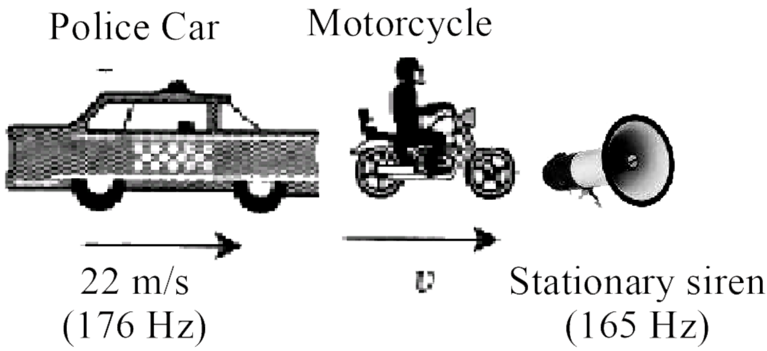
PHYSICS

BOOKS - DISHA PHYSICS (HINGLISH)

WAVES

Physics

1. A police car moving at 22 m/s, chases a motorcylist. The police man sounds his horn at 176 Hz, while both of them move towards a stationary siren of frequency 165 Hz. Calculate the speed of the motorcycle, if it is given that he does not observes any beats



A. 33 m/s

B. 22 m/s

C. Zero

D. 11 m/s

Answer:

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2. A closed organ pipe of length L and an open organ pipe contain gass of densities ρ_1 and ρ_2, respectively. The compressibility of gass are equal in both the pipes. Both the pipes are vibrating in their first overtone with same frequency . The length of the open orange pipe is

(a) $\frac{L}{3}$

$\frac{4l}{3}$

(c) $\frac{4l}{3}\sqrt{\frac{\rho_1}{\rho_2}}$

(d) $\frac{4l}{3}\sqrt{\frac{\rho_2}{\rho_1}}$

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

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

C. $\frac{4L}{3}\sqrt{\frac{\rho_1}{\rho_2}}$

D. $\frac{4L}{3}\sqrt{\frac{\rho_2}{\rho_1}}$

Answer:

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3. Two whistles Aand B produces notes of frequencies 660 Hz and 596 Hz respectively. There is a listener at the mid-point of the line joining them. Now the whistle B and the listener start moving with speed 30 m/s away from the whistle A. If speed of sound be 330 m/s, how many beats will be heard by the listener

A. 2

B. 4

C. 6

D. 8

Answer:

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4. An open pipe is in resonance in $2nd$ harmonic with frequency f_1. Now one end of the tube is closed and frequency is increased to f_2 such that the resonance again ocuurs in nth harmonic. Choose the correct option

A. $n = 3,\ f_2 = \frac{3}{4}f_1$

B. $n = 3,\ f_2 = \frac{5}{4}f_1$

C. $n = 5,\ f_2 = \frac{5}{2}f_1$

D. $n = 5,\ f_2 = \frac{3}{4}f_1$

Answer:

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5. The source producing sound and an observer both are moving along the direction of propagation of sound waves. If the respective velocities of sound, source and an observer are v, v_s and v_0, then the apparent frequency heard by the observer will be (n = frequency of sound)

A. $\dfrac{n(v+v_0)}{v-v_0}$

B. $\dfrac{n(v-v_0)}{v-v_s}$

C. $\dfrac{n(v-v_0)}{v+v_s}$

D. $\dfrac{n(v+v_0)}{v+v_s}$

Answer:

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6. A whistle sends out 256 waves in a second. If the whistle approaches the observer with velocity 1/3 of the velocity of sound in air, the number of waves per second the observer will receive

A. 384

B. 192

C. 300

D. 200

Answer:

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7. A source of sound emitting a note of frequency 200 Hz moves towards an observer with a velocity v equal to the velocity of sound. If the observer also moves away from the source with the same velocity v, the apparent frequency heard by the observer is

