PHYSICS

BOOKS - NEET PREVIOUS YEAR (YEARWISE + CHAPTERWISE)

OSCILLATIONS

Exercise

1. A particle executes linear simple harmonic motion with an amplitude of $3cm$. When the

particle is at $2cm$ from the mean position, the magnitude of its velocity is equal to that of its acceleration. Then, its time period in seconds is

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

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

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

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

Answer: C

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2. A body of mass m is attached to the 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 $1kg$, the time period of oscillations becomes 5s. The value of m in kg is

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

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

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

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

Answer: D

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

A. not a simple harmonic

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

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

D. simple harmonic with amplitude $\frac{(a^2 + b^2)}{2}$

Answer: C

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4. A particle is executing SHM along a straight line. Its velocities at distances x_1 and x_2 from

the mean position are v_1 and v_2, respectively.

Its time period is

A. $2\pi\sqrt{\frac{x_1^2+x_2^2}{v_1^2+v_2^2}}$

B. $2\pi\sqrt{\frac{x_2^2-x_1^2}{v_1^2-v_2^2}}$

C. $2\pi\sqrt{\frac{v_1^2+v_2^2}{x_1^2+x_2^2}}$

D. $2\pi\sqrt{\frac{v_1^2-v_2^2}{x_1^2-x_2^2}}$

Answer: B

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5. A particle is executing a simple harmonic motion. Its maximum acceleration is α and maximum velocity is β. Then, its time period of vibration will be

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

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

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

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

Answer: D

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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. $100cm$

B. $150cm$

C. $200cm$

D. $66.7cm$

Answer: B

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7. 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

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8. The oscillation of a body on a smooth horizontal surface is represented by the equation,

$X = A\cos(\omega t)$

where, X = displacement at time t

$\omega =$ frequency of oscillation

Which one of the following graphs shows correctly the variation a with t?

Here, a = acceleration at time t

T = time period

A. 

B. 

C. 

D. 

Answer: C

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

A. $kgms^{-1}$

B. $kgms^{-2}$

C. kgs^{-1}

D. kgs

Answer: C

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10. Out of the following functions representing motion of a particle which represents SHM

I. $y = \sin \omega t - \cos \omega t$

II. $y = \sin^3 \omega t$

III. $y = 5 \cos \left(\frac{3\pi}{4} - 3\omega t \right)$

IV. $y = 1 + \omega t + \omega^2 t^2$

A. Only (IV) does not represent SHM

B. (I) and (II)

C. (I) and (III)

D. Only (I)

Answer: B

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11. The displacement of a particle along the x-axis it 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 of frequency $3\omega/2\pi$

C. non-simple harmonic motion

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

Answer: C

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12. The period of oscillation of 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: D

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13. Which one of the following equations of motion represents simple harmonic motion ?

A. Acceleration $= -k_0 x + k_1 x^2$

B. Acceleration $= -k(x + a)$

C. Acceleration $= k(x + a)$

D. Acceleration $= kx$

Answer: B

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

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

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

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

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

Answer: D

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15. Two simple harmonic motions of angular frequency $100 rads^{-1}$ and $1000 rads^{-1}$ have

the same displacement amplitude. The ratio of their maximum accelerations is

A. $1:10$

B. $1:10^2$

C. $1:10^3$

D. $1:10^4$

Answer: B

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

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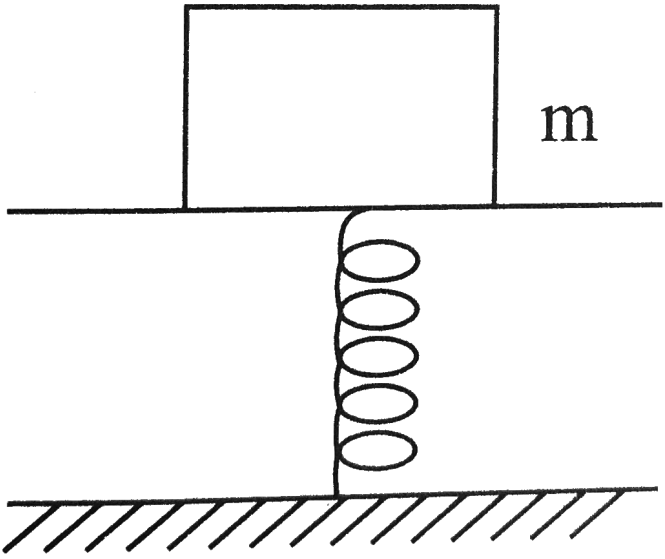
17. A mass of $2.0kg$is put on a that pan attached to a vertical spring fixed on the ground as shown in the figure The mass of the spring and the pen is negligible the mass executing a simple harmonic motion The spring constant is $200N/m$ what should be the minimum amplitude of the motion so that the mass get detached from the pan?

