PHYSICS

BOOKS - MTG PHYSICS (ENGLISH)

OSCILLATIONS

Mcqs

1. All trignometric functions are periodic but only sine or cosine functions are used to define SHM. Why?

A. Pythgoras

B. Carl Friedrich Gauss

C. Leonhard Euler

D. Jean Baptiste Joseph Fourier

Answer: D

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2. The Halley's comet appears after every

A. 72 years

B. 74 years

C. 76 years

D. 78 years

Answer: C

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3. Which one of the following is not a periodic motion?

A. Rotation of the earth about its axis.

B. A freely suspended bar magnet displaced from its N-S direction and released.

C. Motion of hands of a clock.

D. An arrow released from a bow.

Answer: D

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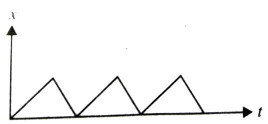
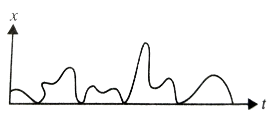
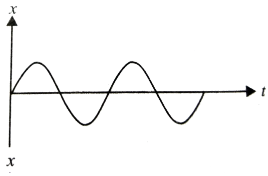
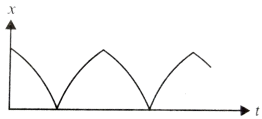
4. Which of the following x-t graphs does not represent periodic motion?

A. 

B. 

C. 

D. 

Answer: B

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5. If the frequency of human heart is 1.25 Hz, the number of heart beats in 1 minutes is

A. 65

B. 75

C. 80

D. 90

Answer: B

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6. In a certain oscillatory system (particle is performing SHM), the amplitude of motion is 5 m and the time period is 4 s. the minimum time taken by the particle for passing betweens points, which are at distances of 4 m and 3 m from the centre and on the same side of it will approximately be

A. $\left(\frac{16}{45}\right)s$

B. $\left(\frac{7}{45}\right)s$

C. $\left(\frac{8}{45}\right)s$

D. $\left(\frac{13}{45}\right)s$

Answer: C

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7. A body of mass m is attached to one end of a massless spring which is suspended vertically from a fixed point. The mass is held in hand so that the spring is neither stretched nor compressed. Suddenly the support of the hand is removed. The lowest position attained by the mass during oscillation is 4cm below the point, where it was held in hand.

(a) What is the amplitude of oscillation ?

(b) Find the frequency of oscillation?

A. 1 cm, 4.5Hz

B. 2 cm, 3.51Hz

C. 3 cm, 2.51Hz

D. 4 cm, 1.5Hz

Answer: B

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

1. $x = \sin^3 \omega t$

2. $x = 1 + \omega t + \omega^2 t^2$

3. $x = \cos \omega t + \cos 3\omega t + \cos 5\omega t$

4. $x = \sin \omega t + \cos \omega t$

A. Only 1

B. Only 1 and 3

C. Only 1 and 4

D. Only 4

Answer: D

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9. Which of the following is not characteristics of simple harmonic motion?

A. The motion is periodic

B. the motion is along a straight line about the mean position

C. The oscillations are responsible for the energy conversion.

D. The acceleration of the particle is directed towards the extreme position.

Answer: D

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10. The equation of motion of a simple harmonic motion is

A. $\frac{d^2x}{dt^2} = -\omega^2 x$

B. $\frac{d^2x}{dt^2} = -\omega^2 t$

C. $\frac{d^2x}{dt^2} = -\omega x$

D. $\frac{d^2x}{dt^2} = -\omega t$

Answer: A

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11. Which of the following expression does not represent simple harmonic motion?

A. $x = A\cos\omega + B\sin\omega$

B. $x = A\cos(\omega t + \alpha)$

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

D. $x = A\sin\omega t\cos^2\omega t$

Answer: D

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12. If a simple harmonic motion is represented by $\frac{d^2x}{dt^2} + \alpha x = 0$, its time period is :

A. $2\pi\sqrt{\alpha}$

B. $2\pi\alpha$

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

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

Answer: C

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13. The time period of simple harmonic motion depends upon

A. amplitude

B. energy

C. phase constant

D. mass

Answer: D

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14. Which of the following motions is not simple harmonic?

A. Vertical oscillations of a spring

B. Motion of a simple pendulum

C. Motion of planet around the sun

D. Oscillation of liquid in a U-tube

Answer: C

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15. If x, v and a denote the displacement, the velocity and the acceleration of a particle executing simple harmonic motion of time period T, then, which of the following does not change with time?

A. $\frac{aT}{v}$

B. $aT + 2\pi v$

C. $\frac{aT}{x}$

D. $a^2T + 4\pi^2v^2$

Answer: C

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16. Which of the following functions of time represent (a) simple harmonic motion and (b) periodic but not simple harmonic motion? Give the period for each case.

(i)$\sin\omega t - \cos\omega t$ (ii) $\sin^2\omega t$ (iii) $\cos\omega t + 2\sin^2\omega t$

A. a simple harmonic motion with a period $\frac{\pi}{\omega}$.

B. a simple harmonic motion with a period $\frac{2\pi}{\omega}$

C. a periodic, but not simple harmonic motionn with a period $\frac{\pi}{\omega}$

D. a periodic, but not simple harmonic motion with a period $\frac{2\pi}{\omega}$

Answer: B

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17. A particle executing simple harmonic motion with an amplitude A. The distance travelled by the particle in one time period is

A. zero

B. A

C. 2A

D. 4A

Answer: D

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18. Two simple harmonic motions are represented by the equations. $y_1 = 10\sin\frac{\pi}{4}(12t+1), y_2 = 5\left(\sin 3pt + \sqrt{3}\cos 3pt\right)$ the ratio of their amplitudes is

A. $1:1$

B. $1:2$

C. $3:2$

D. $2:3$

Answer: A

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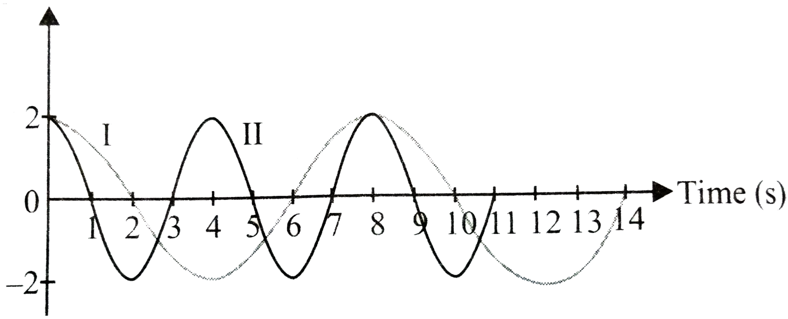
19. Figure shows the displacement-time graphs of two simple harmonic motions I and II. From the graph it follows that



A. curve I has samme frequency as that of curve II.

B. curve I has frequency twice that of curve II.

C. curve I has frequency half that of curve II

D. curve I has frequency four times that of curve II.

Answer: C

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20. A vibratory motion is represented by $x = 2A\cos\omega t + A\cos\left(\omega t + \frac{\pi}{2}\right) + A\cos(\omega t + \pi) + \frac{A}{2}\cos\left(\omega t + \frac{3\pi}{2}\right)$

.

the resultant amplitude of the motion is

A. $\frac{9A}{2}$

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

C. $\frac{5A}{2}$

D. 2A

Answer: B

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21. A particle executing SHM is described by the displacement function $x(t) = A\cos(\omega t + \phi)$, if the initial (t=0) position of the particle is 1 cm, its initial velocity is π cm s^{-1} and its angular frequency is πs^{-1}, then the amplitude of its motion is

A. πcm

B. 2 cm

C. $\sqrt{2}$cm

D. 1 cm

Answer: C

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22. Two particles execute SHMs of the same amplitude and frequency along the same straight line. They cross one another when going in opposite direction. What is the phase difference between them when their displacements are half of their amplitudes ?

A. 60°

B. 30°

C. 120°

D. 150°

Answer: C

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23. Two particles execute SHM of same amplitude and frequency on parallel lines. They pass one another when moving in opposite directions each time their displacement is one third their amplitude. What is the phase difference between them?

A. 0

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

C. π

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

Answer: B

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24. A mass of 2kg is attached to the spring of spring constant $50Nm^{-1}$. The block is pulled to a distance of 5 cm from its equilibrium position at $x=0$ on a horizontal frictionless surface from rest at t=0. Write the expression for its displacement at anytime t.

A. x=0.05sin5t m

B. x=0.05cos5t m

C. x=0.5sin5t m

D. x=5sin5t m

Answer: A

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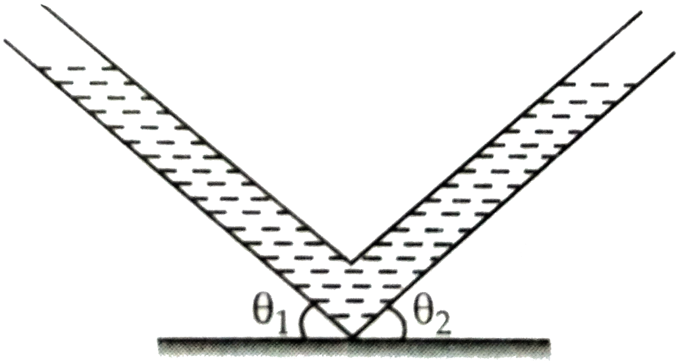
25. A non viscous liquid of density ρ is filled in a tube with A as the area of cross section, as shown in the figure. If the liquid is slightly depressed in one of the arms, the liquid column oscillates with a frequency



A. $\frac{1}{2\pi}\sqrt{\frac{\rho g A \sin\left(\frac{\theta_1+\theta_2}{2}\right)}{m}}$

B. $\frac{1}{2\pi}\sqrt{\frac{\rho g A(\sin\theta_1 - \sin\theta_1)}{m}}$

C. $\frac{1}{2\pi}\sqrt{\frac{\rho g A(\sin\theta_1 + \sin\theta_2)}{m}}$

D. $\frac{1}{2\pi}\sqrt{\frac{\rho g A \sin\left(\frac{\theta_1-\theta_2}{2}\right)}{m}}$

Answer: C

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26. the circular motion of a particle with constant speed is

A. periodic and simple harmonic

B. simple harmonic but not periodic

C. neither periodic nor simple harmonic

D. periodic but not simple harmonic

Answer: D

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27. Simple harmonic motion is the projection of uniform circular motion on

A. x-axis

B. y-axis

C. reference circle

D. any diameter of reference circle

Answer: D

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28. In an SHM, x is the displacement and a is the acceleration at time t. the plot of a against x for one complete oscillation will be

A. a straight line

B. a circle

C. an ellipse

D. a sinusoidal curve

Answer: A

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29. 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, a is zero

B. when x is zero, a is zero

C. when v is maximum, a is maximum

D. value of a is zero, whatever may be the value of v.

Answer: A

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30. Which of the following relationships between the acceleration a and the displacement x of a particle executing simple harmonic motion?

A. $a = 2x^2$

B. $a = -2x^2$

C. $a = 2x$

D. $a = -2x$

Answer: D

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31. A particle executing simple harmonic motion with an amplitude A and angularr frequency ω. The ratio of maximum acceleration to the maximum velocity of the particle is

A. ωA

B. $\omega^2 A$

C. ω

D. $\frac{\omega^2}{A}$

Answer: C

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32. A particle executing SHM with time period T and amplitude A. The mean velocity of the particle averaged over quarter oscillation, is

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

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

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

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

Answer: D

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33. A particle executing SHM. The phase difference between velocity and displacement is

A. 0

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

C. π

D. 2π

Answer: B

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34. A particle executing SHM. The phase difference between acceleration and displacement is

A. 0

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

C. π

D. 2π

Answer: C

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35. A mass attached to a spring is free to oscillate, with angular velocity ω, in a horizontal plane without friction or damping. It is pulled to a distance x_0 and pushed towards the centre with a velocity v_0 at time $t = 0$. Determine the amplitude of the resulting oscillations in terms of the parameters ω, x_0 and v_0.

A. $\sqrt{\frac{v_0^2}{\omega^2} - x_0^2}$

B. $\sqrt{\omega^2 v_0^2 + x_0^2}$

C. $\sqrt{\frac{x_0^2}{\omega^2} + v_0^2}$

D. $\sqrt{\frac{v_0^2}{\omega^2} + x_0^2}$

Answer: D

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36. The piston in the cylinder head of a locomotive has a stroke (twice the amplitude) of 6.0m. If the piston moves with simple harmonic motion with an angular frequency of $200\frac{rad}{\min}$, what is its maximum speed ?

A. $5ms^{-1}$

B. $10ms^{-1}$

C. $15ms^{-1}$

D. $20ms^{-1}$

Answer: B

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37. A particle executing SHM according to the equation $x = 5\cos\left(2\pi t + \frac{\pi}{4}\right)$ in SI units. The displacement and acceleration of the particle at t=1.5 s is

A. $-3.0m, 100ms^{-2}$

B. $+2.54m, 200ms^{-2}$

C. $-3.54m, 140ms^{-2}$

D. $+3.55m, 120ms^{-2}$

Answer: C

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38. A point mass oscillates along the x-axis according to the law $x = x_0\cos(\omega t - \pi/4)$. If the acceleration of the particle is written as $a = A\cos(\omega t + \delta)$, the .