A. 50 Hz

B. 100 Hz

C. 150 Hz

D. 200 Hz

Answer:

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8. The speed of sound in air at a given temperature is 350 m/ s. An engine blows whistle at a frequency of 1200 cps. It is approaching the observer with velocity 50 m/s. The apparent frequency in cps heard by the observer will be

A. 600

B. 1050

C. 1400

D. 2400

Answer:

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9. A source of sound of frequency n is moving towards a stationary observer with a speed S. If the speed of sound in air is V and the frequency heard by the observer is n_1 ,the value of n_1 / n is

A. $(V + S) / V$

B. $V / (V + S)$

C. $(V - S) / V$

D. $V / (V - S)$

Answer:

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10. An observer is moving away from source of sound of frequency 100 Hz. His speed is 33 m/s. If speed of sound is 330 m/s, then the observed frequency is

A. 90 Hz

B. 100 Hz

C. 91 Hz

D. 110 Hz

Answer:

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11. A whistle giving out $450H_Z$ approaches a stationary observer at a speed of $33m/s$. The frequency heard the observer (in H_Z) is (speed of sound $= 330 m / s$)

A. 409

B. 429

C. 517

D. 500

Answer:

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12. Two sirens situated one kilometer apart are producing sound of frequency 330 Hz. An observer starts moving from one siren to the other with a speed of $2 m / s$. If the speed of sound be $330m/s$, what will be the beat frequency heard by the observer?

A. 8

B. 4

C. 6

D. 1

Answer:

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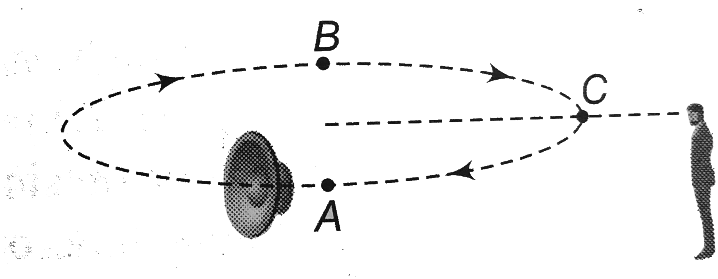
13. 

A small source of sound moves on a circle as shown in the figure and an observer is standing on O. Let n_1,n_2 and n_3 be the frequencies heard when the source is at A, B and C respectively. Then

A. $n_1 > n_2 > n_3$

B. $n_2 > n_3 < n_1$

C. $n_1 = n_2 > n_3$

D. $n_2 > n_1 > n_3$

Answer:

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14. 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. 3

Answer:

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15. A source of sound of frequency 256 Hz is moving towards a wall with a velocity of 5 m/s. How many beats per second will be heard by an observer O standing in such a positoin that the source S is between O and wall? $\left(c = 330\frac{m}{s}\right)$

A. 7.8 Hz

B. 7.7 Hz

C. 3.9 Hz

D. zero

Answer:

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16. The harmonics which are present in a pipe open at one end are

A. odd harmonics

B. even harmonics

C. even as well as odd harmonics

D. None of these

Answer:

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17. A source of sound placed at the open end of a resonance column sends an acoustic wave of pressure amplitude P_0 inside the tube. If the atmospheric pressure is P_A, then the ratio of maximum and minimum pressure at the closed end of the tube will be

A. $\dfrac{(P_A + P_0)}{(P_A - P_0)}$

B. $\dfrac{(P_A + 2P_0)}{(P_A - 2P_0)}$

C. $\dfrac{P_A}{P_A}$

D. $\dfrac{\left(P_A + \frac{1}{2}P_0\right)}{\left(P_A - \frac{1}{2}P_0\right)}$

Answer:

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18. The frequency of fundamental tone in an open organ pipe of length 0.48 m is 320 Hz. Speed of sound is 320 m/sec. Frequency of fundamental tone in closed organ pipe will be

A. 153.8 Hz

B. 160.0 Hz

C. 320.0 Hz

D. 143.2 Hz

Answer:

