PHYSICS

BOOKS - SARAS PUBLICATION

OSCILLATIONS AND WAVES

Example

1. The phase difference between the instantaneous velocity & acceleration of a particle executing simple harmonic motion is

A. zero

B. 0.5π

C. π

D. 0.707π

Answer:

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2. A particle executing simple harmonic motion has a kinetic energy $K_o \cos^2 \omega t$. The maximum values of the potential energy and the total energy are, respectively.....

A. K_0 and $2K_0$

B. 0 and $2K_0$

C. $\frac{K_0}{2}$ and K_0

D. K_0 and K_0

Answer:

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3. A partical executes simple harmonic oscillation with an amplitude a. the period of oscillation is T The minimum time taken by the partical to travel half of the amplitude from the equilibrium position is:

A. $T/2$

B. $T/4$

C. $T/8$

D. $T/12$

Answer:

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4. Two simple harmonic motions of angular frequencies 100 and 1000 rad/s have the same displacement amplitude. The ratio of their maximum acceleration is.....

A. $1:10$

B. $1:10^2$

C. $1:10^3$

D. 1:10^4`

Answer:

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5. Two periodic waves of intensities I_1 and I_2 pass through a region at the same time in the same direction. The sum of the maximum and minimum intensities is :

A. $I_1 + I_2$

B. $\left(\sqrt{I}_1 + \sqrt{I}_2\right)^2$

C. $\left(\sqrt{I}_1 - \sqrt{I}_2\right)^2$

D. $2(I_1 + I_2)$

Answer:

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6. A point performs simple harmonic oscillation of period T and the equation of motion is given by x = $a \sin\left(wt + \frac{\pi}{6}\right)$.

After the elapse of what fraction of the time period the velocity of the point will be equal to half of its maximum velocity ?

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

B. $\frac{T}{6}$

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

D. $\frac{T}{12}$

Answer:

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7. Two points are located at a distance of 10 m and 15 m from the source of oscillation. The period of oscillation is 0.05 sec

and the velocity of the wave is $300m/s$. What is the phase difference between the oscillation of two points?

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

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

C. π

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

Answer:

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

A. $-vexdirectionwithequency1Hz$

B. $+vexdirectionwithequency$pi Hz and $wave \leq n > h$

lambda=0.2m`

C. $+vexdirectionwithequency1Hz$ and $wave \leq n > h$

lambda=0.2m`

D.

$-vexdirectionwithamplitude0.25m$ and $wave \leq n > h$

lambda=0.2m`

Answer:

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9. A simple pendulum performs simple harmonic motion about $x = 0$ with an amplitude and time period T. The speed of the pendulum at $x = \frac{a}{2}$ will be:

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

B. $\frac{3\pi^2 a}{T}$

C. $\frac{\pi a\sqrt{3}}{T}$

D. $\frac{\pi a\sqrt{3}}{2}T$

Answer:

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10. The displacement of a particle along the x-axis is given by $x = a\sin^2\omega t$. The motion of the particle corresponds to

A. simple harmonic motion of frequency ω/π

B. simple harmonic motion of frequency $3\omega/2\pi$

C. non simple harmonic motion

D. simple harmonic motion of frequency $\omega/2\pi$

Answer:

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11. The period of oscillation of a mass m suspended from a spring of negligible mass is T. If along with it another mass M is also suspended the period of oscillation will now be:

A. T

B. $T/\sqrt{2}$

C. $2T$

D. $\sqrt{2}T$

Answer:

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

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

B. πA

C. $2\pi A$

D. A

Answer:

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

A. $510Hz$

B. $514Hz$

C. $516Hz$

D. $508Hz$

Answer:

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

A. Decreases by a factor 20

B. Decreases by a factor 10

C. Increases by a factor 20

D. Increases by a factor 10

Answer:

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

A. $v = v_1 + v_2 + v_3$

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

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

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

Answer:

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16. The damping force on an oscillator is directly proportional to the velocity . The units of the constant of proportionality are

A. $kgms^{-2}$

B. kgs^{-1}

C. kgs

D. $kgms^{-2}$

Answer:

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17. Two sources P and Q produce notes of frequency 660 Hz each. A listener moves from P to Q with a speed of $1ms^{-1}$. If

the speed of sound is $330m/s$, then the number of beats heard by the listener per second willl be

A. zero

B. 4

C. 8

D. 2

Answer:

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

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

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

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

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

Answer:

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19. If we study the vibration of a pipe open at both ends, then which of the following statement is not true?