A. $A = x_0\omega^2, \delta = \frac{3\pi}{4}$

B. $A = x_0, \delta = -\frac{\pi}{4}$

C. $A = x_0\omega^2, \delta = \frac{\pi}{4}$

D. $A = x_0\omega^2, \delta = -\frac{\pi}{4}$

Answer: A

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39. The displacement of a particle executing simple harmonic motion is given by

$x = 3\sin\left(2\pi t + \frac{\pi}{4}\right)$

where x is in metres and t is in seconds. The amplitude and maximum speed of the particle is

A. 3m, $2\pi ms^{-1}$

B. 3m, $4\pi ms^{-1}$

C. 3m, $6\pi ms^{-1}$

D. 3m, $8\pi ms^{-1}$

Answer: C

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40. A particle executes SHM of period 12s. Two sec after it passes through the centre of oscillation, the velocity is found to be 3.142 cm s^{-1} find the amplitude and the length of the path.

A. 6 cm , 12 cm

B. 3 cm , 6 cm

C. 24 cm , 48 cm

D. 12 cm , 24 cm

Answer: D

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41. A particle executing simple harmonic motion with an amplitude 5 cm and a time period 0.2 s. the velocity and acceleration of the particle when the displacement is 5 cm is

A. $0.5\pi ms^{-1}, 0ms^{-2}$

B. $0.5ms^{-1}, -5\pi^2 ms^{-2}$

C. $0ms^{-1}, -5\pi^2 ms^{-2}$

D. $0.5\pi ms^{-1}, -0.5\pi^2 ms^{-2}$

Answer: C

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42. A string of mass 3 kg is under tension of 400 N. the length of the stretched string is 25 cm. if the transverse jerk is stuck at one end of the string how long does the disturbance take to reach the other end?

A. 0.043s

B. 4.33S

C. 0.055 s

D. 0.034 s

Answer: A

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43. Natural length of a spring is 60 cm and its spring constant is 4000 N/m. A mass of 20 kg is hung from it. The extension produced in the spring is (Take, $g = 9.8m/s^2$)

A. 4.9 cm

B. 0.49 cm

C. 9.4 cm

D. 0.94 cm

Answer: A

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44. In simple harmonic motion, at the extreme positions

A. kinetic energy is minimum, potential energy is maximum

B. kinetic energy is maximum, potential energy is minimum

C. both kinetic and potential energies are maximum.

D. both kinetic and potential energies are minimum

Answer: A

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45. The total energy of a simple harmonic oscillation is proportional to

A. amplitude

B. square of amplitude

C. frequency

D. velocity

Answer: B

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46. A particle of mass m executing SHM with amplitude A and angular frequency ω. The average value of the kinetic energy and potential energy over a period is

A. $0, \frac{1}{2}m\omega^2 A^2$

B. $\frac{1}{2}m\omega^2 A^2, 0$

C. $\frac{1}{2}m\omega^2 A^2, \frac{1}{2}m\omega^2 A^2$

D. $\frac{1}{4}m\omega^2 A^2, \frac{1}{4}m\omega^2 A^2$

Answer: D

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47. A simple harmonic oscillator has a period T and energy E. the amplitude of the oscillator is doubled. Choose the correct answer.

A. Period and energy get doubled.

B. Period gets doubled while energy remains the same.

C. Energy gets doubled while period remains the same.

D. period remains the same and energy becomes four times.

Answer: D

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48. A particle executing simple harmonic motion with time period T. the time period with which its kinetic energy oscillates is

A. T

B. 2T

C. 4T

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

Answer: D

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49. A particle executing SHM with an amplitude A. The displacement of the particle when its potential energy is half of its total energy is

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

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

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

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

Answer: A

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50. A particle of mass m is hanging vertically by an ideal spring of force constant K . If the mass is made to oscillate vertically, its total energy is

A. maximum at the extreme position

B. maximum at the mean position

C. minimum at the mean position

D. same at all positions.

Answer: D

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51. Frequency of variation of kinetic energy of a simple harmonic motion of frequency n is

A. 2n

B. n

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

D. 3n

Answer: A

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52. When the displacement of a particle executing SHM is one-fourth of its amplitude, what fraction of the total energy is the kinetic energy?

A. $\frac{16}{15}$

B. $\frac{15}{16}$

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

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

Answer: B

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53. A block whose mass is 1 kg is fastened to a spring. The spring has a spring constant of 100N/m. the block is pulled to a distance x=10 cm from its equilibrium position at x=0 on a frictionless surface from rest at t=0. the kinetic energy and potential energy of the block when it is 5 cm away from the mean position is

A. 0.0375 J, 0.125 J

B. 0.125 J, 0.375 J

C. 0.125 J, 0.125 J

D. 0.375 J, 0.375 J

Answer: A

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54. A body of mass m is situated in a potential field $U(x) = U_0(1 - \cos \alpha x)$ when U_0 and α are constant. Find the time period of small oscialltions.

A. $2\pi\sqrt{\frac{m}{U_0\alpha}}$

B. $2\pi\sqrt{\frac{m}{U_0\alpha^2}}$

C. $2\pi\sqrt{\frac{m}{2U_0\alpha}}$

D. $2\pi\sqrt{\frac{2m}{U_0\alpha^2}}$

Answer: B

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55. The frequency of oscillations of a mass m suspended by spring of v_1. If the length of the spring is cut to one-half, the same mass oscillates with frequency v_2. Determine the value of v_2 / v_1

A. 2

B. $\sqrt{2}$

C. 4

D. $\sqrt{3}$

Answer: B

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56. Time period of oscillation of a spring is 12 s on earth. What shall be the time period if it is taken to moon?

A. 6 s

B. 12 s

C. 36 s

D. 72 s

Answer: B

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57. A 5 kg collar is attached to a spring of spring constant 500 N m^{-1}. It slides without friction over a horizontal rod. The collar is displaced from its equilibrium position by 10 cm and released. The time period of oscillation is

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

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

C. πs

D. $2\pi s$

Answer: A

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58. In the question number 64, the maximum acceleration of the collar is

A. $5ms^{-2}$

B. $10ms^{-2}$

C. $15ms^{-2}$

D. $20ms^{-2}$

Answer: B

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59. A body of mass 20 g connected to a spring of spring constant k, executes simple harmonic motion with a frequency of $(5/\pi)$ Hz. The value of spring constant is

A. $4Nm^{-1}$

B. $3Nm^{-1}$

C. $2Nm^{-1}$

D. $5Nm^{-1}$

Answer: C

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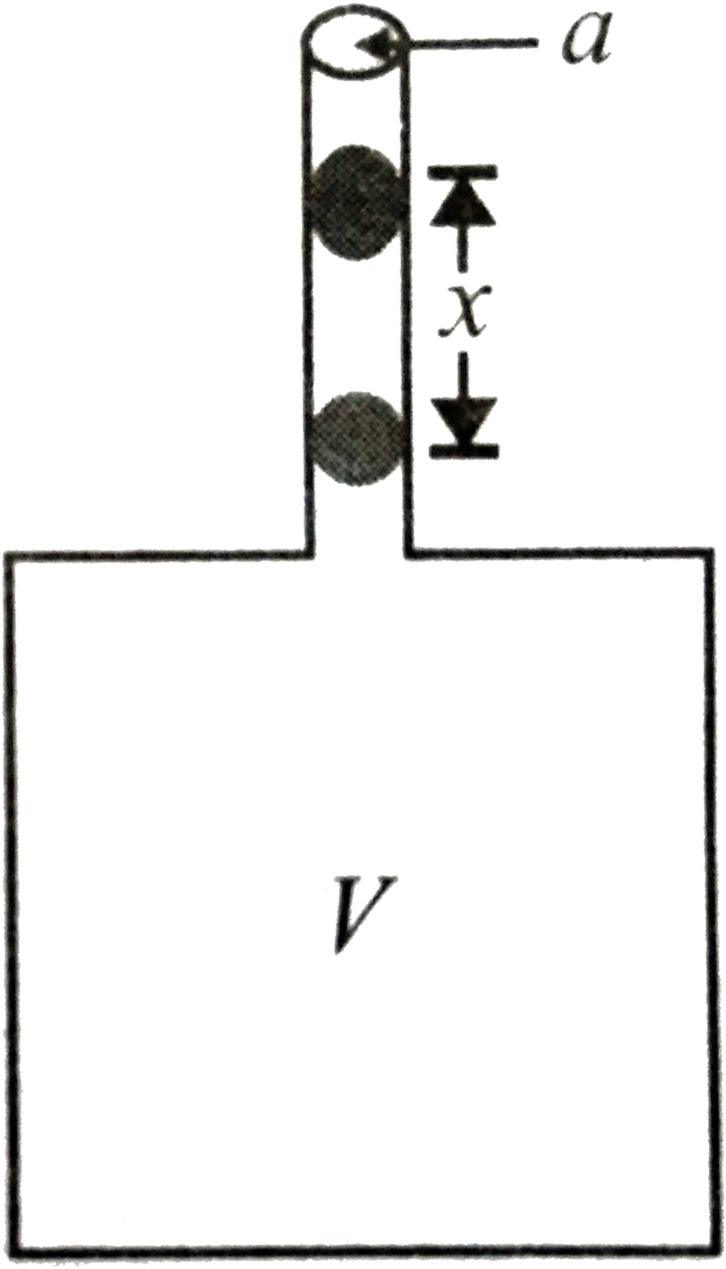
60. An air chamber of volume V has a neck area of cross section A into which a ball of mass m just fits and can move up and down without any friction, figure. Show that when the ball is pressed down a little and released, it executes SHM. Obtain an expression for the time period of oscillations assuming pressure volume variations of air to be isothermal.



A. $T = 2\pi\sqrt{\frac{Ba^2}{mV}}$

B. $T = 2\pi\sqrt{\frac{BV}{ma^2}}$

C. $T = 2\pi\sqrt{\frac{mB}{Va^2}}$

D. $T = 2\pi\sqrt{\frac{mV}{Ba^2}}$

Answer: D

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61. A spring balance has a scale that reads from 0 to 50 kg. the length of the scale is 20 cm. a block of mass m is suspended from this balance, when displaced and released, it oscillates with a period 0.5 s. the value of m is (Take $g = 10ms^{-2}$)

A. 8 kg

B. 12 kg

C. 16 kg

D. 20 kg

Answer: C

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62. To show that a simple pendulum executes simple harmonic motion, it is necessary to assume that

A. length of the pendulum is small

B. mass of the pendulum is small

C. acceleration due to gravity is small

D. amplitude of the oscillation is small

Answer: D

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63. Motion of an oscillating liquid column in a U-tube is

A. periodic but not simple harmonic.

B. non-periodic

C. simple harmonic and time period is independent of the density of the liquid.

D. simple harmonic and time period is directly proportional to the density of the liquid.

Answer: C

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64. What is the effect on the time period of a simple pendulum if the mass off the bob is doubled?

A. Halved

B. Double

C. Becomes 8 times

D. No effects

Answer: D

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65. The acceleration due to gravity on the surface of the moon is $1.7ms^{-2}$. What is the time perioid of a simple pendulum on the surface of the moon, if its time period on the surface of earth is $3.5s$? Take $g = 9.8ms^{-2}$ on the surface of the earth.

A. 4.4 s

B. 8.4 s

C. 16.8 s

D.

Answer: C

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66. Consider a pair of identical pendulums, which oscillate with equal amplitude independently such that when one pendulum is at its extreme position making an angle of 2° to the right with the vertical , the other pendulum makes an angle of 1° to the left of the vertical. What is the phase difference between the pendulums?

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

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

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

D. π

Answer: B

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67. Two pendulums differ in lengths by $22cm$. They oscillate at the same place so that one of them makes 30 oscillations and the other makes 36 oscillations during the same time. The length (in cm) of the pendulum are :

A. 72 and 50

B. 60 and 38

C. 50 and 28

D. 80 and 58

Answer: A

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68. The time period of a simple pendulum on the surface of the earth is 4s. Its time period on the surface of the moon is

A. 4s

B. 8s

C. 10s

D. 12s

Answer: C

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69. A disc of radius R=10 cm oscillates as a physical pendulum about an axis perpendicular to the plane of the disc at a distance r from its centre. If $r = \frac{R}{4}$, the approximate period of oscillation is (Take $g = 10 ms^{-2}$)

A. 0.84 s

B. 0.94 s

C. 1.26 s

D. 1.42 s

Answer: B

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70. A simple pendulum is oscillating in a stationery lift. When the lift falls freely, the frequency of oscillations of the pendulum is

A. zero

B. v

C. $2v$

D. infinite

Answer: A

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71. A simple pendulum of length l and having a bob of mass M is suspended ina car. The car is moving on a circular track of radius R with a uniform speed v. If the pendulum makes small oscillations in a radial direction about its equilibrium, what will be its time period ?