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19. A standing wave having 3 nodes and 2 antinodes is formed between two atoms having a distance 1.21Å between them. The wavelength of the standing wave is

A. 1.21 Å

B. 2.42 Å

C. 6.05 Å

D. 3.63 Å

Answer:

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20. A string on a musical instrument is 50 cm long and its fundamental frequency is 270 Hz. If the desired frequency of 1000 Hz, is to be produced, the required length of the string is

A. 13.5 cm

B. 2.7 cm

C. 5.4 cm

D. 10.3 cm

Answer:

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21. The loudness and the pitch of a sound depends on

A. intensity and velocity

B. frequency and velocity

C. intensity and frequency

D. frequency and number of harmonics

Answer:

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22. If in an experiment for determination of velocity of sound by resonance tube method using a tuning fork of $512Hz$, first resonance was observed at$30.7cm$ and second was obtained at $63.2cm$, then maximum possible error in velocity of sound is (consider actual speed of sound in air is `332m//s

A. 204 cm/sec

B. 110 cm/sec

C. 58 cm/sec

D. 80 cm/sec

Answer:

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23. You are given four tuning forks, the lowest frequency of the fork is 300Hz. By striking two tuning forks at a time any of 1, 2, 3, 5, 7 & 8 Hz beat frequencies are heard. The possible frequencies of the other three forks –

(1) 301, 302 & 307

(2) 301, 303 & 308

(3) 300, 304 & 307

(4) 305, 307 & 308

A. 1,2 and 3 are correct

B. 1 and 2 are correct

C. 2 and 4 are correct

D. 1 and 3 are correct

Answer:

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24. Doppler shift in frequency depends upon

(1) the frequency of the wave produced

(2) the velocity of the source

(3) the velocity of the observer

(4) distance from the source to the listener

A. 1,2 and 3 are correct

B. 1 and 2 are correct

C. 2 and 4 are correct

D. 1 and 3 are correct

Answer:

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25. The (x, y) co-ordinates of the corners of a square plate are $(0, 0)$, (L, L) and $(0, L)$. The edges of the plate are clamped and transverse standing waves are set up in it. If $u(x, y)$ denotes the displacement of the plate at the point (x, y) at some instant of time, the possible expression (s) for u is (are) $(a = positivecons\tan t)$

A. 1,2 and 3 are correct

B. 1 and 2 are correct

C. 2 and 4 are correct

D. 1 and 3 are correct

Answer:

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26. A plate was cut from a quartz crystal and is used to control the frequency of an oscillating electrical circuit. Longitudinal standing waves are set up in the plate with displacement antinodes at opposite faces. The fundamental frequency of vibration is given by the equation $f_0 = \frac{2.87 \times 10^4}{s}$ .Here s is thickness of the plate and density of quartz is $2658.76 kg / m^3$

Young's modulus of elasticity for quartz is –

A. $7 \times 10^{11} N / m^2$

B. $8.76 \times 10^{12} N / m^2$

C. $2 \times 10^{12} N / m^2$

D. Information insufficient

Answer:

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27. A plate was cut from a quartz crystal and is used to control the frequency of an oscillating electrical circuit. Longitudinal standing waves are set up in the plate with displacement antinodes at opposite faces. The fundamental frequency of vibration is given by the equation $f_0 = \frac{2.87 \times 10^4}{s}$ .Here s is thickness of the plate and density of quartz is $2658.76 kg / m^3$

If the quartz plate is vibrating in 3rd harmonic while measuring the frequency of 1.2×10^6 Hz, then the thickness of the plateis

A. 71.75 cm

B. 7.175 cm

C. 6.02 cm

D. 0.07 cm

Answer:

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28. Statement-1 : Beats cannot be produced by light sources.

