is moving towards a stationary listener with $\frac{1}{10^{th}}$ of the speed of sound. The ratio of apparent to real frequency 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

49. A train moves towards a stationary observer with speed 34 m/s. The train sounds a whistle and its frequency registered by the observer is f_1. If the speed of train is reduced to 17 m/s, the frequency registered is f_2. If speed fo sound is 340 m/s, then the ratio f_1 / f_2 is :

A. $\frac{18}{19}$

B. $\frac{1}{2}$

C. 2

D. $\frac{19}{18}$

Answer: D

Watch Video Solution

50. An observer is approaching with a speed v , towards a stationary source emitting sound waves of wavelength λ_0 . The wavelength shift detected by the observer is (Take c= speed of sound)

A. $\frac{\lambda_0 v}{c}$

B. $\frac{\lambda_0 c}{v}$

C. $\frac{\lambda_0 v^2}{c^2}$

D. Zero

Answer: D

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Assignment Section B Objective Type Questions

1. The longitudinal wave can be observed in

A. Elastic media

B. inelastic media

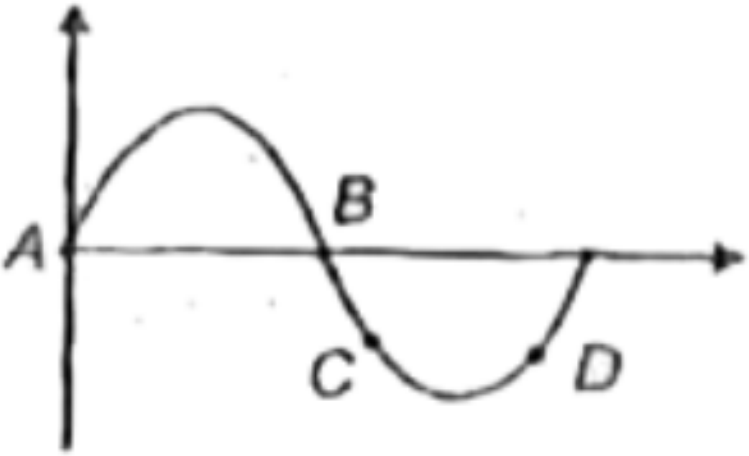
C. Both (1) & (2)

D. None of these

Answer: A

Watch Video Solution

2. A transverse pulse is shown in the figure , on which 4 points are shown at any instant . Which of the following points are in a state to move upward in subsequent time ?



A. A,B

B. A,D

C. B,C

D. B,D

Answer: C

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3. A rope of length L and mass m hangs freely from the ceiling. The velocity of transverse wave as a function of position x from the bottom is proportional to

A. T

B. $T\left(\frac{\sqrt{2}-1}{\sqrt{2}}\right)$

C. $\frac{T}{\sqrt{2}}$

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

Answer: C

Watch Video Solution

4. A Uniform rope having mass m hags vertically from a rigid support. A transverse wave pulse is produced at the lower end. The speed v of wave pulse varies with height h from the lower end as

A. 

B. 

C. 

D. 

Answer: A

Watch Video Solution

5. If a transverse pulse is created at the topmost point of a uniform rope suspended vertically, then

A. $\sqrt{\frac{L}{2g}}$

B. $\sqrt{\frac{2L}{g}}$

C. $\sqrt{\frac{L}{g}}$

D. $\sqrt{\frac{4L}{g}}$

Answer: D

Watch Video Solution

6. Which one of the following represents a wave ?

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

B. $y = A\cos^2(at - bx + c) + A\sin^2(at - bx + c)$

C. $y = A\sin kx$

D. $y = A \sin \omega t$

Answer: A

Watch Video Solution

7. 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 $ax \pm bt$ or $x - vt$ or $x + vt$,i.e. $y = f(x \pm vt)$. Is the converse true? Examine if the folliwing function for y can possibly represent a travelling wave

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

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

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

A. Only (a)

B. (b) & (c)

C. (c) & (d)

D. Only (c)

Answer: A

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8. In a sinusoidal wave, the time required for a particular point to move from maximum displacement to zero displacement is 0.17 sec. The frequency of the wave is

A. 0.73 Hz

B. 0.36 Hz

C. 1.47 Hz

D. 2.94 Hz

Answer: C

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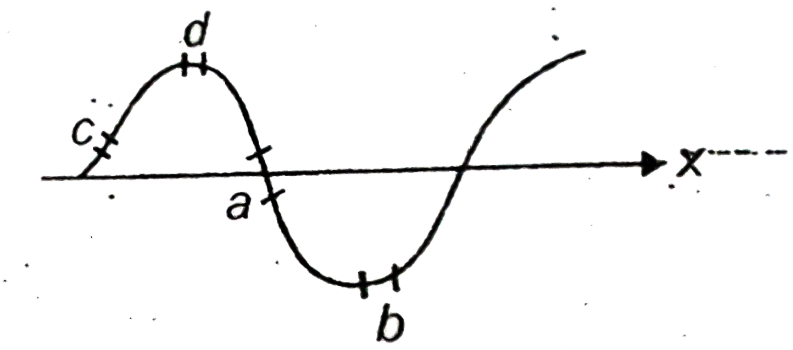

9.