A. $T = 2\pi\sqrt{\frac{L}{g}}$

B. $T = 2\pi\sqrt{\frac{L}{\sqrt{g^2 + \frac{v^4}{R^2}}}}$

C. $T = 2\pi\sqrt{\frac{L}{\sqrt{g^2 + \frac{v^2}{R}}}}$

D. $T = 2\pi\sqrt{\frac{L}{g^2 - \frac{v^4}{R^2}}}$

Answer: B

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72. A simple pendulum executing SHM with a period of 6 s between two extreme positions B and C about a point O. if the length of the arc BC is 10 cm, how long will the pendulum take the move from

position C to a position D towards O exactly midway between C and O?

A. 0.5 s

B. 1 s

C. 1.5 s

D. 3 s

Answer: B

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73. The length of a second's pendulum on the surface of Earth in 1m. What will be the length of a second's pendulum on the moon?

A. $\frac{1}{6}$m

B. 1m

C. $\frac{1}{36}m$

D. 36 m

Answer: A

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74. What is the length of a simple pendulum which ticks second?

A. 0.5 m

B. 1 m

C. 1.5 m

D. 2 m

Answer: B

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

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

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

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

Answer: C

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76. A particle oscillating under a force $\overrightarrow{F} = -k\overrightarrow{x} - b\overrightarrow{v}$ is a (k and b are constants)

A. simple harmonic oscillator

B. linear oscillator

C. damped osillator

D. forced oscillator

Answer: C

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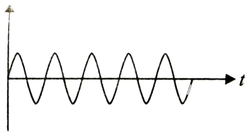
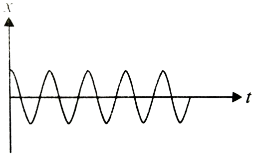
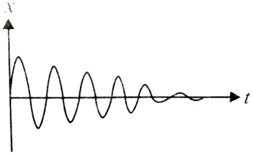
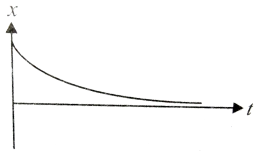
77. Which of the following displacement-time graphs represent damped harmonic oscillation?

A. 

B. 

C. 



D.

Answer: C

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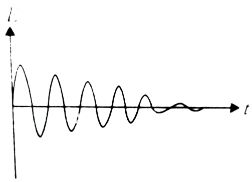
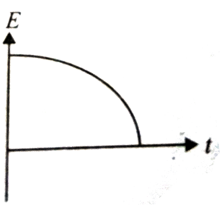
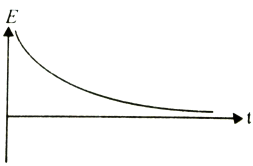
78. Which of the following energy-time graphs represents dajmped harmonic oscillator?



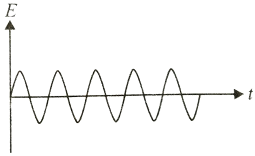
A.



B.



C.

D. 

Answer: C

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79. A block of mass 200 g executing SHM under the influence of a spring of spring constant $k = 90Nm^{-1}$ and a damping constant $b = 40gs^{-1}$. The time elapsed for its amplitude to drop to half of its initial value is (Given, ln $(1/2) = -0.693$)

A. 7s

B. 9s

C. 4s

D. 11s

Answer: A

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80. In the question number 93, the time elapsed for its mechanical energy to drop half of its initial value is

A. 2.5 s

B. 3.5 s

C. 4.5 s

D. 7.5 s

Answer: B

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81. In case of force oscillations of a body

A. driving force is constant throughout.

B. driving force is to be applied only momentarily

C. driving force has to be periodic and continuous

D. driving force is not required.

Answer: C

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82. Resonance is an example of

A. forced oscillation

B. damped oscillation

C. free oscillation

D. none of these

Answer: A

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83. In case of a forced vibration, the resonance wave becomes very sharp when the

A. restroring force is small

B. damping force is small

C. quality factor is small

D. applied periodic force is small.

Answer: B

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84. At resonance, the amplitude of forced oscillations is

A. minimum

B. maximum

C. zero

D. none of these

Answer: B

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85. Which of the following statements is correct?

A. Every periodic motion is simple harmonic motion.

B. In simple harmonic motion the period is proportional to the square of the amplitude of oscillation.

C. In simple harmonic motion the phase constant depends on initial condition

D. The resonance frequency of a driven oscillator depends on the damping.

Answer: C

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86. A particle of mass (m) is attached to a spring (of spring constant k) and has a natural angular frequency ω_0. An external force $R(t)$ proportional to $\cos\omega t(\omega \neq \omega_0)$ is applied to the oscillator. The time displacement of the oscillator will be proportional to.

A. $\frac{m}{\omega_0^2 - \omega^2}$

B. $\frac{1}{m(\omega_0^2 - \omega^2)}$

C. $\frac{1}{m(\omega_0^2 + \omega^2)}$

D. $\frac{m}{\omega_0^2 + \omega^2}$

Answer: B

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Higher Order Thinking Skills

1. An ideal gas enclosed in a cylindrical container supports a freely moving piston of mass M. The piston and the cylinder have equal cross-sectional area A. When the piston is in equilibrium, the volume of the gas is V_0 and its pressure is P_0. The piston is slightly displaced from the equilibrium position and released. Assuming that the system is completely isolated from its surrounding, the piston executes a simple harmonic motion with frequency

A. $\frac{1}{2\pi}\sqrt{\frac{MV_0}{A\gamma P_0}}$

B. $\frac{1}{2\pi}\frac{A\gamma P_0}{V_0 M}$

C. $\frac{1}{2\pi}\frac{V_0 M P_0}{A^2\gamma}$

D. $\frac{1}{2\pi}\sqrt{\frac{A^2\gamma P_0}{MV_0}}$

Answer: D

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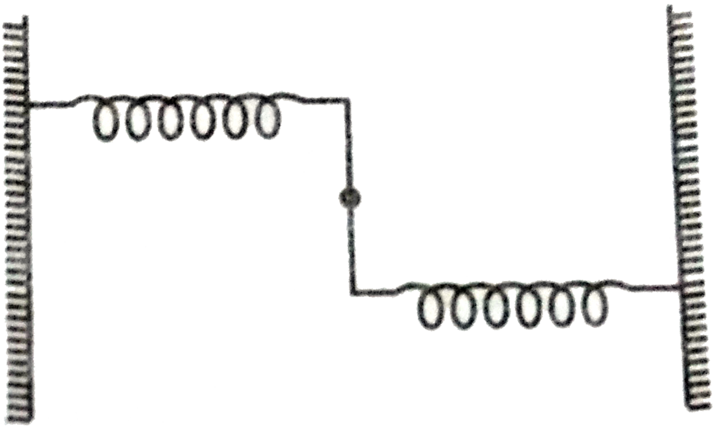
2. 

A uniform rod of length l and mass M is pivoted at the centre. Its two ends are attached to two ends are attached to two springs of equal spring constant k. the springs are fixed to rigid support as shown in figure and the rod is free to oscillate in the horizontal plane. the rod is gently pushed through a small angle θ in one direction and released. the frequency of oscillation is

A. $\frac{1}{2\pi}\sqrt{\frac{2k}{6M}}$

B. $\frac{1}{2\pi}\sqrt{\frac{k}{M}}$

C. $\frac{1}{2\pi}\sqrt{\frac{6k}{M}}$

D. $\frac{1}{2\pi}\sqrt{\frac{24k}{M}}$

Answer: C

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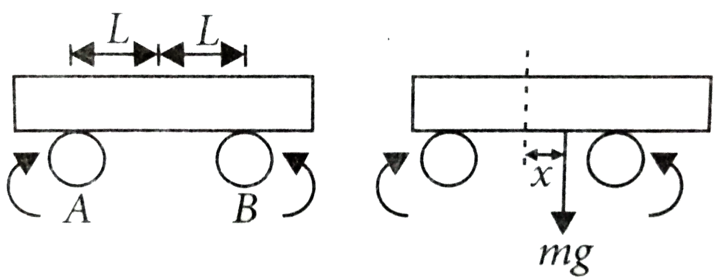
3. 

A uniform bar with mass m lies symmetrically across two rapidly rotating fixed rollers, A and B with distance L=2.0 cm between the bar's centre of mass and each roller. The rollers, whose directions of rotation are shown in figures slip against the bar with coefficient of kinetic friction $\mu_k = 0.40$. suppose the bar is displaced horizontally by the distance x as shown in figure and then released. the angular frequency ω of the resulting horizontal simple harmonic motion of the bar is (in $rad \quad s^{-1}$)

A. 20

B. 15

C. 16

D. 17

Answer: A

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4. A pendulum has a string of length 99.39 cm. how much length of the pendulum must be shortened to keep the current time of the pendulum if it loses 4 s a day?

A. 0.0009 cm

B. 0.009 cm

C. 0.09 cm

D. 0.9 cm

Answer: B

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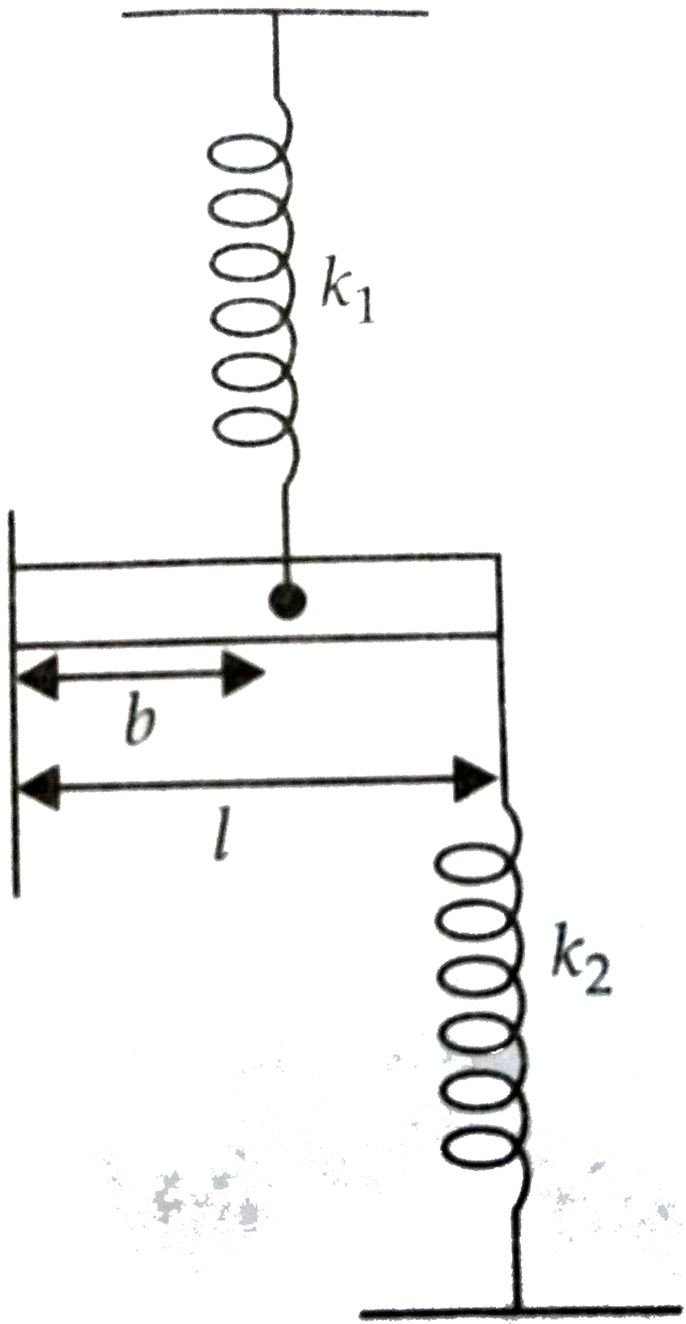

5.

A rod of mass m and length l is connected by two spring of spring constants k_1 and k_2, so that it is horizontal at equilibrium. What is the natural frequency of the system?