$(Tak \in gg = 10m/s^2)$



A. $8.0cm$

B. $10.0cm$

C. Any value less than $12.0cm$

D. $4.0cm$

Answer: B

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18. The particle executing simple harmonic motion has a kinetic energy $K_0 \cos^2 \omega t$. The maximum values of the potential energy and the energy are respectively

A. 0 and $2K_0$

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

C. K_0 and $2K_0$

D. K_0 and K_0

Answer: D

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

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

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

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

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

Answer: C

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20. A rectangular block of mass m and area of cross-section A floats in a liquid of density ρ. If it is given a small vertical displacement from

equilibrium, it undergoes oscillation with a time period T. Then

A. $T \propto \sqrt{\rho}$

B. $T \propto \frac{1}{\sqrt{A}}$

C. $T \propto \frac{1}{\rho}$

D. $T \propto \frac{1}{\sqrt{m}}$

Answer: B

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21. A particle executing simple harmonic motion of amplitude $5cm$ has maximum speed of $3.14cm/s$. The frequency of its oscillation is

A. $3Hz$

B. $2Hz$

C. $4Hz$

D. $1Hz$

Answer: D

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22. Two springs of spring constants K_1 and K_2 are joined in series. The effective spring constant of the combination is given by

A. $\sqrt{k_1 k_2}$

B. $\frac{(k_1 + k_2)}{2}$

C. $k_1 + k_2$

D. $\frac{k_1 k_2}{(k_1 + k_2)}$

Answer: D

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23. Which one of the following statement is true for the speed v and the acceleration a of a particle executing simple harmonic motion?

A. When v is maximum, α is maximum

B. Value of α is zero, whatever may be the value of v

C. When v is zero, α is zero

D. When v is maximum, α is zero

Answer: D

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24. The potential energy of a harmonic oscillation when is half way to its and end point is (where E it's the total energy)

A. $\frac{1}{4}E$

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

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

D. $\frac{1}{8}E$

Answer: A

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25. A particle of mass m oscillates with simple harmonic motion between points x_1 and x_2, the equilibrium position being O. Its potential energy is plotted. It will be as given below in the graph

A. 

B. 

C. 

D. 

Answer: C

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26. Displacement between maximum potential energy position energy potential and maximum kinetic energy position for a particle executing $S.H.M$ is

A. $\pm \frac{a}{2}$

B. $\pm a$

C. $\pm 2a$

D. ± 1

Answer: B

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27. When a dampled harmonic oscillator completes 100 oscillations, its amplitude is reduced to $\frac{1}{3}$ of its initial value. When will be its amplitude when it completes 200 oscillations?

A. $\frac{1}{5}$

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

C. $\frac{1}{6}$

D. $\frac{1}{9}$

Answer: D

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28. A mass is suspended separately by two springs of spring constants k_1 and k_2 in successive order. The time periods of oscillations in the two cases are T_1 and T_2

respectively. If the same mass be suspended by connecting the two springs in parallel, (as shown in figure) then the time period of oscillations is T. The correct relations is

A. $T^2 = T_1^2 + T_2^2$

B. $T^{-2} = T_1^{-2} + T_2^{-2}$

C. $T^{-1} = T_1^{-1} + T_2^{-1}$

D. $T = T_1 + T_2$

Answer: B

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29. In SHM restoring force is $F = -kx$, where k is force constant, x is displacement and a is amplitude of motion, then total energy depends upon

A. k, a and m

B. k, x,m

C. k, a

D. k,x

Answer: C

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30. Two simple harmonic motions given by, $x = a\sin(\omega t + \delta)$ and $y = a\sin\left(\omega t + \delta + \frac{\pi}{2}\right)$ act on a particle will be

A. circular anti-clockwise

B. circular clockwise

C. elliptical anti-clockwise

D. elliptical clockwise

Answer: B

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31. A pendulum is displaced to an angle θ from its equilibrium position, then it will pass through its mean position with a velocity v equal to

A. $\sqrt{2gl}$

B. $\sqrt{2gl\sin\theta}$

C. $\sqrt{2gl\cos\theta}$

D. $\sqrt{2gl(1-\cos\theta)}$

Answer: D

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32. The time period of a simple pendulum is 2s. It its length is increased by 4 times, then its period becomes

A. $16s$

B. $12s$

C. $8s$

D. $4s$

Answer: D

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33. A mass m is vertically suspended from a spring of negligible mass, the system oscillates with a frequency n. what will be the

frequency of the system, if a mass $4m$ is suspended from the same spring?

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

B. $4n$

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

D. $2n$

Answer: C

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34. Two simple pendulums of length 0.5 m and 20 m respectively are given small linear displacement in one direction at the same time. They will again be in the phase when the pendulum of shorter length has completed oscillations [$nT_1 = (n-1)T_2$, where T_1 is time period of shorter length & T_2 be time period of longer length and n are no. of oscillations completed]

A. 5

B. 1

C. 2

D. 3

Answer: C

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35. Two simple harmonic motions with the same frequency act on a particle at right angles i.e., along X-axis and Y-axis. If the two amplitudes are equal and the phase difference is $\pi/2$, the resultant motion will be

A. a circle

B. an ellipse with the major axis along Y-axis

C. an ellipse with the major axis along X-axis

D. a straight line inclined at 45° to the X-axis

Answer: A

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36. A hollow sphere is filled with water. It is hung by a long thread. As the water flows out of a hole at the bottom, the period of oscillation will

A. first increase and then decrease

B. first decrease and then increase

C. increase continuously

D. decrease continuously

Answer: A

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37. A particle starts simple harmonic motion from the mean position. Its amplitude is a and time period is T. what is its displacement when its speed is half of its displacement when its speed is half of its maximum speed?