The figure shows the snapshot of a travelling sine wave in a string. Four elemental portions a,b,c and d are indicated on the string. The elemental portion with maximum potential energy is/are

A. a

B. b

C. c

D. b and d

Answer: A

Watch Video Solution

10. Wave of frequency 500 Hz has a phase velocity $360m/s$. The phase difference between two displacement at a certain point at time $10^{-3}s$ apart will be

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

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

C. π

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

Answer: C

Watch Video Solution

11. The equation of a travelling wave is,

$Y = A\sin 2\pi(pt - x/5)$

Then the ratio of maximum particle velocity to wave velocity is,

A. $\frac{\pi a}{5}$

B. $2\sqrt{5\pi a}$

C. $\frac{2\pi a}{5}$

D. $\frac{2\pi a}{\sqrt{5}}$

Answer: C

Watch Video Solution

12. A travelling wave pulse is given by

$$y = \frac{4}{3x^2 + 48t^2 + 24xt + 2}$$

where x and y are in metre and t is in second. The velocity of wave is :-

A. 4m/s

B. 2 m/s

C. 8 m/s

D. 12 m/s

Answer: A

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13. The ratio of maximum particle velocity to wave velocity is [where symbols have their usual meanings]

A. kA

B. $A\omega$

C. $k\omega$

D. $\frac{\omega}{k}$

Answer: A

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14. What is the phase difference between the displacement wave and pressure wave in sound wave :-

A. Zero

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

C. π

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

Answer: B

Watch Video Solution

15. The driver of a car treavelling with speed $30ms^{-1}$ toward a hill sounds a horn of frequenvy 600 Hz. If the velocity of sound in air is $300ms^{-1}$ the frequency of reflected sound as heard by diver is

A. 500 Hz

B. 550 Hz

C. 555.5 Hz

D. 720 Hz

Answer: D

Watch Video Solution

16. The ratio of intensities between two coherent sound sources 4:1. the difference of loudness in decibel (dB) between maximum and minimum intensities, when they interfere in space is

A. $20\log_{10}(3)$

B. $10\log_{10}(2)$

C. $20\log_{10}(2)$

D. $10\log_{10}(3)$

Answer: A

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17. The intensity of a sound wave gets reduced by $20\,\%$ on passing through a slab. The reduction intensity on passage through two such consecutive slabs

A. 0.36 I

B. 0. 64 I

C. 0.4 I

D. 0.8 I

Answer: B

Watch Video Solution

18. two periodic waves of intesities l_1 and l_2 pass through a region at the same time in the same direction. The sum of the maximum and minimum intensities is

A. $2(l_1 + l_2)$

B. $l_1 + l_2$

C. $\left(\sqrt{l_1} + \sqrt{l_2}\right)$

D. $\left(\sqrt{l_1} - \sqrt{l_2}\right)$

Answer: A

Watch Video Solution

19. A standing wave is represented by, $y - A\sin(100t)\cos(0.01x)$, where x,y and A are in millimeter and t in second. The velocity of the wave is

A. 10^4 m/s

B. Not derivable

C. 1 m/s

D. 10^2 m/s

Answer: A

Watch Video Solution

20. The length of a sonometer wire AB is 110 cm. Where should the two bridges be placed from A to divide the wire in 3 segments whose fundamental frequencies are in the ratio of $1:2:3$?

A. 60 cm and 90 cm

B. 30 cm and 60 cm

C. 30 cm and 90 cm

D. 40 cm and 80 cm

Answer: A

Watch Video Solution

21. Standing waves are produced in a 10 m long stretched string. If the string vibrates in 5 segments and the wave velcoity is 20 m/s the

frequency

A. 5Hz

B. 10 Hz

C. 2 Hz

D. 4 Hz

Answer: A

Watch Video Solution

22. If the tension and diameter of a sonometer wire of fundamental frequency n is doubled and density is halved then its fundamental frequency will become

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

B. $\sqrt{2n}$

C. n

D. $\frac{n}{\sqrt{2}}$

Answer: C

Watch Video Solution

23. Two waves having equation

$x_1 = a\sin(\omega t + \phi_1)$

$x_2 = a\sin(\omega t + \phi_2)$

If in the resultant wave the frequency and amplitude remains equals to amplitude of superimposing waves. Then phase diff. between them : -