A. $\frac{1}{2\pi}\frac{\sqrt{k_1 b^2 + k_2 l^2}}{ml^2}$

B. $\frac{1}{2\pi}\frac{\sqrt{2k_1 b^2 + k_2 l^2}}{ml^2}$

C. $\frac{1}{2\pi}\sqrt{\frac{k_1 b^2 + k_2 l^2}{2ml^2}}$

D. $\frac{1}{2\pi}\sqrt{\frac{3(k_2 b^2 + k_2 l^2)}{ml^2}}$

Answer: D

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6. A spring is loaded with two blocks m_1 and m_2, where m_1 is rigidly fixed with the spring and m_2 just kept on the block m_1 as shown in the figure. The maximum energy of oscillation that is possible for the system having the block m_2 in contact with m_1 is

A. $\frac{m_1^2 g^2}{k}$

B. $\frac{m_1 g^2}{2k}$

C. $\frac{m_2^2 g^2}{2k}$

D. $\frac{(m_1 + m_2)^2 g^2}{2k}$

Answer: D

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7. Two particles execute SHM of same amplitude and same time period, about same mean position but with a phase difference between them. At an instant they are found to cross each other at $x = +\frac{A}{3}$. The phase difference between them is

A. $2\cos^{-1}\left(\frac{1}{5}\right)$

B. $2\sin^{-1}\left(\frac{1}{5}\right)$

C. $2\cos^{-1}\left(\frac{1}{3}\right)$

D. $2\sin^{-1}\left(\frac{1}{5}\right)$

Answer: C

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8. A particle executes S.H.M. between $x = -A$ and $x = +A$. The time taken for it to go from 0 to A/2 is T_1 and to go from A/2 to A is T_2. Then

A. $T_1 < T_2$

B. $T_1 > T_2$

C. $T_1 = T_2$

D. $T_1 = 2T_2$

Answer: A

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1. The displacement of a particle is represented by the equation $y = 3\cos\left(\frac{\pi}{4} - 2\omega t\right)$.

The motion of the particle is

A. simple harmonic with period $\frac{2\pi}{\omega}$

B. simple harmonic with period $\frac{\pi}{\omega}$

C. periodic but not simplee harmonic

D. non-periodic.

Answer: B

Watch Video Solution

2. The displacement of a particle is represented by the equation $y = \sin^3 \omega t$. The motion is

A. non-periodic

B. periodic but not simple harmonic

C. simple harmonic with period $2\pi/\omega$

D. simple harmonic with period π/ω

Answer: B

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3. The ralation between acceleration and displacement of four particles are given below

which one of the particles is executing simple harmonic motion?

A. $a_x = +2x$

B. $a_x = +2x^2$

C. $a_x = -2x^2$

D. $a_x = -2x$

Answer: D

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4. Motion of an oscillating liquid column in a U-tube is

A. periodic but not simple harmonic.

B. non-periodic

C. simple harmonic and time period is independent of the density of the liquid.

D. simple harmonic and time period is directly proportional to the density of the liquid.

Answer: C

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5. A particle is acted simultaneously by mutually perpendicular simple harmonic motions x=a cosωt and $y = a \sin \omega t$. The trajectory of motion of the particle will be

A. an ellipse

B. a parabola

C. a circle

D. a straight line.

Answer: C

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6. The displacement of a particle varies with time according to the relation $y = a \sin \omega t + b \cos \omega t$.

A. The motion is oscillatory but not SHM.

B. The motion is SHM with amplitude $a + b$.

C. The motion is SHM with amplitude $a^2 + b^2$

D. The motion is SHM with amplitude $\sqrt{a^2 + b^2}$.

Answer: D

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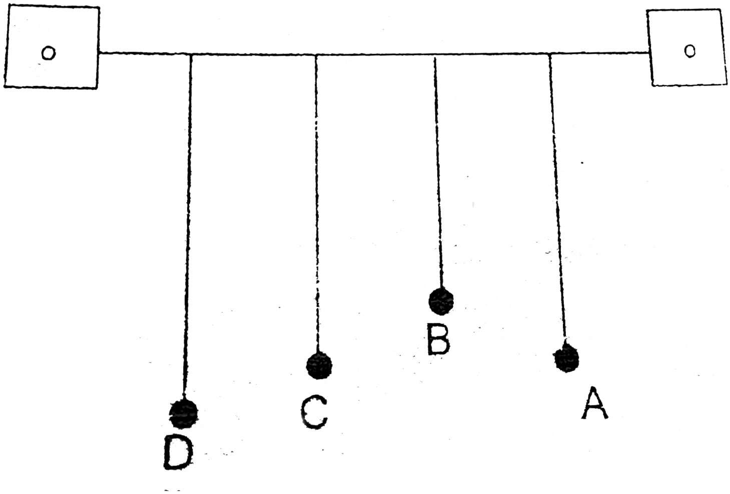
7. Four pendulums A,B,C and D are suspended from the same elastic support as shown in Fig. A and C are of the same length, while B is smaller than A and D is larger then A. If A is given a transverse displacement,



A. D will vibrate with maximum amplitude

B. C will vibrate with maximum amplitude

C. B will vibrate with maximum amplitude

D. All the four will oscillate with equal amplitude.

Answer: B

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8. The equation of motion of a particle is $x = a\cos(\alpha t)^2$. The motion is

A. periodic but not oscillatory

B. periodic and oscillatory

C. oscillatory but not periodic

D. Neither periodic nor oscillatory.

Answer: C

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9. A particle executing SHM has a maximum speed of 30 cm s^{-1} and a maximum acceleration of 60 cm s^{-1}. The period of oscillation is

A. πs

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

C. $2\pi s$

D. $\frac{\pi}{t}s$

Answer: A

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Assertion Reason

1. Assertion: The motion of the earth around the sun is perriodic but not oscillatory.

Reason: Oscillatory motion is necessarily periodic but periodic motion is not necessarily oscillatory.

A. If both assertion and reson are true and reason is the correct explanation of assertion

B. If both assertion and reason are true but reason is not the correct explanation of assertion.

C. If assertion is true but reason is false.

D. If both assertion and reason are false.

Answer: B

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2. Assertion: A combination of two simple harmonic motions with a arbitrary amplitudes and phases is not necessarily periodic.

Reason: A periodic motion can always be expressed as a sum of infinite number of harmonic motions with appropriate amplitudes.

A. If both assertion and reson are true and reason is the correct explanation of assertion

B. If both assertion and reason are true but reason is not the correct explanation of assertion.

C. If assertion is true but reason is false.

D. If both assertion and reason are false.

Answer: B

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3. Assertion: The motion of a simple pendulum is simple harmoni for all angular displacement.

Reason: Motion of simple pendulum is independent of the angular displacement.

A. If both assertion and reson are true and reason is the correct explanation of assertion

B. If both assertion and reason are true but reason is not the correct explanation of assertion.

C. If assertion is true but reason is false.

D. If both assertion and reason are false.

Answer: D

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4. Assertion: Simple harmonic motion is the projection of uniform circular motion on the diameter of the circle in which the latter motion occurs.

Reason: Simple harmonic motion is a uniform motion.

A. If both assertion and reson are true and reason is the correct explanation of assertion

B. If both assertion and reason are true but reason is not the correct explanation of assertion.

C. If assertion is true but reason is false.

D. If both assertion and reason are false.

Answer: C

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5. Assertion: The graph of total energy of a particle in SHM with respect to position is a straight line with zero slope.

Reason: Total energy of particle in SHM remains constant throughout its motion.

A. If both assertion and reson are true and reason is the correct explanation of assertion

B. If both assertion and reason are true but reason is not the correct explanation of assertion.

C. If assertion is true but reason is false.

D. If both assertion and reason are false.

Answer: A

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6. Assertion: If the amplitude of a simple harmonic oscillator is doubled, its total energy becomes double.

Reason: The toal energy is directly proportional to the amplitude of vibration of the harmonic oscillator.

A. If both assertion and reson are true and reason is the correct explanation of assertion

B. If both assertion and reason are true but reason is not the correct explanation of assertion.

C. If assertion is true but reason is false.

D. If both assertion and reason are false.

Answer: D

View Text Solution

7. Assertion: Every periodic motion is not simple harmonic motion.

Reason: The motion governed by the force law F=-kx is simple harmonic.

A. If both assertion and reson are true and reason is the correct explanation of assertion

B. If both assertion and reason are true but reason is not the correct explanation of assertion.

C. If assertion is true but reason is false.

D. If both assertion and reason are false.

Answer: A

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8. Assertion: A block of small mass m attached to a stiff spring will have large oscillation frequency.

Reason: Stiff springs have high value of spring constant.

A. If both assertion and reson are true and reason is the correct explanation of assertion

B. If both assertion and reason are true but reason is not the correct explanation of assertion.

C. If assertion is true but reason is false.

D. If both assertion and reason are false.

Answer: A

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9. Assertion: In damped oscillation, the energy of the system is dissipated continuously.

Reason: For small damping, the oscillations remain approximately periodic.

A. If both assertion and reson are true and reason is the correct explanation of assertion

B. If both assertion and reason are true but reason is not the correct explanation of assertion.

C. If assertion is true but reason is false.

D. If both assertion and reason are false.

Answer: B

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10. Assertion: In forced oscillations, th steady state motion of the particle is simpl harmonic.

Reason: The frequency of particle after the free oscillations die out, is the natural frequency of the particle.

A. If both assertion and reson are true and reason is the correct explanation of assertion

B. If both assertion and reason are true but reason is not the correct explanation of assertion.

C. If assertion is true but reason is false.

D. If both assertion and reason are false.

Answer: C

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11. Assertion: An earthquake will not cause uniform damage to all building in an affected area, even if they are built with the same strength and materials.

Reason: The one with its natural frequency close to the frequency of seismic wave is likely to be damaged less.

A. If both assertion and reson are true and reason is the correct explanation of assertion

B. If both assertion and reason are true but reason is not the correct explanation of assertion.

C. If assertion is true but reason is false.

D. If both assertion and reason are false.

Answer: C

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12. Assertion: A child in a garden swing periodically presses his feet against the ground to maintain the oscillations.

Reason: All free oscillations eventually die out because of the ever present damping force.

A. If both assertion and reson are true and reason is the correct explanation of assertion

B. If both assertion and reason are true but reason is not the correct explanation of assertion.

C. If assertion is true but reason is false.

D. If both assertion and reason are false.

Answer: A

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13. Assertion: The skill in swinging to greater heights lies in the synchronisation of the rhythm of pushing against the ground with the natural frequency of the swing.

Reason: The phenomenon behind this is resonance.

A. If both assertion and reson are true and reason is the correct explanation of assertion

B. If both assertion and reason are true but reason is not the correct explanation of assertion.

C. If assertion is true but reason is false.

D. If both assertion and reason are false.

Answer: A

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14. Assertion: In the ideal case of zero damping, the amplitude of simpl harmonic motion at resonance is is infinite.

Reason: All real sysmtems have some damping.

A. If both assertion and reson are true and reason is the correct explanation of assertion

B. If both assertion and reason are true but reason is not the correct explanation of assertion.

C. If assertion is true but reason is false.

D. If both assertion and reason are false.

Answer: B

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15. Assertion : The amplitude of oscillation can never be infinite.

Reason : The energy of oscillator is continuously dissipated.

A. If both assertion and reson are true and reason is the correct explanation of assertion

B. If both assertion and reason are true but reason is not the correct explanation of assertion.

C. If assertion is true but reason is false.

D. If both assertion and reason are false.

Answer: A

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Periodic And Oscillatory Motions

1. All trignometric functions are periodic but only sine or cosine functions are used to define SHM. Why?

A. Pythgoras

B. Carl Friedrich Gauss

C. Leonhard Euler

D. Jean Baptiste Joseph Fourier

Answer: D

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2. The Halley's comet appears after every

A. 72 years

B. 74 years

C. 76 years

D. 78 years

Answer: C

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3. Which one of the following is not a periodic motion?

A. Rotation of the earth about its axis.

B. A freely suspended bar magnet displaced from its N-S direction and released.

C. Motion of hands of a clock.

D. An arrow released from a bow.

Answer: D

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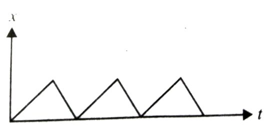
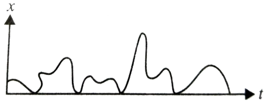
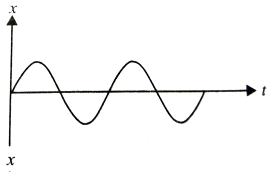
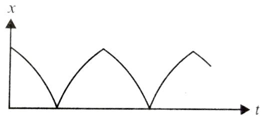
4. Which of the following x-t graphs does not represent periodic motion?

A. 

B. 

C. 

D. 

Answer: B

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5. If the frequency of human heart is 1.25 Hz, the number of heart beats in 1 minutes is

A. 65

B. 75

C. 80

D. 90

Answer: B

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6. In a certain oscillatory system (particle is performing SHM), the amplitude of motion is 5 m and the time period is 4 s. the minimum time taken by the particle for passing betweens points, which are at distances of 4 m and 3 m from the centre and on the same side of it will approximately be

A. $\left(\frac{16}{45}\right)s$

B. $\left(\frac{7}{45}\right)s$

C. $\left(\frac{8}{45}\right)s$

D. $\left(\frac{13}{45}\right)s$

Answer: C

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7. A body of mass m is attached to one end of a massless spring which is suspended vertically from a fixed point. The mass is held in hand so that the spring is neither stretched nor compressed. Suddenly the support of the hand is removed. The lowest position attained by the mass during oscillation is 4cm below the point, where it was held in hand.

(a) What is the amplitude of oscillation ?

(b) Find the frequency of oscillation?