Statement-2: Light sources have constant phase difference

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 False, Statement-2 is True

D. Statement-1 is True, Statement-2 is True , Statement-2 is a correct explanation for Statement-1

Answer:

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29. Assertion : In the case of a stationary wave, a person hear a loud sound at the nodes as compared to the particles of the medium vibrate in phases. Reason: in a stationary wave all particles of the medium vibrate in a phase

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

B. Statement-1 is True, Statement-2 is True , Statement-2 is NOT a correct explanation for Statement-2

C. Statement-1 is False, Statement-2 is True

D. Statement-1 is True, Statement-2 is True , Statement-2 is a correct explanation for Statement-2

Answer:

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30. Assertion : Velocity of particles, while crossing mean position (in stationary waves) varies from maximum at antinodes to zero at nodes.Reason:Amplitude of vibration is maximum at antinodes and at nodes amplitude is zero and all the particles between two successive nodes across the mean position together.

A. Statement-1 is True, Statement-2 is True , Statement-2 is a correct explanation for Statement-3

B. Statement-1 is True, Statement-2 is True , Statement-2 is NOT a correct explanation for Statement-3

C. Statement-1 is False, Statement-2 is True

D. Statement-1 is True, Statement-2 is True , Statement-2 is a correct explanation for Statement-3

Answer:

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31. A tuning fork makes 256 vibrations per second in air. When the speed of sound is $330m/s$, the wavelength of the note emitted is :

A. 0.56 m

B. 0.89 m

C. 1.11 m

D. 1.29 m

Answer:

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32. In a sinusoidal wave the time required for a particular point to move from equilibrium position to maximum displacement is $0.17s$, then the frequency of wave is:

A. 1.47 Hz

B. 0.36 Hz

C. 0.73 Hz

D. 2.94 Hz

Answer:

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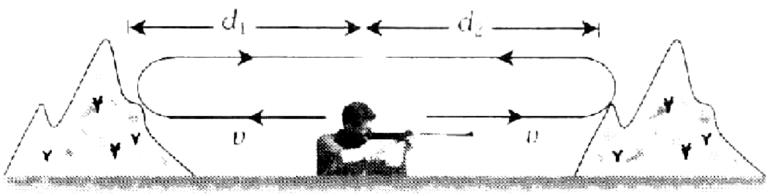
33. A man is standing between two parallel cliffs and fires a gun. If he hears first and second echoes after 1.5 s and 3.5s respectively, the distance between the cliffs is (Velocity of sound in air $= 340 ms^{-1}$)



A. 1190 m

B. 850 m

C. 595 m

D. 510 m

Answer:

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34. The velocities of sound at same temperature in two monoatomic gases densities ρ_1 and ρ_2 are v_1 and v_2 repectively , if $\frac{\rho_1}{\rho_2} = 4$, then the value of $\frac{v_1}{v_2}$ will be

A. $1:2$

B. $4:1$

C. $2:1$

D. $1:4$

Answer:

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35. A wave of frequency 500 Hz has velocity 360 m/sec. The distance between two nearest points 60° out of phase, is

A. 0.6 cm

B. 12 cm

C. 60 cm

D. 120 cm

Answer:

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36. Two waves are given by$y_1 = a\sin(\omega t - kx)$ and $y_2 = a\cos(\omega t - kx)$. The phase difference between the two waves is

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

B. π

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

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

Answer:

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37. The relation between time and displacement for two particles is given by

$y = 0.06 \sin 2\pi(0.04t + \phi_1),\, y_2 = 0.03 \sin 2\pi(1.04t + \phi_2)$

The ratio of the intensities of the waves produced by the vibrations of the two particles will be

A. $2:1$

B. $1:2$

C. $4:1$

D. $1:4$

Answer:

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38. A travelling wave is described by the equation $y = y_0 \sin\left(\left(ft - \frac{x}{\lambda}\right)\right)$. The maximum particle velocity is equal to four times the wave velocity if

A. $\lambda = \frac{\pi Y_0}{4}$

B. $\lambda = \frac{\pi Y_0}{2}$

C. $\lambda = \pi Y_0$

D. $\lambda = 2\pi Y_0$

Answer:

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39. Which one of the following does not represent a travelling wave?