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

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

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

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

Answer: B

Watch Video Solution

24. The standing wave in a medium is expressed as $y = 0.2\sin(0.8x)\cos(3000t)m$. The distance between any two consecutive points of minimum of maximum displacement is

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

B. $\frac{\pi}{4}m$

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

D. None of these

Answer: D

Watch Video Solution

25. The equation of a standing wave in a string fixed at both its ends is given as y=2A sin kx cos ωt. The amplitude and frequency of a particle

vibrating at the point of string midway between a node and an antinode is

A. $A, \frac{\omega}{2\pi}$

B. $\frac{A}{\sqrt{2}}, \frac{\omega}{2\pi}$

C. $A, \frac{\omega}{\pi}$

D. $\sqrt{2}A, \frac{\omega}{2\pi}$

Answer: D

Watch Video Solution

26. Two sinusoidal waves are superposed. Their equations are

$y_1 = A\sin\left(kx - \omega t + \frac{\pi}{6}\right)$ and $y_2 = A\sin\left(kx - \omega t - \frac{\pi}{6}\right)$

the equation of their resultant is

A. $y_2 = A\sin\left(kx - \omega t - \frac{\pi}{6}\right)$ The equation of resultant wave is

B. $y = \frac{A}{\sqrt{3}}\sin(kx - \omega t)$

C. $y = A\sqrt{3}\sin(kx - \omega t)$

D. $y = A\sqrt{3}\sin\left(kx - \omega t - \frac{\pi}{3}\right)$

Answer: B

Watch Video Solution

27. For an organ pipe, four of the six harmonics of frequency less than 1000 Hz are 300, 600, 750 and 900 Hz. The two missing harmonics are

A. 75 , 150

B. 150450

C. 400 , 800

D. 250 , 400

Answer: B

Watch Video Solution

28. A second harmonic has to be generated in a string of length L stretched between two rigid supports. The point where the string has to be plucked and touched are

A. $\frac{l}{4}, \frac{l}{2}$

B. $\frac{l}{4}, \frac{3l}{4}$

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

D. $\frac{l}{2}, \frac{3l}{4}$

Answer: A

Watch Video Solution

29. In a string wave , all particles of the medium cross the mean position with

A. Different speeds at different instants

B. Different speeds at same instant

C. Same speed at different instants

D. Same speed at same instant

Answer: B

Watch Video Solution

30. Two waves represented by the following equations are travelling in the same $y_1 = 5\sin 2\pi(75t - 0.25x) y_2 10\sin 2\pi(150t - 0.50x)$. The intensity ratio I_1 / I_2 of the two waves is

A. $1:2$

B. $1:4$

C. $1:8$

D. $1:16$

Answer: B

Watch Video Solution

31. In a closed end pipe of length $105cm$, standing waves are set up corresponding to the third overtone . What distance from the closed end, amongst the following is a pressure node?

A. 5 cm

B. 15 cm

C. 25 cm

D. 30 cm

Answer: B

Watch Video Solution

32. A uniform string resonates with a tuning fork, at a maximum tension of 32 N. If it is divided into two segments by placing a wedge

at a distance one fourth of length from one end, then resonance frequency will occur at a maximum value of tension :-

A. 2N

B. 4N

C. 8N

D. 16N

Answer: A

Watch Video Solution

33. If in a stationary wave the amplitude corresponding to antinode is 4 cm, then the amplitude corresponding to a particle of medium located exactly midway between a node and an antinode is :-

A. 2cm

B. $2\sqrt{2}cm$

C. $\sqrt{2}cm$

D. 1.5 cm

Answer: B

Watch Video Solution

34. If f_1 and f_2 be the fundamental frequencies of the two segments into which a stretched string is divided by means of a bridge , then find the original fundamental frequency f of the complete string.

A. $\frac{f_1 f_2}{f_1 + f_2} = f$

B. $2f = f_1 + f_2$

C. $\sqrt{f} = \sqrt{f_1} + \sqrt{f_2}$

D. $\sqrt{f_1 + f_2} = 2f$

Answer: A

Watch Video Solution

35. Two sound waves of intensity 2 W/m^2 and $3W/m^2$ meet at a point to produce a resultant intensity $5W/m^2$. The phase difference between two waves is

A. π

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

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

D. Zero

Answer: C

Watch Video Solution

36. The two waves of same frequency moving in the same direction give rise to

A. Beats

B. Interference

C. Stationary waves

D. None of these

Answer: B

Watch Video Solution

37. The string of a violin emits a note of 205 Hz when its tension is correct. The string is made slightly more taut and it produces 6 beats in 2 seconds with a tuning fork of frequency 205 Hz. The frequency of the note emitted by the taut string is