A. 1 cm, 4.5Hz

B. 2 cm, 3.51Hz

C. 3 cm, 2.51Hz

D. 4 cm, 1.5Hz

Answer: B

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Simple Harmonic Motion

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

1. $x = \sin^3 \omega t$

2. $x = 1 + \omega t + \omega^2 t^2$

3. $x = \cos \omega t + \cos 3\omega t + \cos 5\omega t$

4. $x = \sin \omega t + \cos \omega t$

A. Only 1

B. Only 1 and 3

C. Only 1 and 4

D. Only 4

Answer: D

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2. Which of the following is not characteristics of simple harmonic motion?

A. The motion is periodic

B. the motion is along a straight line about the mean position

C. The oscillations are responsible for the energy conversion.

D. The acceleration of the particle is directed towards the extreme position.

Answer: D

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3. The equation of motion of a simple harmonic motion is

A. $\frac{d^2x}{dt^2} = -\omega^2 x$

B. $\frac{d^2x}{dt^2} = -\omega^2 t$

C. $\frac{d^2x}{dt^2} = -\omega x$

D. $\frac{d^2x}{dt^2} = -\omega t$

Answer: A

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4. Which of the following expression does not represent simple harmonic motion?

A. $x = A\cos\omega + B\sin\omega$

B. $x = A\cos(\omega t + \alpha)$

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

D. $x = A\sin\omega t\cos^2\omega t$

Answer: D

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5. If a simple harmonic motion is represented by $\frac{d^2x}{dt^2} + \alpha x = 0$, its time period is :

A. $2\pi\sqrt{\alpha}$

B. $2\pi\alpha$

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

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

Answer: C

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6. The time period of simple harmonic motion depends upon

A. amplitude

B. energy

C. phase constant

D. mass

Answer: D

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7. Which of the following motions is not simple harmonic?

A. Vertical oscillations of a spring

B. Motion of a simple pendulum

C. Motion of planet around the sun

D. Oscillation of liquid in a U-tube

Answer: C

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8. If x, v and a denote the displacement, the velocity and the acceleration of a particle executing simple harmonic motion of time period T, then, which of the following does not change with time?

A. $\frac{aT}{v}$

B. $aT + 2\pi v$

C. $\frac{aT}{x}$

D. $a^2T + 4\pi^2 v^2$

Answer: C

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9. Which of the following functions of time represent (a) simple harmonic motion and (b) periodic but not simple harmonic motion?

Give the period for each case.

(i)$\sin\omega t - \cos\omega t$ (ii) $\sin^2\omega t$ (iii) $\cos\omega t + 2\sin^2\omega t$

A. a simple harmonic motion with a period $\frac{\pi}{\omega}$.

B. a simple harmonic motion with a period $\frac{2\pi}{\omega}$

C. a periodic, but not simple harmonic motionn with a period $\frac{\pi}{\omega}$

D. a periodic, but not simple harmonic motion with a period $\frac{2\pi}{\omega}$

Answer: B

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10. A particle executing simple harmonic motion with an amplitude A. The distance travelled by the particle in one time period is

A. zero

B. A

C. 2A

D. 4A

Answer: D

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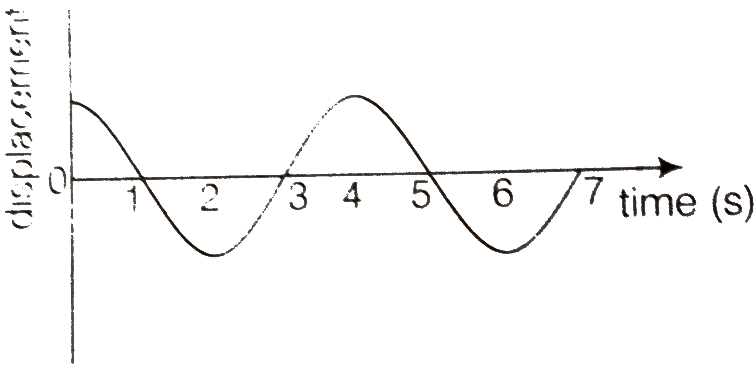
11. Displacement versus time curve for a particle executing SHM is shown in figure. Choose the correct statements.



A. Phase of the oscillator is same at t=0 s and t=2 s.

B. Phase of the oscillator is same at t=2 s and t=5s

C. Phase of the oscillator is same at t=1s and t=7 s

D. Phase of the oscillator is same at t=1s and t=5s.

Answer: D

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12. Two simple harmonic motions are represented by the equations. $y_1 = 10\sin\frac{\pi}{4}(12t+1), y_2 = 5\left(\sin 3pt + \sqrt{3}\cos 3pt\right)$ the ratio of their amplitudes is

A. $1:1$

B. $1:2$

C. $3:2$

D. $2:3$

Answer: A

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13. A vibratory motion is represented by

$$x = 2A\cos\omega t + A\cos\left(\omega t + \frac{\pi}{2}\right) + A\cos(\omega t + \pi) + \frac{A}{2}\cos\left(\omega t + \frac{3\pi}{2}\right)$$

.

the resultant amplitude of the motion is

A. $\frac{9A}{2}$

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

C. $\frac{5A}{2}$

D. 2A

Answer: B

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14. A particle executing SHM is described by the displacement function $x(t) = A\cos(\omega t + \phi)$, if the initial (t=0) position of the particle is 1 cm, its initial velocity is π cm s^{-1} and its angular frequency is πs^{-1}, then the amplitude of its motion is

A. πcm

B. 2 cm

C. $\sqrt{2}$cm

D. 1 cm

Answer: C

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15. Two particles execute SHMs of the same amplitude and frequency along the same straight line. They cross one another when going in opposite direction. What is the phase difference between them when their displacements are half of their amplitudes ?

A. 60°

B. 30°

C. 120°

D. 150°

Answer: C

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16. Two particles execute SHM of same amplitude and frequency on parallel lines. They pass one another when moving in opposite directions each time their displacement is one third their amplitude. What is the phase difference between them?

A. 0

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

C. π

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

Answer: B

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17. A mass of 2kg is attached to the spring of spring constant $50Nm^{-1}$. The block is pulled to a distance of 5 cm from its equilibrium position at $x=0$ on a horizontal frictionless surface from rest at t=0. Write the expression for its displacement at anytime t.

A. x=0.05sin5t m

B. x=0.05cos5t m

C. x=0.5sin5t m

D. x=5sin5t m

Answer: A

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Simple Harmonic Motion And Uniform Circular Motion

1. the circular motion of a particle with constant speed is

A. periodic and simple harmonic

B. simple harmonic but not periodic

C. neither periodic nor simple harmonic

D. periodic but not simple harmonic

Answer: D

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2. Simple harmonic motion is the projection of uniform circular motion on

A. x-axis

B. y-axis

C. reference circle

D. any diameter of reference circle

Answer: D

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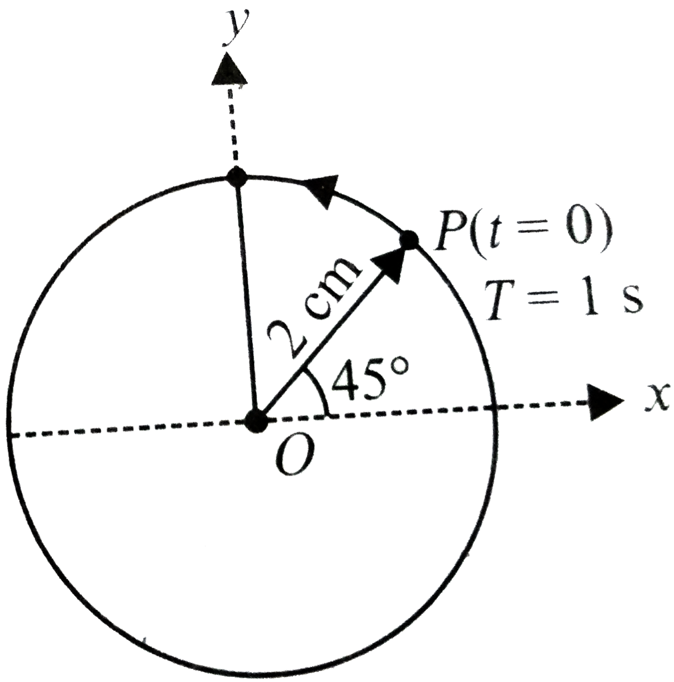

3.

Figure shows the circular motion of a particle. The radius of the circle, the period, sense of revolution and the initial positionn are indicated in the figure. The simple harmonic motion off the x-projection of the radius vector of the rotating particle P is

A. $x = 2\cos\left(2\pi t + \frac{\pi}{4}\right)$

B. $x = 2\sin\left(2\pi t + \frac{\pi}{4}\right)$

C. $x = 2\sin\left(2\pi t - \frac{\pi}{4}\right)$

D. $x = 2\cos\left(2\pi t - \frac{\pi}{4}\right)$

Answer: A

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Velocity And Acceleration In Simple Harmonic Motion

1. In an SHM, x is the displacement and a is the acceleration at time t. the plot of a against x for one complete oscillation will be

A. a straight line

B. a circle

C. an ellipse

D. a sinusoidal curve

Answer: A

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2. 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, a is zero

B. when x is zero, a is zero

C. when v is maximum, a is maximum

D. value of a is zero, whatever may be the value of v.

Answer: A

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3. Which of the following relationships between the acceleration a and the displacement x of a particle executing simple harmonic motion?

A. $a = 2x^2$

B. $a = -2x^2$

C. $a = 2x$

D. $a = -2x$

Answer: D

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4. A particle executing simple harmonic motion with an amplitude A and angularr frequency ω. The ratio of maximum acceleration to the maximum velocity of the particle is

A. ωA

B. $\omega^2 A$

C. ω

D. $\frac{\omega^2}{A}$

Answer: C

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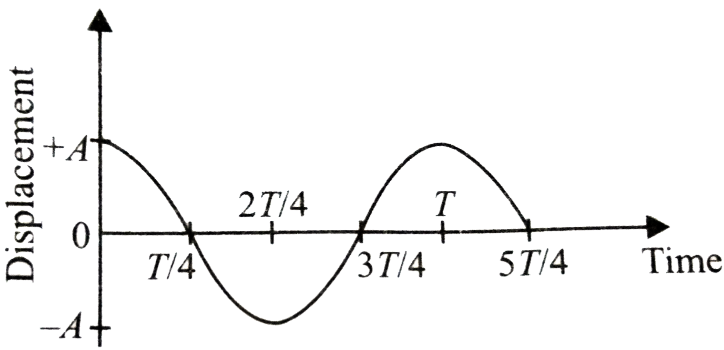
5. The displacement-time graph for a particle executing SHM is as shown in figure. Which of the following statements is correct?



A. The velocity of the particle is maximum at $t = \frac{3}{4}T$.

B. The velocity of the particle is maximum at $t = \frac{T}{2}$

C. The acceleration of the particle is maximum at $t = \frac{T}{4}$

D. The acceleration of the particle is maximum at $t = \frac{3}{4}$T.

Answer: A

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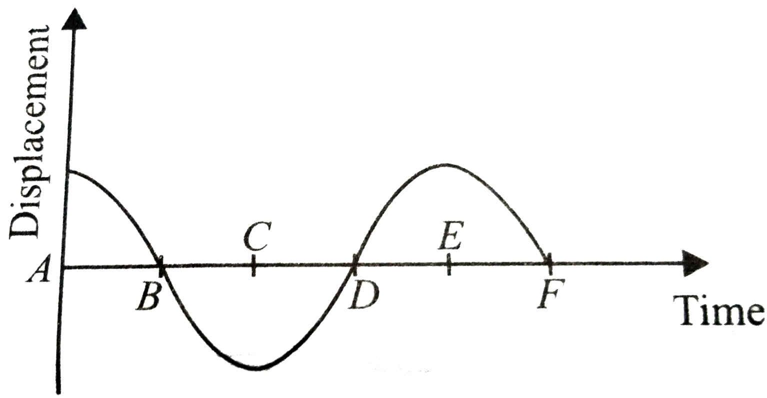
6. displacement versus time curve for a particle executing SHM is is as shown in figure. At what points the velocity of the particle is zero?



A. A,C,E

B. B,D,F

C. A,D,F

D. C,E,F

Answer: A

Watch Video Solution

7. A particle executing SHM with time period T and amplitude A. The mean velocity of the particle averaged over quarter oscillation, is

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

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

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

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

Answer: D

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8. A particle is in linear simple harmonic motion between two points. A and B, 10 cm apart (figure.) take direction from A to B as the positive direction and choose the correct statements.

AO= OB= 5cm

BC=8cm

A. The sign of acceleration and force on the particle when it is at A is negative.

B. The sign of acceleration and force on the particle when it is at B is positive

C. The sign of velocity, acceleration and force on the particle when it is 3 cm away from A going towards B are positive

D. The sign of velocity, acceleration and force on the particle when it is 4 cm away from B going towards A are positive.