A. $y = \sin(x - vt)$

B. $y = y_m \sin k(x + vt)$

C. $y = y_m \log (x - vt)$

D. $y = f(x^2 - vt^2)$

Answer:

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40. The path difference between the two waves

$$y_1 = a_1 \sin\left(\omega t - \frac{2\pi x}{\lambda}\right) \text{ and } y(2) = a_2 \cos\left(\omega t - \frac{2\pi x}{\lambda} + \phi\right)$$

is

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

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

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

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

Answer:

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41. 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. $\lambda = (\pi y_0 / 3$

C. $\lambda = \pi y_0 / 2$

D. $\lambda = \pi y_0$

Answer:

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42. The equation of a plane progressive wave is given by $y = 0.025\sin(100t + 0.25x)$.The frequency of this wave would be

A. $\frac{50}{\pi}Hz$

B. $\frac{100}{\pi}Hz$

C. 100 Hz

D. 50 Hz

Answer:

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43. A wave travelling in positive X-direction with $A = 0.2m$ has a velocity of $360m/\sec$ if $\lambda = 60m$, then correct exression for the wave is

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

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:

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44. The equation of a wave is given as $y = 0.07\sin(12\pi x - 3000\pi t)$. . where xis in metre and t in sec, then the correct statement is

A. $\lambda = 1/6m, v = 250m/s$

B. $a = 0.07m, v = 300m/s$

C. $n = 1500, v = 200m/s$

D. None

Answer:

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45. The equation of a progressive wave is given by $y = 0.5\sin(20x - 400t)$ where xand y are in metre and tis in second. The velocity of the wave is

A. 10 m/s

B. 20 m/s

C. 200 m/s

D. 400 m/s

Answer:

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46. There is a destructive interference between the two waves of wavelength λ coming from two different paths at a point. To get maximum sound or constructive interference at that point, the path of one wave is to be increased by

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

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

C. $\frac{3\lambda}{4}$

D. λ

Answer:

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47. If two waves of same frequency and same amplitude superimpose and produce third wave of same amplitude, then waves differ in phase by –

A. π

B. $2\pi/3$

C. $\pi/2$

D. zero

Answer:

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48. Equation of motion in the same direction is given by $y_1 = A\sin(\omega t - kx)$,$y_2 = A\sin(\omega t - kx - \theta)$. The amplitude of the medium particle will be

A. $2A\cos\frac{\theta}{2}$

B. $2A\cos\theta$

C. $\sqrt{2}A\cos.\ \frac{\theta}{2}$

D. $\sqrt{2}A\cos\theta$

Answer:

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49. The amplitude of a wave represented by displacement equation $y = \frac{1}{\sqrt{a}} \sin \omega \pm \frac{1}{\sqrt{b}} \cos \omega t$ will be

A. $\frac{a+b}{ab}$

B. $\frac{\sqrt{a}+\sqrt{b}}{ab}$

C. $\frac{\sqrt{a} \pm \sqrt{b}}{ab}$

D. $\sqrt{\frac{a+b}{ab}}$

Answer:

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50. The displacement of a wave disturbance propagating in the positive x-direction is given by

$y = \frac{1}{1+x^2}$ at $t = 0$ and $y = \frac{1}{1+(x-1)^2}$ at $t = 2s$

where, x and y are in meter. The shape of the wave disturbance does not change during the propagation. what is the velocity of the wave?

A. 0.5

B. 1

C. 2

D. 4

Answer:

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51. P, Q and R are three particles of a medium which lie on the x-axis. A sine wave of wavelength λ is travelling through the medium in the x-direction. P and Q always have the same speed, while P and R always have the same velocity.