A. 211 Hz

B. 199 Hz

C. 208 Hz

D. 202 Hz

Answer: C

Watch Video Solution

38. When two tuning forks (fork 1 and fork 2) are sounded simultaneously, 4 beats per second are heard. Now some tape is attached to the prongs of fork 2. When the tuning forks are sounded again, 6 beats per second are heard. If the frequency of fork 1 is 200 Hz, 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

39. A rocket is moving at a speed of 220 m s^{-1} towards a stationary target, emits a sound of frequency 1000 Hz. Some of the sound reaching the target gets reflected back to the rocket as an echo. The frequency of the echo as detected by the rocket is

(Take velocity of sound = 330 m s^{-1})

Watch Video Solution

40. A source frequency f gives 5 beats when sounded with a frequency 200Hz. The second harmonic of same source gives 10 beats when sounded with a source of frequency 420Hz. The value of f is

A. 205Hz

B. 195 Hz

C. 200 Hz

D. 210 Hz

Answer: A

Watch Video Solution

41. A vibrating tuning fork is moving slowly and uniformly ins a horizontal circular path of radiu 8 m . The shortest distance of an observer ins ame plane from the tuning fork is 9m. The distance between the tuning fork and observer at the instant when apparent frequency becomes maximum is

A. 9m

B. 25 m

C. 15 m

D. $\sqrt{353}$ m

Answer: D

Watch Video Solution

42. the frequency changes by 10 % as the source approaches a stationary observer with constant speed v_s. What would be the percentage change in frequency as the sources reaccedes the observer with the same speed ? Given , that $v_s << v$(v= speed pf sound in air)

A. 10.5%

B. 9.5%

C. 4.5%

D. 1.5%

Answer: B

Watch Video Solution

43. A train blowintg its whistle moves with constant - speed on a straight tack towards obsever and then crosses him . If the ratio and difference between the actual and apparent frequencies be 3:2 in the two cases , then the speed of train is [v is speed of sound]

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

B. $\frac{v}{5}$

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

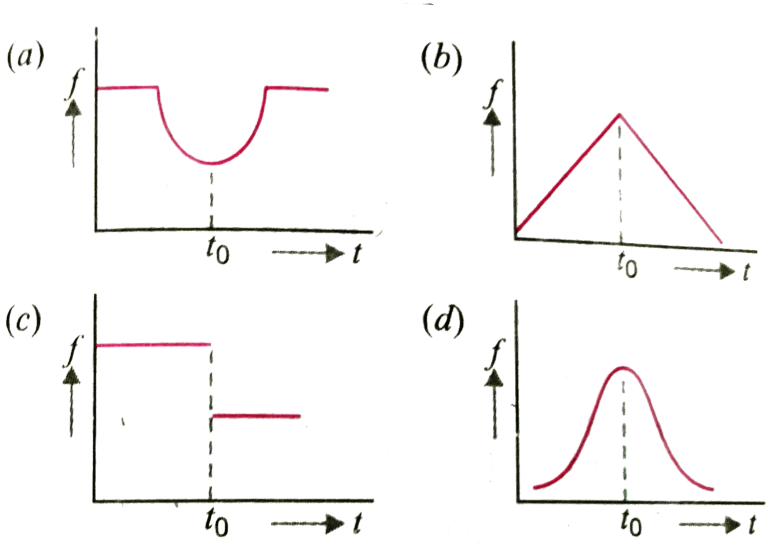
D. $\frac{3v}{2}$

Answer: B

Watch Video Solution

44. A man is standing on a railway platform listening to the whistle of an engine, that passes the man at constant speed without stopping. If the engine passes the man at time t_0, how does the frequency f of the

whistle as head by the man changes with time ?



A.

B.

C.

D.

Answer: A

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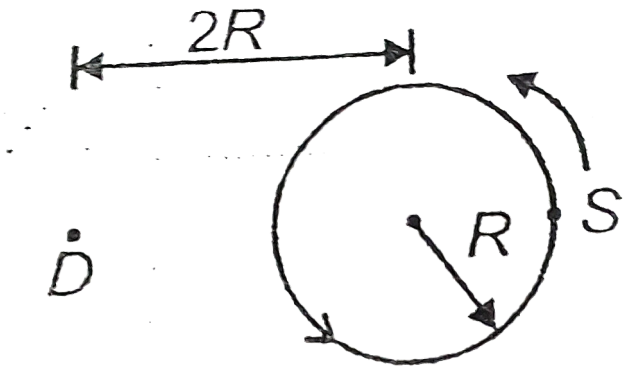
45. A whistle 'S' of frequency v revolves in a circle of radius R at a constant speed v. what is the ratio of the largest and smallest frequency detected by a detector D, at rest, at a distance 2 R from the centre of the circle as shown in the figure? (take speed of sound in air as c)