Answer: C

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9. A particle executing SHM. The phase difference between velocity and displacement is

A. 0

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

C. π

D. 2π

Answer: B

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10. A particle executing SHM. The phase difference between acceleration and displacement is

A. 0

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

C. π

D. 2π

Answer: C

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11. A mass attached to a spring is free to oscillate, with angular velocity ω, in a horizontal plane without friction or damping. It is pulled to a distance x_0 and pushed towards the centre with a velocity v_0 at time $t = 0$. Determine the amplitude of the resulting oscillations in terms of the parameters ω, x_0 and v_0.

A. $\sqrt{\frac{v_0^2}{\omega^2} - x_0^2}$

B. $\sqrt{\omega^2 v_0^2 + x_0^2}$

C. $\sqrt{\frac{x_0^2}{\omega^2} + v_0^2}$

D. $\sqrt{\frac{v_0^2}{\omega^2} + x_0^2}$

Answer: D

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12. The piston in the cylinder head of a locomotive has a stroke (twice the amplitude) of 6.0m. If the piston moves with simple harmonic motion with an angular frequency of $200\frac{rad}{\min}$, what is its maximum speed ?

A. $5ms^{-1}$

B. $10ms^{-1}$

C. $15ms^{-1}$

D. $20ms^{-1}$

Answer: B

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13. A particle executing SHM according to the equation $x = 5\cos\left(2\pi t + \frac{\pi}{4}\right)$ in SI units. The displacement and acceleration of the particle at t=1.5 s is

A. $-3.0m, 100ms^{-2}$

B. $+2.54m, 200ms^{-2}$

C. $-3.54m, 140ms^{-2}$

D. $+3.55m, 120ms^{-2}$

Answer: C

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14. A point mass oscillates along the x-axis according to the law $x = x_0 \cos(\omega t - \pi / 4)$. If the acceleration of the particle is written as $a = A \cos(\omega t + \delta)$, the .

A. $A = x_0 \omega^2, \delta = \frac{3\pi}{4}$

B. $A = x_0, \delta = -\frac{\pi}{4}$

C. $A = x_0 \omega^2, \delta = \frac{\pi}{4}$

D. $A = x_0 \omega^2, \delta = -\frac{\pi}{4}$

Answer: A

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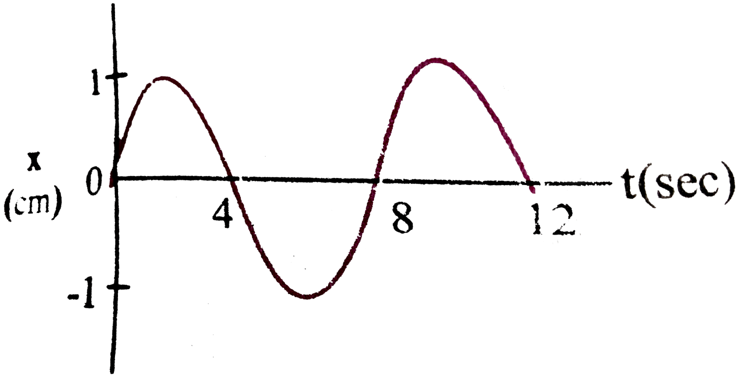
15. The $x - t$ graph of a particle undergoing simple harmonic motion is shown in figure. Acceleration of particle at $t = 4 / 3s$ is



A. $\frac{\sqrt{3}}{32}\pi^2 cms^{-2}$

B. $-\frac{\pi^2}{32}cms^{-2}$

C. $\frac{\pi^2}{32}cms^{-2}$

D. $-\frac{\sqrt{3}}{32}\pi^2 s^{-2}$

Answer: D

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16. The displacement of a particle executing simple harmonic motion is given by

$x = 3\sin\left(2\pi t + \frac{\pi}{4}\right)$

where x is in metres and t is in seconds. The amplitude and maximum speed of the particle is

A. 3m, $2\pi ms^{-1}$

B. 3m, $4\pi ms^{-1}$

C. 3m, $6\pi ms^{-1}$

D. 3m, $8\pi ms^{-1}$

Answer: C

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17. A particle executes SHM of period 12s. Two sec after it passes through the centre of oscillation, the velocity is found to be 3.142 cm s^{-1} find the amplitude and the length of the path.

A. 6 cm , 12 cm

B. 3 cm , 6 cm

C. 24 cm , 48 cm

D. 12 cm , 24 cm

Answer: D

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18. A particle executing simple harmonic motion with an amplitude 5 cm and a time period 0.2 s. the velocity and acceleration of the particle when the displacement is 5 cm is

A. $0.5\pi ms^{-1}, 0ms^{-2}$

B. $0.5ms^{-1}, -5\pi^2 ms^{-2}$

C. $0ms^{-1}, -5\pi^2 ms^{-2}$

D. $0.5\pi ms^{-1}, -0.5\pi^2 ms^{-2}$

Answer: C

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Force Law For Simple Harmonic Motion

1. A string of mass 3 kg is under tension of 400 N. the length of the stretched string is 25 cm. if the transverse jerk is stuck at one end of the string how long does the disturbance take to reach the other end?

A. 0.043s

B. 4.33S

C. 0.055 s

D. 0.034 s

Answer: A

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2. Natural length of a spring is 60 cm and its spring constant is 4000 N/m. A mass of 20 kg is hung from it. The extension produced in the spring is (Take, $g = 9.8 m / s^2$)

A. 4.9 cm

B. 0.49 cm

C. 9.4 cm

D. 0.94 cm

Answer: A

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Energy In Simple Harmonic Motion

1. In simple harmonic motion, at the extreme positions

A. kinetic energy is minimum, potential energy is maximum

B. kinetic energy is maximum, potential energy is minimum

C. both kinetic and potential energies are maximum.

D. both kinetic and potential energies are minimum

Answer: A

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2. The total energy of a simple harmonic oscillation is proportional to

A. amplitude

B. square of amplitude

C. frequency

D. velocity

Answer: B

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3. A particle of mass m executing SHM with amplitude A and angular frequency ω. The average value of the kinetic energy and potential energy over a period is

A. $0, \frac{1}{2}m\omega^2A^2$

B. $\frac{1}{2}m\omega^2A^2, 0$

C. $\frac{1}{2}m\omega^2A^2, \frac{1}{2}m\omega^2A^2$

D. $\frac{1}{4}m\omega^2A^2, \frac{1}{4}m\omega^2A^2$

Answer: D

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4. A simple harmonic oscillator has a period T and energy E. the amplitude of the oscillator is doubled. Choose the correct answer.

A. Period and energy get doubled.

B. Period gets doubled while energy remains the same.

C. Energy gets doubled while period remains the same.

D. period remains the same and energy becomes four times.

Answer: D

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5. A particle executing simple harmonic motion with time period T. the time period with which its kinetic energy oscillates is

A. T

B. 2T

C. 4T

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

Answer: D

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6. A particle executing SHM with an amplitude A. The displacement of the particle when its potential energy is half of its total energy is

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

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

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

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

Answer: A

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7. A particle of mass m is hanging vertically by an ideal spring of force constant K . If the mass is made to oscillate vertically, its total energy is

A. maximum at the extreme position

B. maximum at the mean position

C. minimum at the mean position

D. same at all positions.

Answer: D

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8. Frequency of variation of kinetic energy of a simple harmonic motion of frequency n is

A. 2n

B. n

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

D. 3n

Answer: A

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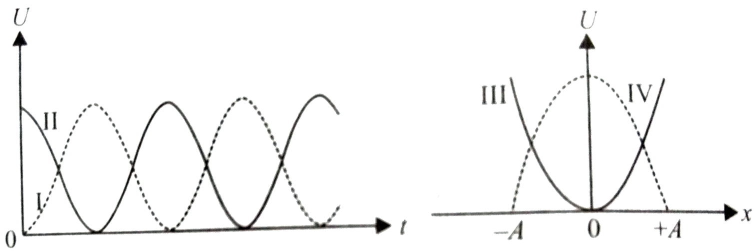
9. For a particle executing simple harmonic motion, the displacement x is given by x=$A \cos \omega t$. Identify the graph, which represents the variation of potential energy (U) as a function of time t and displacement x.



A. I,III

B. II,III

C. I,IV

D. II,IV

Answer: D

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10. When the displacement of a particle executing SHM is one-fourth of its amplitude, what fraction of the total energy is the kinetic energy?

A. $\frac{16}{15}$

B. $\frac{15}{16}$

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

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

Answer: B

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11. A block whose mass is 1 kg is fastened to a spring. The spring has a spring constant of 100N/m. the block is pulled to a distance x=10 cm from its equilibrium position at x=0 on a frictionless surface from rest at t=0. the kinetic energy and potential energy of the block when it is 5 cm away from the mean position is

A. 0.0375 J, 0.125 J

B. 0.125 J, 0.375 J

C. 0.125 J, 0.125 J

D. 0.375 J, 0.375 J

Answer: A

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Some Systems Executing Simple Harmonic Motion

1. A body of mass m is situated in a potential field $U(x) = U_0(1 - \cos \alpha x)$ when U_0 and α are constant. Find the time period of small oscialltions.

A. $2\pi\sqrt{\frac{m}{U_0\alpha}}$

B. $2\pi\sqrt{\frac{m}{U_0\alpha^2}}$

C. $2\pi\sqrt{\frac{m}{2U_0\alpha}}$

D. $2\pi\sqrt{\frac{2m}{U_0\alpha^2}}$

Answer: B

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2. The frequency of oscillations of a mass m suspended by spring of v_1. If the length of the spring is cut to one-half, the same mass oscillates with frequency v_2. Determine the value of v_2 / v_1

A. 2

B. $\sqrt{2}$

C. 4

D. $\sqrt{3}$

Answer: B

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3. Time period of oscillation of a spring is 12 s on earth. What shall be the time period if it is taken to moon?

A. 6 s

B. 12 s

C. 36 s

D. 72 s

Answer: B

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4. A 5 kg collar is attached to a spring of spring constant 500 N m^{-1}. It slides without friction over a horizontal rod. The collar is displaced from its equilibrium position by 10 cm and released. The time period of oscillation is

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

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

C. πs

D. $2\pi s$

Answer: A

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5. In the question number 64, the maximum acceleration of the collar is

A. $5ms^{-2}$

B. $10ms^{-2}$

C. $15ms^{-2}$

D. $20ms^{-2}$

Answer: B

View Text Solution

6. A body of mass 20 g connected to a spring of spring constant k, executes simple harmonic motion with a frequency of $(5/\pi)$ Hz. The value of spring constant is

A. $4Nm^{-1}$

B. $3Nm^{-1}$

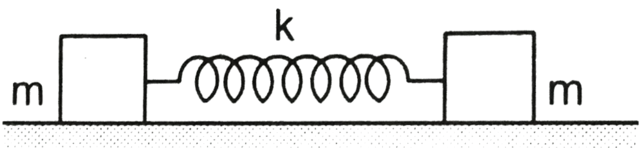
C. $2Nm^{-1}$

D. $5Nm^{-1}$

Answer: C

Watch Video Solution

7. Consider the situation shown in figure. Show that if the blocks are displaced slightly in opposite directions and released, they will execute simple harmonic motion. Calculate the time period.



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

B. $2\pi\sqrt{\frac{m}{2k}}$

C. $2\pi\sqrt{\frac{m}{4k}}$

D. $2\pi\sqrt{\frac{2m}{k}}$

Answer: B

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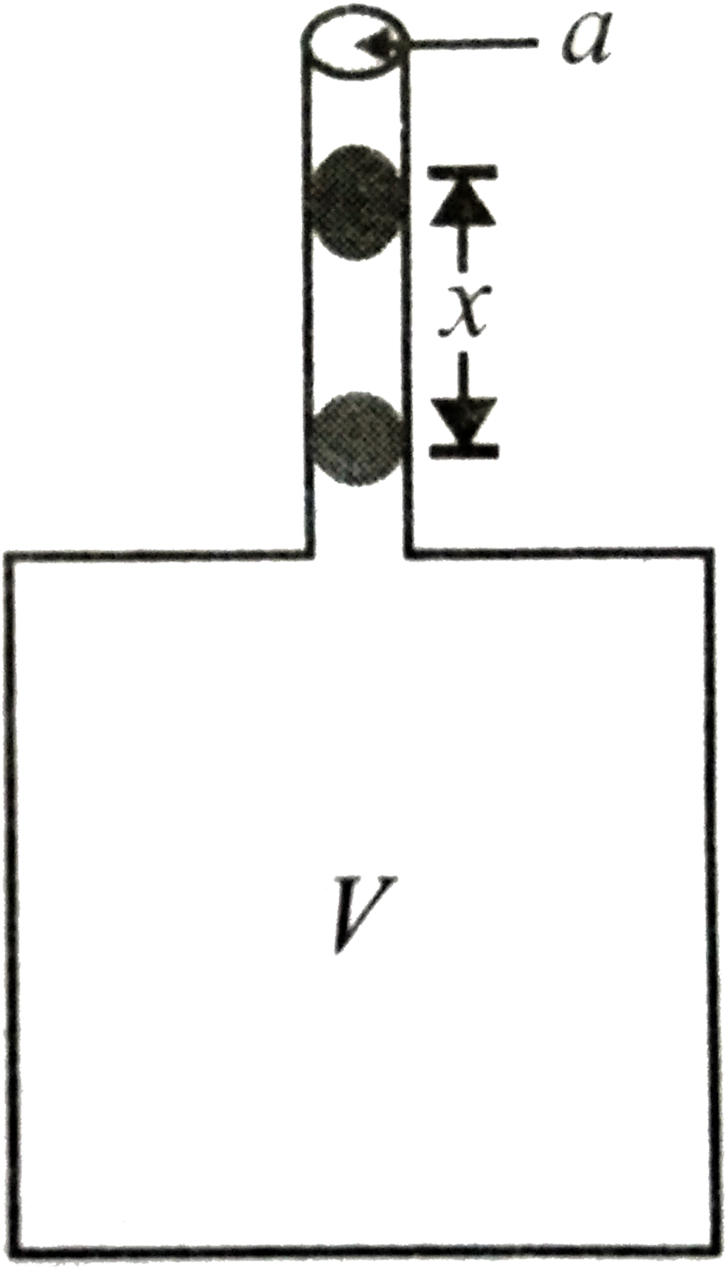
8. An air chamber of volume V has a neck area of cross section A into which a ball of mass m just fits and can move up and down without any friction, figure. Show that when the ball is pressed down a little and released, it executes SHM. Obtain an expression for the time period of oscillations assuming pressure volume variations of air to be isothermal.