The minimum distance between –

(1) P and Q is λ

(2) P and Q is $\lambda/2$

(3) P and R is $\lambda/2$

(4) P and R is λ

A. 1, 2 and 3 are correct

B. 1 and 2 are correct

C.) 2 and 4 are correct

D. 1 and 3 are correct

Answer:

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52. A wave represented by the given equation $Y = A\sin\left(10\pi x + 15\pi t + \frac{\pi}{3}\right)$, where x is in meter and t is in second. The expression represents

(1) A wave travelling in the negative X direction with a velocity of 1.5 m/sec

(2) A wave travelling in the negative X direction with a wavelength of 0.2 m

(3) A wave travelling in the positive X direction with a velocity of 1.5 m/sec.

(4) A wave travelling in the positive X direction with a wavelength of 0.2 m

A. 1, 2 and 3 are correct

B. 2 and 2 are correct

C.) 2 and 4 are correct

D. 2 and 3 are correct

Answer:

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53. It is usually more convenient to describe a sound wave in terms of pressure wave as compared to displacement wave because –

(1) Two waves of same intensity but different frequencies have different displacement amplitude but same pressure amplitude

(2) The human ear responds to the change in pressure and not to the displacement wave.

(3) The electronic detector (microphone) does respond to the change in pressure but not to the displacement.

(4) None of the above

A. 1, 2 and 3 are correct

B. 3 and 2 are correct

C.) 2 and 4 are correct

D. 3 and 3 are correct

Answer:

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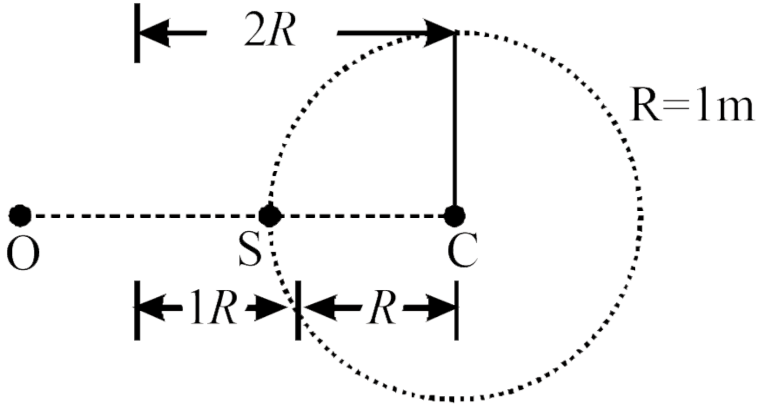
54. Sound from a point isotropic source spreads equally in all directions in homogeneous medium. Therefore its intensity decreases with square of distance from the source. When distance between observer and the source changes, apart from changes in intensity, the observer listens sound of pitch higher or lower than actual pitch depending upon the fact that the distance between the observer and source is decreasing or increasing respectively. An observer O is at a distance 2R from centre of a circle of radius R. A point isotropic sound source S moves on the circle with uniform angular velocity$\omega = \pi/3\ \mathrm{rad}/s$. Initially observer, source and centre of the circle are in same line.



Starting from initial moment, the source moves through an angular displacement 180°. Intensity of the sound as observed by the observer decreases by a factor of –

A. 2

B. 3

C. 4

D. 9

Answer:

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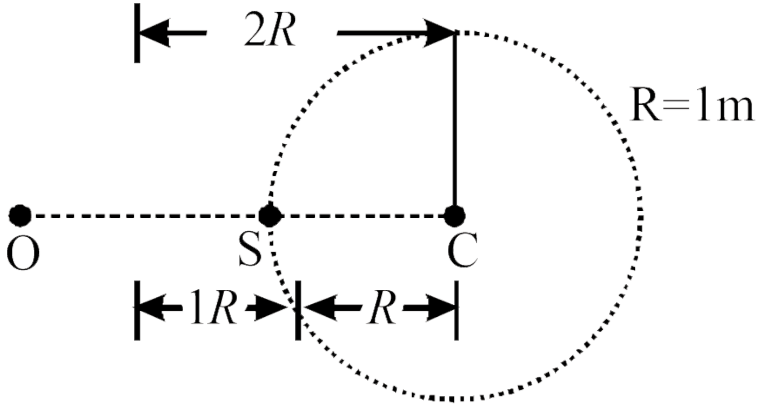
55. Sound from a point isotropic source spreads equally in all directions in homogeneous medium. Therefore its intensity decreases with square of distance from the source. When distance between observer and the source changes, apart from changes in intensity, the observer listens sound of pitch higher or lower than actual pitch depending upon the fact that the distance between the observer and source is decreasing or increasing respectively. An observer O is at a distance 2R from centre of a circle of radius R. A point isotropic sound source S moves on the circle with uniform angular velocity$\omega = \pi / 3 \ \mathrm{rad} / s$. Initially observer, source and centre of the circle are in same line.