A. $\left(\frac{c+v}{c-v}\right)$

B. $\sqrt{2}\left(\frac{c+v}{c-v}\right)$

C. $\sqrt{2}$

D. $\frac{(c+v)}{c\sqrt{2}}$

Answer: A

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Assignment Section C Previous Year Questions

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

A. 350 Hz

B. 361 Hz

C. 411 Hz

D. 448 Hz

Answer: D

Watch Video Solution

2. The two harmonics of a tube closed at one end and open at other are 200 Hz and 260 Hz. What is the funamental frequency of the system?

A. 10 Hz

B. 20 Hz

C. 30 Hz

D. 40 Hz

Answer: B

Watch Video Solution

3. 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. L

B. 2L

C. $\frac{L}{2}$

D. 4L

Answer: B

Watch Video Solution

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

A. 1

B. 4

C. 3

D. 2

Answer: D

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5. A siren emiting a sound of frequency 800 Hz moves away from on obsever 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 m Velocity of sound in air $= 330ms^{-1}$)

A. 885 Hz

B. 765Hz

C. 800 Hz

D. 838 Hz

Answer: D

Watch Video Solution

6. An air column, closed at one end and open at the other, resonates with a tunning fork when the smallest length of the coloumn is 50 cm. The next larger length of the column resonating with the same tunning fork is

A. 200 cm

B. 66.7 cm

C. 100 cm

D. 150 cm

Answer: D

Watch Video Solution

7. A unifrom rope of length L and mass m_1 hangs vertically from a rigid support. A block of mass m_1 is attched to the free end of the rope. A transverse pulse of wavelength λ_1 is produced at the lower end of the

rope. The wavelength of the pulse when it reaches the top of the rope is $\lambda_2 therat io \lambda_2 / \lambda_1$ ia

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

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

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

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

Answer: C

Watch Video Solution

8. A string is stretched betweeb fixed points separated by $75.0cm$. It observed to have resonant frequencies of $420Hz$ and $315Hz$. There are no other resonant frequencies between these two. The lowest resonant frequency for this strings is

A. 105 Hz

B. 155 Hz

C. 205 Hz

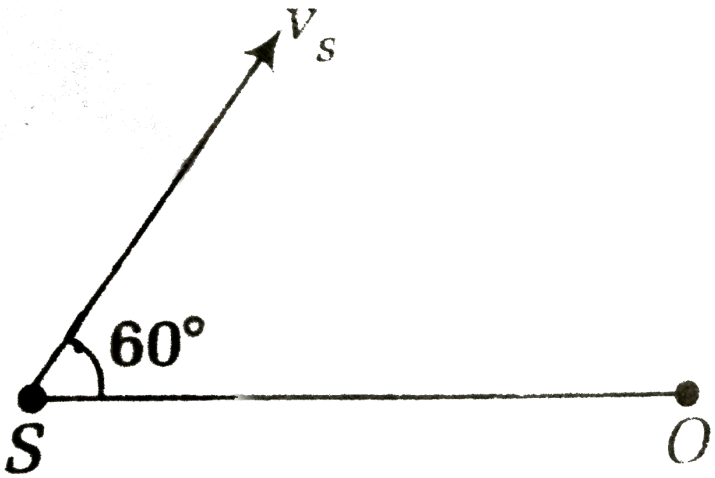
D. 10.5 Hz

Answer: A

Watch Video Solution

9. A source of sound S emitting waves of frequency 100 Hz. And an observer O 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 show in the figure. The observer is at rest . The

apparent frequency observed by the observer in air is $330ms^{-1}$, is



A. 97 Hz

B. 100 Hz

C. 103 Hz

D. 106 Hz

Answer: C

Watch Video Solution

10. 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 legth of organ pipe open at both the ends is

A. 140 cm

B. 80 cm

C. 100 cm

D. 120 cm

Answer: D

Watch Video Solution

11. If n_1, n_2 and n_3 are the fundamental frequencies of three segments into which a string is divided, then the original fundamental frequency n of 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

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12. The number of possible natural oscillartions of air column in a pipe closed at one end of length 85 cm whose ferquences lie below 1250 Hz are (velocity of sound = 340 ms^(-1))`

A. 4

B. 5

C. 7

D. 6

Answer: D

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13. A speeding motorcyclist sees traffic jam ahead of him. He slows down 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

A. 1332 Hz

B. 1372 Hz

C. 1412 Hz

D. 1454 Hz

Answer: C

Watch Video Solution

14. If we study the vibration of a pipe open at both ends, which of the following

statements is not true?