A. $\frac{\sqrt{2}}{3}a$

B. $\frac{\sqrt{3}}{2}a$

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

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

Answer: B

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38. A linear harmonic oscillator of force constant $2 \times 10^6 N/m$ and amplitude (0.01 m) has a total mechanical energy of (160 J). Its.

A. maximum potential enregy is $160J$

B. maximum potential energy is $100J$

C. maximum potential energy is zero

D. maximum potential energy is 100J`

Answer: A

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39. In a simple harmonic motion, when the displacement is one-half the amplitude, what fraction of the total energy is kinetic ?

A. Zero

B. $\frac{1}{4}$

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

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

Answer: D

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40. A particle is subjected to two mutually perpendicular simple harmonic motions such that its X and y coordinates are given by $X = 2\sin\omega t$, $y = 2\sin\left(\omega + \frac{\pi}{4}\right)$

The path of the particle will be:

A. a straight line

B. a circle

C. an ellipse

D. a parabola

Answer: C

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41. A body executes SHM with an amplitude a. At what displacement from the mean positions, the potentail energy of the body is one-fourth of its total energy?

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

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

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

D. Some other fraction of a

Answer: B

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42. A simple harmonic oscillation has an amplitude A and time period T. The time required to travel from $x = A$ to $x = \frac{A}{2}$ is

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

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

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

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

Answer: A

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43. If a simple harmonic oscillator has got a displacement of $0.02m$ and acceleration equal

to $2.0ms^{-2}$ at any time, the angular frequency of the oscillator is equal to

A. $10rad/s$

B. $0.1rad/s$

C. $100rad/s$

D. $1rad/s$

Answer: A

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44. A simple pendulum is suspended from the roof of a trolley which moves in a horizontal direction with an acceleration α, then the time period is given by $T = 2\pi\sqrt{\left(\frac{I}{T}\right)}$ where g is equal to

A. g

B. $g - \alpha$

C. $g + \alpha$

D. $\sqrt{\left(g^2 + \alpha^2\right)}$

Answer: D

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45. A body is executing S.H.M. when its displacement from the mean position is 4 cm and 5 cm, the corresponding velocity of the body is 10 cm/sec and 8 cm/sec. Then the time period of the body is

A. 2π sec

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

C. π sec

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

Answer: C

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46. The amgular velocity and the amplitude of a simple pendulum is ω and a respectively. At a displacement x from the mean position, if its kinetic energy is T and potential energy is U, then the ratio of T to U is

A. $\left(\frac{a^2 - x^2\omega^2}{x^2\omega^2}\right)$

B. $\frac{x^2\omega^2}{(a^2 - x^2\omega^2)}$

C. $\frac{(a^2 - x^2)}{x^2}$

D. $\frac{x^2}{(a^2 - x^2)}$

Answer: C

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47. The composition of two simple harmonic motions of equal periods at right angle to each other and with a phase difference of p

results in the displacement of the particle along

A. circle

B. figure of eight

C. straight line

D. ellipse

Answer: C

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48. A mass m is suspended from the two coupled springs connected in series. The force constant for springs are $k_1 \text{and} k_2$. The time period of the suspended mass will be

A. $T = 2\pi\sqrt{\dfrac{m}{k_1 - k_2}}$

B. $T = 2\pi\sqrt{\dfrac{mk_1k_2}{k_1 + k_2}}$

C. $T = 2\pi\sqrt{\dfrac{m}{k_1 + k_2}}$

D. $T = 2\pi\sqrt{\dfrac{m(k_1 + k_2)}{k_1k_2}}$

Answer: D

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49. A particle, with restoring force proportional to displacement and resulting force proportional to velocity is subjected to a force $F \sin \omega t$. If the amplitude of the particle is maximum for $\omega = \omega_1$, and the energy of the particle is maximum for $\omega = \omega_2$, then

A. $\omega_1 = \omega_0$ and $\omega_2 \neq \omega_0$

B. $\omega_1 = \omega_0$ and $\omega_2 = \omega_0$

C. $\omega_1 \neq \omega_0$ and $\omega_2 = \omega_0$

D. $\omega_1 \neq \omega_0$ and $\omega_2 \neq \omega_0$

Answer: C

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50. A particle moving along the X-axis executes simple harmonic motion, then the force acting on it is given by

where, A and K are positive constants.

A. $-Akx$

B. $A \cos kx$

C. $A \exp(-kx)$

D. Akx

Answer: A

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