A. $T = 2\pi\sqrt{\frac{Ba^2}{mV}}$

B. $T = 2\pi\sqrt{\frac{BV}{ma^2}}$

C. $T = 2\pi\sqrt{\frac{mB}{Va^2}}$

D. $T = 2\pi\sqrt{\frac{mV}{Ba^2}}$

Answer: D

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9. A spring balance has a scale that reads from 0 to 50 kg. the length of the scale is 20 cm. a block of mass m is suspended from this balance, when displaced and released, it oscillates with a period 0.5 s. the value of m is (Take $g = 10ms^{-2}$)

A. 8 kg

B. 12 kg

C. 16 kg

D. 20 kg

Answer: C

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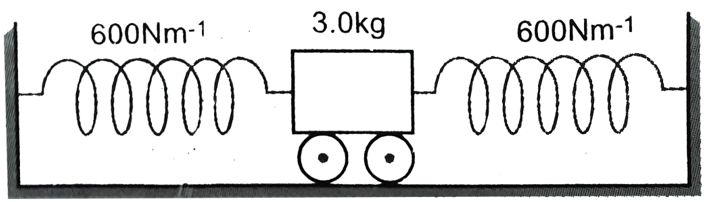
10. A trolley of mass 3.0kg is connected to two identical spring each of force constant $600Nm^{-1}$ as shown in figure. If the trolley is displaced from its equilibrium position by 5.0 cm and released, what is

(a) the period of ensuing oscillation?

(b) the maximum speed of trolley?

(c) How much is the total energy dissipated as heat by the time the trolley comes to rest due to damping forces?



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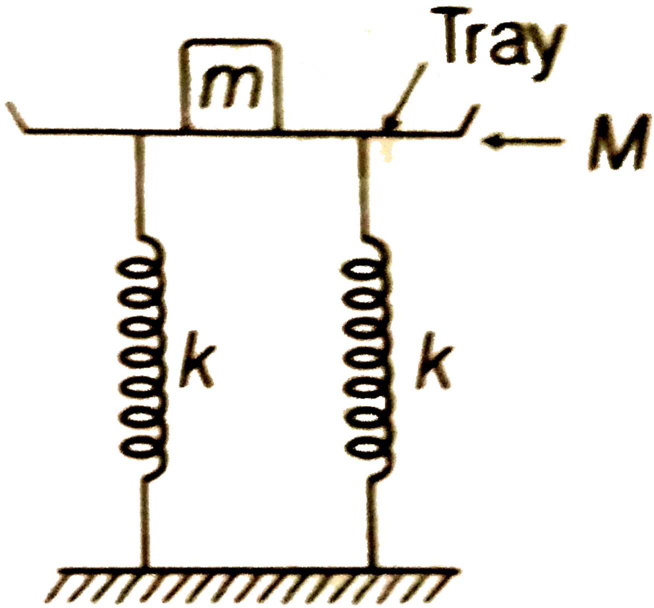

11.

A tray of mass M=10kg is supported on two identical springs, each of spring constant k, as shown in figure, when the tray is depressed a little and released, it executes simple harmonic motion of period 1.5 s. when a block of mass m is placed on the tray, the speed of oscillation becomes 3 s. the value of m is

A. 10 kg

B. 20 kg

C. 30 kg

D. 40 kg

Answer: C

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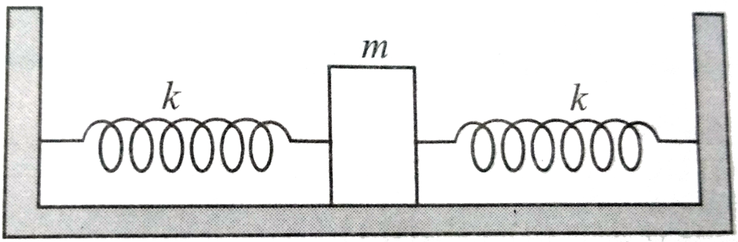
12. Two identical springs of spring constant k are attached to a block of mass m and to fixed supports as shown in the figure. The time period of oscillation is



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

B. $2\pi\sqrt{\frac{m}{2k}}$

C. $2\pi\sqrt{\frac{2m}{k}}$

D. $\pi\sqrt{\frac{m}{2k}}$

Answer: B

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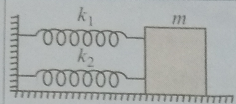
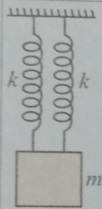
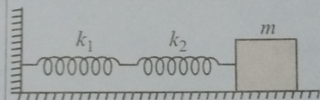
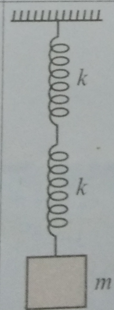
13. Match the column I with column II.

	Column I		Column II
(A)		(p)	$T = 2\pi\sqrt{\frac{m(k_1+k_2)}{k_1k_2}}$
(B)		(q)	$T = 2\pi\sqrt{\frac{2m}{k}}$
(C)		(r)	$T = 2\pi\sqrt{\frac{m}{2\,k}}$
(D)		(s)	$T = 2\pi\sqrt{\frac{m}{k_1+k_2}}$

A. A-p,B-q,C-s,D-r

B. A-s,B-r,C-p,D-q

C. A-r,B-p,C-s,D-q

D. A-p,B-r,C-q,D-s

Answer: B

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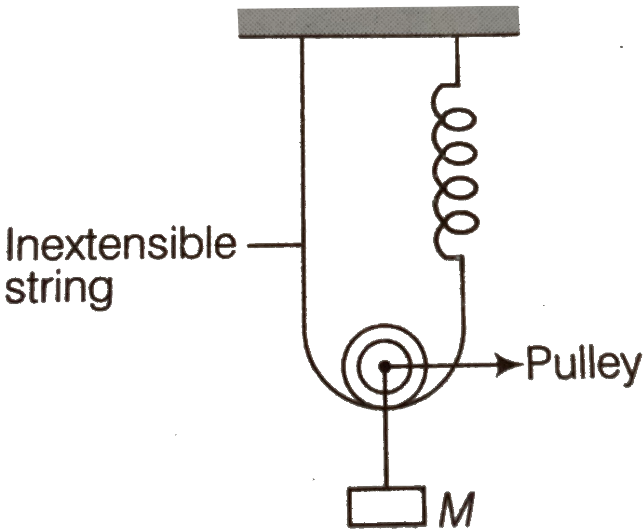
14. Find the time period of mass M when displaced from its equilibrium position and then released for the system shown in figure.



A. $2\pi\sqrt{\frac{M}{k}}$

B. $2\pi\sqrt{\frac{m}{2k}}$

C. $2\pi\sqrt{\frac{m}{4k}}$

D. $2\pi\sqrt{\frac{2M}{k}}$

Answer: C

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15. To show that a simple pendulum executes simple harmonic motion, it is necessary to assume that

A. length of the pendulum is small

B. mass of the pendulum is small

C. acceleration due to gravity is small

D. amplitude of the oscillation is small

Answer: D

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16. Motion of an oscillating liquid column in a U-tube is

A. periodic but not simple harmonic.

B. non-periodic

C. simple harmonic and time period is independent of the density of the liquid.

D. simple harmonic and time period is directly proportional to the density of the liquid.

Answer: C

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17. What is the effect on the time period of a simple pendulum if the mass off the bob is doubled?

A. Halved

B. Double

C. Becomes 8 times

D. No effects

Answer: D

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18. The acceleration due to gravity on the surface of the moon is $1.7ms^{-2}$. What is the time perioid of a simple pendulum on the surface of the moon, if its time period on the surface of earth is $3.5s$? Take $g = 9.8ms^{-2}$ on the surface of the earth.

A. 4.4 s

B. 8.4 s

C. 16.8 s

D.

Answer: C

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19. Consider a pair of identical pendulums, which oscillate with equal amplitude independently such that when one pendulum is at its extreme position making an angle of 2° to the right with the vertical , the other pendulum makes an angle of 1° to the left of the vertical. What is the phase difference between the pendulums?

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

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

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

D. π

Answer: B

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20. Two pendulums differ in lengths by $22cm$. They oscillate at the same place so that one of them makes 30 oscillations and the other makes 36 oscillations during the same time. The length (in cm) of the pendulum are :

A. 72 and 50

B. 60 and 38

C. 50 and 28

D. 80 and 58

Answer: A

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21. The time period of a simple pendulum on the surface of the earth is 4s. Its time period on the surface of the moon is

A. 4s

B. 8s

C. 10s

D. 12s

Answer: C

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22. A disc of radius R=10 cm oscillates as a physical pendulum about an axis perpendicular to the plane of the disc at a distance r from its centre. If $r = \frac{R}{4}$, the approximate period of oscillation is (Take $g = 10ms^{-2}$)

A. 0.84 s

B. 0.94 s

C. 1.26 s

D. 1.42 s

Answer: B

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23. A simple pendulum is oscillating in a stationery lift. When the lift falls freely, the frequency of oscillations of the pendulum is

A. zero

B. v

C. $2v$

D. infinite

Answer: A

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24. A simple pendulum of length l and having a bob of mass M is suspended ina car. The car is moving on a circular track of radius R with a uniform speed v. If the pendulum makes small oscillations in a radial direction about its equilibrium, what will be its time period ?

A. $T = 2\pi\sqrt{\frac{L}{g}}$

B. $T = 2\pi\sqrt{\frac{L}{\sqrt{g^2 + \frac{v^4}{R^2}}}}$

C. $T = 2\pi\sqrt{\frac{L}{\sqrt{g^2 + \frac{v^2}{R}}}}$

D. $T = 2\pi\sqrt{\frac{L}{g^2 - \frac{v^4}{R^2}}}$

Answer: B

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25. A simple pendulum executing SHM with a period of 6 s between two extreme positions B and C about a point O. if the length of the arc BC is 10 cm, how long will the pendulum take the move from position C to a position D towards O exactly midway between C and O?

A. 0.5 s

B. 1 s

C. 1.5 s

D. 3 s

Answer: B

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26. The length of a second's pendulum on the surface of Earth in 1m. What will be the length of a second's pendulum on the moon?

A. $\frac{1}{6}$m

B. 1m

C. $\frac{1}{36}m$

D. 36 m

Answer: A

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27. What is the length of a simple pendulum which ticks second?