A. Odd harmonics of the fundamental frequency will be generated

B. All harmonics of he fundamental frequency will be generated

C. Presssure change will be maximum at both ends

D. Open end will be antinode

Answer: C

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15. 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 Hz .The unknown frequency is

A. 246 Hz

B. 240 Hz

C. 260 Hz

D. 245 Hz

Answer: D

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16. A wave travelling in the $+ve$ x-direction having displacement along y-direction as $1m$, wavelength 2π m and frequency of $1/\pi$ Hz is represented by

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

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

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

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

Answer: D

Watch Video Solution

17. Two sources of sound placed closed to each other are emitting orogressive 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

A. 8 beats per second with intensity ratio 81: 1 between waxing and waning

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

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

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

Answer: B

Watch Video Solution

18. If f_1, f_2 and f_3 are the fundamental frequencies of three segments into which a string is divided, then the original fundamental frequency f_0 of the whole string is

A. $\frac{1}{v} = \frac{1}{v_1} + \frac{1}{v_2} + \frac{1}{v_3}$

B. $\frac{1}{\sqrt{v}} = \frac{1}{\sqrt{v_1}} + \frac{1}{\sqrt{v_2}} + \frac{1}{\sqrt{v_3}}$

C. $\sqrt{v} = \sqrt{v_1} + \sqrt{v_2} + \sqrt{v_3}$

D. $v = v_1 + v_2 + v_3$

Answer: A

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19. 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 t is in seconds. The ratio of maximum particle velocity to the wave velocity is -

A. 2π

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

C. 3π

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

Answer: B

Watch Video Solution

20. A rocket is moving at a speed of 220 m s^{-1} towards a stationary target, emits a sound of frequency 1000 Hz. Some of the sound reaching the target gets reflected back to the rocket as an echo. The

frequency of the echo as detected by the rocket is

(Take velocity of sound = 330 m s^{-1})

A. 3500 Hz

B. 4000 Hz

C. 5000 Hz

D. 3000 Hz

Answer: C

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21. Two waves are represented by the equations

$y_1 = a\sin(\omega t + kx + 0.785)$

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

where, x is in meter and t in second

The phase difference between them and resultant amplitude due to their superposition are

A. 45∘ and 1.84 a

B. 30∘ and a

C. 30∘ and 2a

D. 45∘ and a

Answer: B

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22. Sound waves travel at 350 m s^{-1} through a warm air and at 3500 m s^{-1} through brass. The wavelength of a 700 Hz acoustic wave as it enters brass from warm air

A. Decreases by a factor 20

B. Decreases by a factor 10

C. Increases by a factor 20

D. Increases by a factor 10

Answer: D

Watch Video Solution

23. Two indentical piano wires, kept under the same tension T have a fundamental frequency of 600Hz. 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. 0.04

B. 0.01

C. 0.02

D. 0.03

Answer: C

Watch Video Solution

24. A transverse wave is represented by y = Asin$(\omega t - kx)$. 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

25. A tuning fork of frequency 512 Hz marks 4 beat/s with the vibration string of a piano. The beat frequency decreases to 2 beat/s when the tension in the piano string is slightly incrased. The frequency of the piano string before increasing the tension was

A. 508 Hz

B. 510 Hz

C. 514 Hz

D. 516 Hz

Answer: A

Watch Video Solution

26. Each of the two strings of length 51.6 cm and 49.1 cm are tensioned 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

27. The driver of a car treavelling with speed $30ms^{-1}$ toward a hill sounds a horn of frequenvy 600 Hz. If the velocity of sound in air is $300ms^{-1}$ the frequency of reflected sound as heard by diver is

A. 555.5 Hz

B. 720 Hz

C. 500 Hz

D. 550 Hz

Answer: B

Watch Video Solution

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

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

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

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

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

Answer: C

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29. The wave described by y $= 0.25\sin(10\pi x - 2\pi t)$ where x and y are in meters and t in seconds , is a wave travelling along the

A. $-x$-direction with amplitude 0.25 m and wavelength $\lambda = 0.2$m

B. $-x$-direction with frequency 1 Hz

C. $+$ x-direction with frequency π Hz and wavelength $\lambda = 0.2m$

D. $+x$-direction with frequency 1 Hz and wavelength $\lambda = 0.2m$

Answer: D

Watch Video Solution

30. Two points are located at a distance of 10 m and 15 m from the source of oscillation. The period fo oscillation is 0.05 s ad the velocity fo the wave is 300 ms^{-1} . What is the phase difference between the oscillations of two points?