A. Open end will be anti-node

B. Odd harmonics of the fundamental frequency will be generated

C. All harmonics of the fundamental frequency will be generated

D. Pressure change will be maximum at both ends

Answer:

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

A. $254 Hz$

B. $246 Hz$

C. $240Hz$

D. $260Hz$

Answer:

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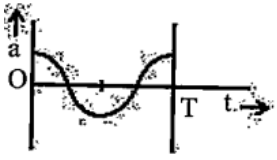
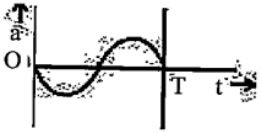
21. The oscillation of a body on a smooth horizontal surface is represented by the equation, X = A cos (ωt) where X = displacement at time t `omega = frequency of oscillation Which one of the following graphs shows correctly the variation a with it?

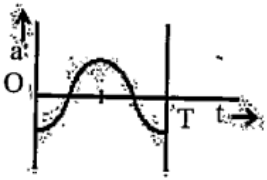
A.



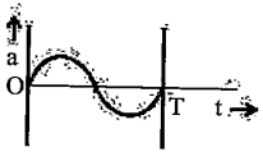
B.



C.



D.



Answer:

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22. A solid cylinder of mass 50 kg and radius 0.5 m is free to rotate about the horizontal axis. A massless string is wound round the cylinder with one end attached to it and other hanging freely. Tension in the string required to produce an angular acceleratrion of 2 revolutions s^{-2} is

A. $25N$

B. $50N$

C. $78.5N$

D. $157N$

Answer:

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23. If n_1, n_2 and n_3 are the fundamental frequency of three segemnts into which a string is divided, then the original fundamental frequency n of the string is given by

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

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

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

D. $n = n_1 + n_2 + n_3$

Answer:

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24. The number of possible natural oscillations of air column in a pipe closed at one end of length 85 cm whose

frequencies lie below 1250 Hz are (velocity of sound = $340ms^{-1}$)

A. 4

B. 5

C. 7

D. 6

Answer:

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25. When two displacement represented by $y_1 = a\sin t(\omega t)$ and $y_2 = b\cos t(\omega t)$ are superimposed the motion is

A. simple harmonic with amplitude $\frac{a}{b}$

B. simple harmonic with amplitude $\sqrt{a^2+b^2}$

C. simple harmonic with amplitude $\frac{a+b}{2}$

D. not a simple harmonic

Answer:

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26. For a parallel beam of monochromatic light of wavelength λ diffraction is produced by a single slit whose width 'a' is of the order of the wavelength of the light. If 'D' is the distance of the screen from the slit, the width of the central maxima will be:

A. $\frac{D\lambda}{a}$

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

C. $\frac{2Da}{\lambda}$

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

Answer:

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

A. $100cm$

B. $120cm$

C. $140cm$

D. $80cm$

Answer:

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28. A particle is executing SHM along a straight line. Its velocities at dsitances x_1 and x_2 from the mean position are V_1 and V_2, respectively. Its time period is

A. $2\pi\sqrt{\dfrac{x_2^2 - x_1^2}{V_1^2 - V_2^2}}$

B. $2\pi\sqrt{\dfrac{V_1^2 - V_2^2}{x_1^2 - x_2^2}}$

C. $2\pi\sqrt{\dfrac{V_1^2 - V_2^2}{x_1^2 - x_2^2}}$

D. $2\pi\sqrt{\dfrac{x_1^2 - x_2^2}{V_1^2 - V_2^2}}$

Answer:

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29. Two similar springs p and Q have spring constants Kp and kQ, such that Kp>KQ. The are stretched, first by the same amount (case a), then by the same force (case b). The work done by the springs Wp and WQ are related as, in case (a) and case (b), respectively:

A. $W_P > W_Q$, W_Q gt W_P`

B. $W_P = W_Q, W_Q > W_P$

C. $W_P = W_Q, W_Q < W_P$

D. $W_P = W_Q, W_P > W_Q$

Answer:

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30. In the spectrum of hydrogen, the ratio of the longest wavelength in the Lyman series to the longest wavelength in the Balmer series is

A. $\frac{5}{27}$

B. $\frac{4}{9}$

C. $\frac{9}{4}$

D. $\frac{27}{5}$

Answer:

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31. A partcile is executing a simple harmonic motion.Its maximum acceleration is α and maximum velocity is β. Then, its time periods of vibartion will be

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

B. $\frac{\beta^2}{\alpha^2}$

C. $\frac{\alpha}{\beta}$

D. $\frac{\beta^2}{\alpha}$

Answer:

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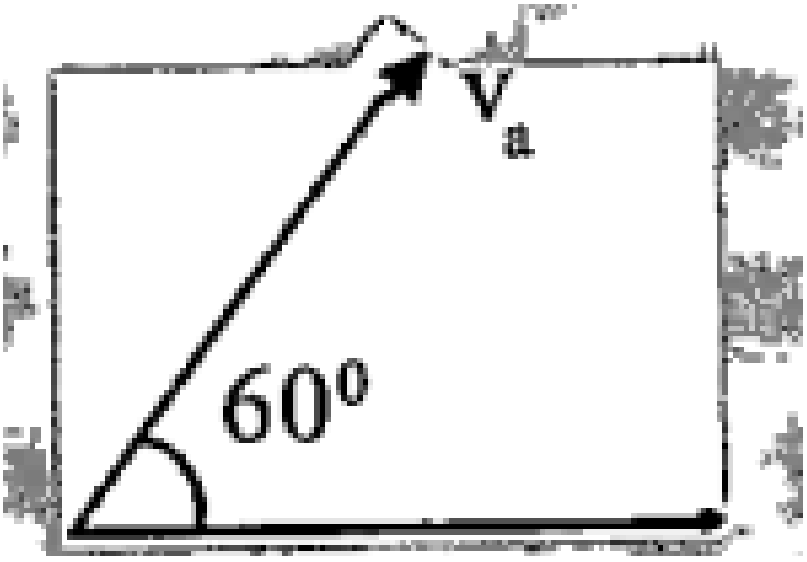
32. A source od sound S emitting waves of frequency 100 Hz and an observer o are located at some distance from each other. The source is moving with a speed of $19.4ms^{-1}$ at an angle of 60° with the source observe line as shwon in the figure. The observer is at rest. The apparent frequency observed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



A. $97Hz$

B. $100Hz$

C. $103Hz$

D. $106Hz$

Answer:

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33. A string is stretched between fixed points separated by 75.0 cm. It is obsereved to have resonant frequencies of 420 Hz and 315 Hz. They are no other resonant frequencies between these two. The lowest resonant frequencies for this string is

A. $105Hz$

B. $155Hz$

C. $205Hz$

D. $10.5Hz$

Answer:

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34. A body of mass m is attached to lower end of a spring whose upper end is fixed. The spring has negligible mass. When the mass m is slightly pulled down and released, it oscillates with a time period of 3s. When the mass m is increased by 1 kg, the time period of oscillations becomes 5s. Find the value of m is kg.

A. $\frac{16}{9}$

B. $\frac{9}{16}$

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

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

Answer:

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

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

B. $4L$

C. L

D. $2L$

Answer:

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36. 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. 3

B. 2

C. 1

D. 4

Answer:

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37. A siren emitting a sound of frequency 800 Hz moves away from an observer towards a cliff at a speed of $15ms^{-1}$ Then , the frequency of sound that the observer hears in the echo reflected from the cliff is:

A. $885Hz$

B. $765Hz$

C. $800Hz$

D. $838Hz$

Answer:

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38. An air column, closed at one end and open at the other resonates with a tuning fork when the smallest length of the cloumn is 50 cm. The next larger length of the column resonating with the same tuning frok is:

A. $200cm$

B. $66.7cm$

C. $100cm$

D. $150cm$

Answer:

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

A. $20Hz$

B. $30Hz$

C. $40Hz$

D. $10Hz$

Answer:

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40. A particle executes linear simple harmonic motion with an amplitude of 3 cm. When the particle is at 2 cm from the

mean position, the magnitude of its velocity is equal to that of its acceleration. Then find its time period in seconds.

A. $\frac{\sqrt{5}}{2\pi}$

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

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

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

Answer:

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