During a complete round trip of star on the circle, the observer listens a sound, whose –

A. wavelength first decreases to a maximum value then increases to the original value

B. wavelength first increases to a maximum value then decreases to the original value

C. During the first half time wavelength increases then decreases to the original value

D. None of the above is correct because in Doppler's effect, it is the pitch of sound which changes and not its wavelength, irrespective of motion of source or observer.

Answer:

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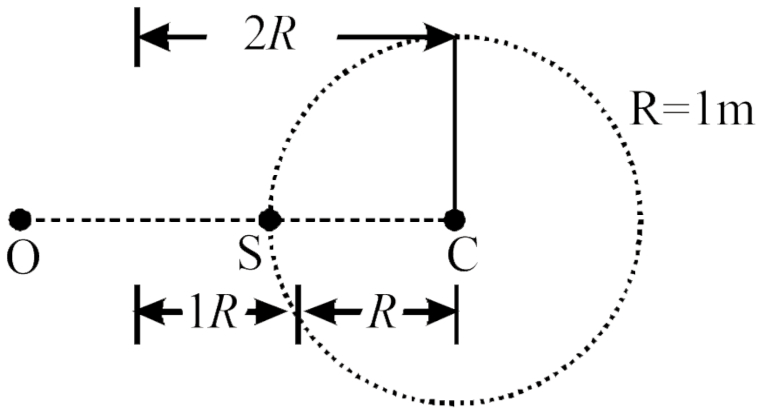
56. Sound from a point isotropic source spreads equally in all directions in homogeneous medium. Therefore its intensity decreases with square of distance from the source. When distance between observer and the source changes, apart from changes in intensity, the observer listens sound of pitch higher or lower than actual pitch depending upon the fact that the distance between the observer and source is decreasing or increasing respectively. An observer O is at a distance 2R from centre of a circle of radius R. A point isotropic sound source S moves on the circle with uniform angular velocity$\omega = \pi / 3 \ \mathrm{rad} / s$. Initially observer, source and centre of the circle are in same line.



Sound emitted by the source at two successive instants t_1 and t_2 has minimum and maximum observed pitch respectively, then –

A. $t_1 = 1s, t_2 = 5s$

B. $t_1 = 5s, t_2 = 7s$

C. $t_1 = 7s, t_2 = 11s$

D. $t_1 = 5s, t_2 = 11s$

Answer:

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57. Statement-1 : Particle velocity and wave velocity both are independent of time.

Statement-2 : For the propagation of wave motion, the medium must have the properties of elasticity and inertia.

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 False, Statement-2 is True.

D. Statement -1 is True, Statement-2 is False.

Answer:

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58. Statement-1 : Speed of wave $\frac{\text{Wavelength}}{\text{Time period}}$

Statement-2 : Wavelength is the distance between two nearest particles vibrating in 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 False, Statement-2 is True.

D. Statement -1 is True, Statement-2 is False.

Answer:

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59. Assertion: Transverse waves are not produced in liquids and gases.

Reason: Light waves are transverse waves.

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 False, Statement-2 is True.

D. Statement -1 is True, Statement-2 is False.

Answer:

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