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

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

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

D. π

Answer: C

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

A. 12

B. 0

C. 1

D. 6

Answer: D

Watch Video Solution

32. A transerse wave propagating along x-axis is represented by

$y(\times, t) = 8\sin\left(0.5\pi \times -4\pi t - \frac{\pi}{4}\right)$,

where,x is in metre and t is in second, the speed of the wave is

A. $4\pi m/s$

B. $0.5\pi m/s$

C. $\frac{\pi}{4} m/s$

D. $8m/s$

Answer: D

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33. The of reverberation of a room A is 1s. What will be the time (in second) of reverberatio of a room, having all the dimesions double of those of roon A?

A. 2

B. 4

C. $\frac{1}{2}$

D. 1

Answer: A

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34. Which one of the following statements is true ?

A. Both light and sound waves in air are transverse

B. The sound waves in air are longitudinal while the light waves are transverse

C. Both light are sound waves in air are longitudinal

D. Both light and sound waves can travel in vacuum .

Answer: B

Watch Video Solution

35. A point source emits sound equallt in all direction in a non - absoring medium. Two points P and Q are at distance of 2m and 3m repectively from the source. The ratio of the intensities of the waves at P and Q is

A. $9:4$

B. $2:3$

C. $3:2$

D. $4:9$

Answer: A

Watch Video Solution

36. Two vibrating tunign forks produce progessive waves given by

$y_1 = 4\sin 500\pi t$ and $y_2 2\sin 506\pi t.$

Number of beat produced pre minture is .

A. 360

B. 180

C. 3

D. 60

Answer: B

Watch Video Solution

37. 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. 0.57 radian

B. 1.0 radian

C. 1.24 radian

D. 1.57 radian

Answer: B

Watch Video Solution

38. A hospital uses an ultrasonic scanner to locate tumours in a tissue. What is the wavelength of sound in the tissue in which the speed of sound is 1.7 km s^{-1}? The operating frequency of the scanner is 4.2 MHz.

A. $4 \times 10^{-3} m$

B. $8 \times 10^{-3} m$

C. $4 \times 10^{-4} m$

D. $8 \times 10^{-4} m$

Answer: C

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39. Two sound waves having a phase difference of 60° have path difference of

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

B. $\frac{\lambda}{3}$

C. 2λ

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

Answer: A

Watch Video Solution

40. A transverse wave is represented by the equation

$$y = y_0 \sin. \frac{2\pi}{\lambda}(vt - x)$$

For what value of λ, the maximum particle velocity equal to two times the wave velocity?

(A) $\lambda = 2\pi y_0$ (B) $\lambda = \frac{\pi y_0}{3}$ (C) $\lambda = \frac{\pi y_0}{2}$ (D) $\lambda = \pi y_0$

A. $\lambda = \frac{\pi y_0}{2}$

B. $\lambda = \frac{\pi y_0}{3}$

C. $\lambda = 2\pi y_0$

D. $\lambda = \pi y_0$

Answer: D

Watch Video Solution

41. A wave travelling in positive X-direction with A = 0.2 m velocity = 360 m/s and λ = 60 m, then correct expression for the wave is : -

A. $y = 0.2 \sin\left[2\pi\left(6t + \frac{x}{60}\right)\right]$

B. $y = 0.2 \sin\left[\pi\left(6t + \frac{x}{60}\right)\right]$

C. $y = 0.2 \sin\left[2\pi\left(6t - \frac{x}{60}\right)\right]$

D. $y = 0.2 \sin\left[\pi\left(6t - \frac{x}{60}\right)\right]$

Answer: C

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42. The phase difference between two waves represented by $y_1 = 10^{-6} \sin[100t + (x/50) + 0.5]m$, $y_2 = 10^{-6} \cos[100t + (x/50)]m$ where x is expressed in metres and t is expressed in seconds, is approximately

A. 1.07 radian

B. 2.07 radian

C. 0.5 radian

D. 1.5 radian

Answer: A

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43. A wave of frequency 100 Hz is sent along a string towards a fixed end. When this wave travels back after reflection, a node is formed at a distance of 10 cm frome the fixed end of the string. The speed of incident (and reflected) wave are

A. 20 m/s

B. 40 m/s

C. 5 m/s

D. 10 m/s

Answer: A

Watch Video Solution

44. A standing wave having 3 node and 2 antinode is formed between two atoms having a distance 1.21 A between the wavelength of the standing wave is

A. 6.05Å

B. 2.42Å

C. 1.21Å

D. 3.63Å

Answer: C

Watch Video Solution

45. Two waves of wavelength 50 cm and 51 cm produce 12 beat/s . The speed of sound is

A. 340 m/s

B. 331 m/s

C. 306 m/s

D. 360 m/s

Answer: C

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46. Two sound sources emitting sound each of wavelength λ are fixed at a given distance apart. A listener moves with a velocity u along the line joining the two sources. The number of beats heard by him per second is

A. $\frac{2u}{\lambda}$

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

C. $\sqrt{u\lambda}$

D. $\frac{u}{2\lambda}$

Answer: A

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47. Two vibrating tunign forks produce progessive waves given by

$y_1 = 4\sin 500\pi t$ and $y_2 2\sin 506\pi t$.

Number of beat produced pre minture is .

A. 360

B. 180

C. 60

D. 3

Answer: B

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48. A vehical , with a horn of frequency n is moving with a velocity of 30 m/s in a direaction prependicualr to the estaright line joining the ovsercer and the vehicle. The observer perpenives the sound to have a frequency $n + n_1$. Then (If the sound velcoity in air is 300m/s)

A. $n_1 = 0.1n$

B. $n_1 = 0$

C. $n_1 = 10n$

D. $n_1 = -0.1n$

Answer: B

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49. A whistle revolves is a circle with angular velocity w= 20 rad/s using a string of length 50 cm. If the actual frequency of sound from the

whistle is 385 Hz. Then the minimum frequency heard by the observer far away from the centre is (velocity of sound v=340 m/s)

A. 385 Hz

B. 374 Hz

C. 394 Hz

D. 333 Hz

Answer: B

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50. An observer moves towards a stationary source of sound with a speed $\frac{1}{5}$th of the speed of sound. The wavelength and frequency of the source emited are λ and f, respectively. The apparent frequency and wavelength recorded by the observer are, respectively-

(a) $f, 1.2\lambda$ (b) $0.8f, 0.8\lambda$ (c) $1.2f, 1.2\lambda$ (d) $1.2f, \lambda$

A. 1.2f,1.2 lambda

B. $1.2f, \lambda$

C. f,1.2λ

D. 0.8f , 0.8 lambda

Answer: B

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51. A car is moving towards a high cliff. The car driver sounds a horn of frequency f. The realected sound heard by the driver has a frequency 2f. If v be the velocity of sound , then the velocity of the car, in the same velocity units will be

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

B. $\frac{v}{3}$

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

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

Answer: B

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52. 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. 2π

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

C. 3π

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

Answer: B

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53. Which one of the following statements is true ?

A. The sound waves in air are longitudinal while the light waves are transverse

B. Both light and sound waves in air are longitudinal

C. Both light and sound waves can travel in vaccum

D. Both light and sound waves in air are transverse .

Answer: A

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Assignment Section D Assertion Reason Type Questions

1. A : Doppler's effect in sound is asymmetric but in light , it is symmetric

R : In Sound , change in frequency depends on the individual velocity of both the source as well as the observer . In light , change in frequency depends on the relative velocity between source and observer .

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2. A : The propagation of sound in air should be an isothermal process .

R : As air is bad conductor of heat , its temperature does not change by compression or expansion.

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3. A : Velocity of sound in air increased with increase in humidity .

R : Velocity of sound doesn't depend upon medium .

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4. Statement I: Intensity of sound wave changes when the listener moves towards or away from the stationary source.

Statement II: The motion of listener causes the apparent change in wavelength.

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5. Assertion : A vibrating tuning fork sounds louder when its stem is pressed against a desk top.

Reason : When a wave reaches another denser medium, part of the wave is reflected.

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6. A : Longitudinal waves do not exhibit the phenomenon of polarisation .

R : In longitudinal waves medium particle vibrate in direction normal to the wave propagation .

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7. A : If a wave moving in a rarer medium , gets reflected at the boundary of a denser medium , then it encounter a sudden change in phaso or π .

R : If a wave propagating in a denser medium , gets reflected from rarer medium , then there will be no abrupt phase change .

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8. A : Speed of sound in moist air is more than its speed in dry air .

R : Dry air is denser than moist air at atmospheric pressure .

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9. STATEMENT-1 : Sound travels faster in solids as compared to liquids and gases .

STATEMENT-2 : Solids are more elastic than liquids and gases .

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10. A : There is no energy transferred by standing waves .

R : The total energy of each of incident and reflected wave .

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11. A : In Doppler's effect the value of apparent frequency depends on the relative motion between source and observer .

R : The change in frequency in Doppler effect is independent from the distance between source and observer .

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12. A : The pitch of female voice is higher than the pitch of male voice .

R : Pitch distinguishes between a shrill and a grave sound .