A. 0.5 m

B. 1 m

C. 1.5 m

D. 2 m

Answer: B

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

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

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

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

Answer: C

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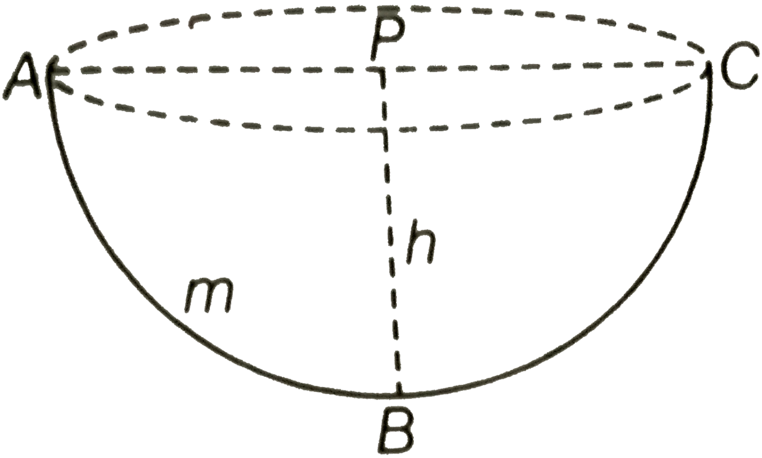
29. A sphere fo mass m makes SHM in a hemispherical bowl ABC and it moves from A to C and back to A via ABC, so that PB = h. If acceleration due to gravity is g, the speed of the ball when it just crosses the point

B is



A. $2gh$

B. mgh

C. $\sqrt{2gh}$

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

Answer: C

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Damped Simple Harmonic Motion

1. A particle oscillating under a force $\overrightarrow{F} = -k\overrightarrow{x} - b\overrightarrow{v}$ is a (k and b are constants)

A. simple harmonic oscillator

B. linear oscillator

C. damped osillator

D. forced oscillator

Answer: C

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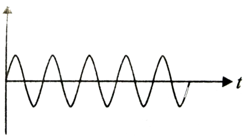
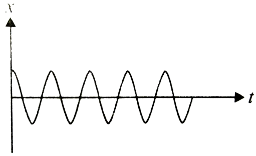
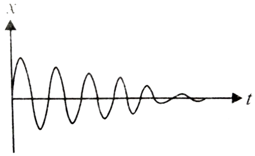
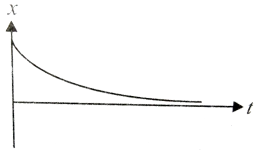
2. Which of the following displacement-time graphs represent damped harmonic oscillation?

A. 

B. 

C. 

D. 

Answer: C

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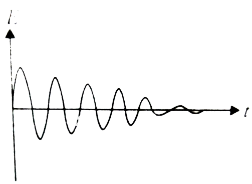
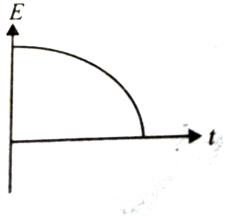
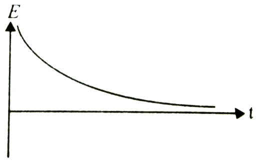
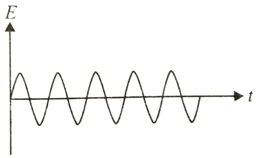
3. Which of the following energy-time graphs represents dajmped harmonic oscillator?

A. 

B. 

C. 

D. 

Answer: C

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4. A block of mass 200 g executing SHM under the influence of a spring of spring constant $k = 90Nm^{-1}$ and a damping constant $b = 40gs^{-1}$. The time elapsed for its amplitude to drop to half of its initial value is (Given, ln $(1/2) = -0.693$)

A. 7s

B. 9s

C. 4s

D. 11s

Answer: A

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5. In the question number 93, the time elapsed for its mechanical energy to drop half of its initial value is

A. 2.5 s

B. 3.5 s

C. 4.5 s

D. 7.5 s

Answer: B

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Forced Oscillation And Resonance

1. In case of force oscillations of a body

A. driving force is constant throughout.

B. driving force is to be applied only momentarily

C. driving force has to be periodic and continuous

D. driving force is not required.

Answer: C

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2. Resonance is an example of

A. forced oscillation

B. damped oscillation

C. free oscillation

D. none of these

Answer: A

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3. In case of a forced vibration, the resonance wave becomes very sharp when the

A. restroring force is small

B. damping force is small

C. quality factor is small

D. applied periodic force is small.

Answer: B

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4. At resonance, the amplitude of forced oscillations is

A. minimum

B. maximum

C. zero

D. none of these

Answer: B

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5. Which of the following statements is correct?

A. Every periodic motion is simple harmonic motion.

B. In simple harmonic motion the period is proportional to the square of the amplitude of oscillation.

C. In simple harmonic motion the phase constant depends on initial condition

D. The resonance frequency of a driven oscillator depends on the damping.

Answer: C

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6. A particle of mass (m) is attached to a spring (of spring constant k) and has a natural angular frequency ω_0. An external force $R(t)$

proportional to $\cos \omega t (\omega \neq \omega_0)$ is applied to the oscillator. The time displacement of the oscillator will be proportional to.

A. $\dfrac{m}{\omega_0^2 - \omega^2}$

B. $\dfrac{1}{m\left(\omega_0^2 - \omega^2\right)}$

C. $\dfrac{1}{m\left(\omega_0^2 + \omega^2\right)}$

D. $\dfrac{m}{\omega_0^2 + \omega^2}$

Answer: B

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Ncert Exemplar

1. The displacement of a particle is represented by the equation $y = 3\cos\left(\frac{\pi}{4} - 2\omega t\right)$.

The motion of the particle is

A. simple harmonic with period $\frac{2\pi}{\omega}$

B. simple harmonic with period $\frac{\pi}{\omega}$

C. periodic but not simplee harmonic

D. non-periodic.

Answer: B

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2. The displacement of a particle is represented by the equation $y = \sin^3 \omega t$. The motion is

A. non-periodic

B. periodic but not simple harmonic

C. simple harmonic with period $2\pi / \omega$

D. simple harmonic with period π / ω

Answer: B

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3. The ralation between acceleration and displacement of four particles are given below

which one of the particles is executing simple harmonic motion?

A. $a_x = +2x$

B. $a_x = +2x^2$

C. $a_x = -2x^2$

D. $a_x = -2x$

Answer: D

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4. Motion of an oscillating liquid column in a U-tube is

A. periodic but not simple harmonic.

B. non-periodic

C. simple harmonic and time period is independent of the density of the liquid.

D. simple harmonic and time period is directly proportional to the density of the liquid.

Answer: C

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5. A particle is acted simultaneously by mutually perpendicular simple harmonic motions x=a cosωt and $y = a \sin \omega t$. The trajectory of motion of the particle will be

A. an ellipse

B. a parabola

C. a circle

D. a straight line.

Answer: C

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6. The displacement of a particle varies with time according to the relation $y = a\sin\omega t + b\cos\omega t$.

A. The motion is oscillatory but not SHM.

B. The motion is SHM with amplitude $a + b$.

C. The motion is SHM with amplitude $a^2 + b^2$

D. The motion is SHM with amplitude $\sqrt{a^2 + b^2}$.

Answer: D

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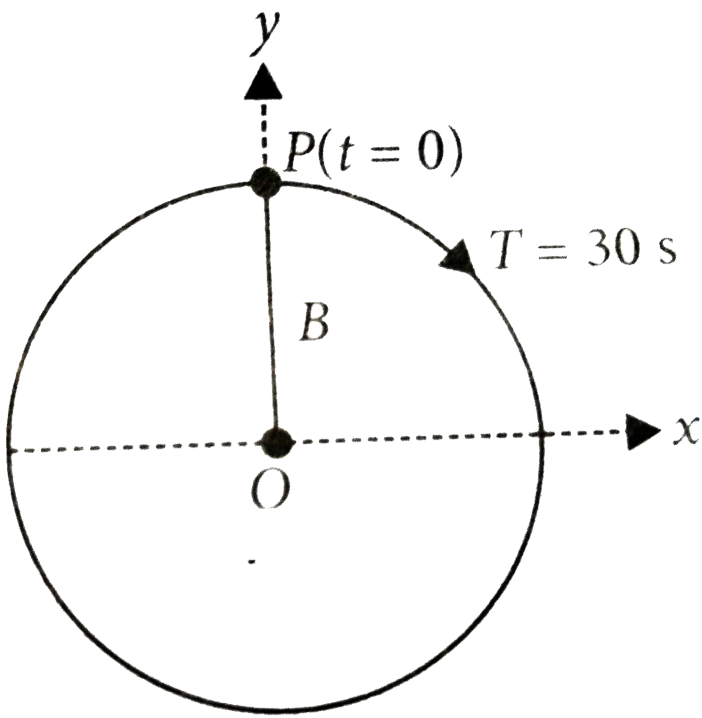
7. Figure shows the circular motion of a particle. The radius of the circle, the period, same of revolution and the initial position are indicated on the figure. The simple harmonic motion of the x-projection of the radius vector the rotating particle P is



A. $x(t) = B\sin\left(\frac{2\pi}{30}t\right)$

B. $x(t) = B\cos\left(\frac{\pi}{15}t\right)$

C. $x(t) = B\sin\left(\frac{\pi}{15}t + \frac{\pi}{2}\right)$

D. $x(t) = B\cos\left(\frac{\pi}{15}t + \frac{\pi}{2}\right)$

Answer: A

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8. The equation of motion of a particle is $x = a\cos(\alpha t)^2$. The motion is

A. periodic but not oscillatory

B. periodic and oscillatory

C. oscillatory but not periodic

D. Neither periodic nor oscillatory.

Answer: C

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9. A particle executing SHM has a maximum speed of 30 cm s^{-1} and a maximum acceleration of 60 cm s^{-1}. The period of oscillation is

A. πs

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

C. $2\pi s$

D. $\frac{\pi}{t}s$

Answer: A

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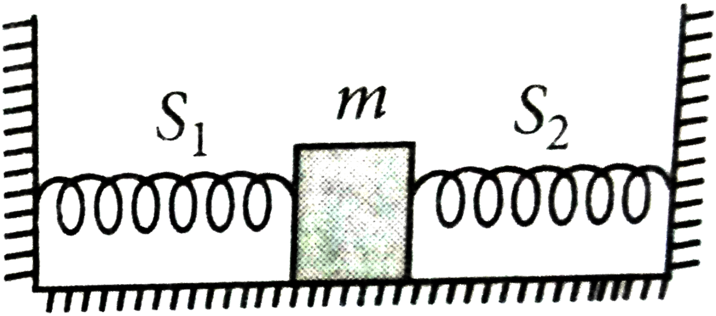
10. 

When a mass m is connected individually to two springs S_1 and S_2, the oscillation frequencies are υ_1 and υ_2. If the same mass is attached to the two springs as shown in figure, the oscillation frequency would be

A. $\upsilon_1 + \upsilon_2$

B. $\sqrt{\upsilon_1^2 + \upsilon_2^2}$

C. $\left(\frac{1}{\upsilon_1} + \frac{1}{\upsilon_2}\right)^{-1}$

D. $\sqrt{\upsilon_1^2 - \upsilon_2^2}$

Answer: B

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Assertion And Reason

1. Assertion: The motion of the earth around the sun is perriodic but not oscillatory.

Reason: Oscillatory motion is necessarily periodic but periodic motion is not necessarily oscillatory.

A. If both assertion and reson are true and reason is the correct explanation of assertion

B. If both assertion and reason are true but reason is not the correct explanation of assertion.

C. If assertion is true but reason is false.

D. If both assertion and reason are false.

Answer: B

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2. Assertion: A combination of two simple harmonic motions with a arbitrary amplitudes and phases is not necessarily periodic.

Reason: A periodic motion can always be expressed as a sum of infinite number of harmonic motions with appropriate amplitudes.

A. If both assertion and reson are true and reason is the correct explanation of assertion

B. If both assertion and reason are true but reason is not the correct explanation of assertion.

C. If assertion is true but reason is false.

D. If both assertion and reason are false.

Answer: B

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3. Assertion: The motion of a simple pendulum is simple harmoni for all angular displacement.

Reason: Motion of simple pendulum is independent of the angular displacement.

A. If both assertion and reson are true and reason is the correct explanation of assertion

B. If both assertion and reason are true but reason is not the correct explanation of assertion.

C. If assertion is true but reason is false.

D. If both assertion and reason are false.

Answer: D

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4. Assertion: Simple harmonic motion is the projection of uniform circular motion on the diameter of the circle in which the latter motion occurs.

Reason: Simple harmonic motion is a uniform motion.

A. If both assertion and reson are true and reason is the correct explanation of assertion

B. If both assertion and reason are true but reason is not the correct explanation of assertion.

C. If assertion is true but reason is false.

D. If both assertion and reason are false.

Answer: C

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5. Assertion: The graph of total energy of a particle in SHM with respect to position is a straight line with zero slope.

Reason: Total energy of particle in SHM remains constant throughout its motion.

A. If both assertion and reson are true and reason is the correct explanation of assertion

B. If both assertion and reason are true but reason is not the correct explanation of assertion.

C. If assertion is true but reason is false.

D. If both assertion and reason are false.

Answer: A

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6. Assertion: If the amplitude of a simple harmonic oscillator is doubled, its total energy becomes double.

Reason: The toal energy is directly proportional to the amplitude of vibration of the harmonic oscillator.

A. If both assertion and reson are true and reason is the correct explanation of assertion

B. If both assertion and reason are true but reason is not the correct explanation of assertion.

C. If assertion is true but reason is false.

D. If both assertion and reason are false.

Answer: D

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7. Assertion: Every periodic motion is not simple harmonic motion.

Reason: The motion governed by the force law F=-kx is simple harmonic.

A. If both assertion and reson are true and reason is the correct explanation of assertion

B. If both assertion and reason are true but reason is not the correct explanation of assertion.

C. If assertion is true but reason is false.

D. If both assertion and reason are false.

Answer: A

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8. Assertion: A block of small mass m attached to a stiff spring will have large oscillation frequency.

Reason: Stiff springs have high value of spring constant.

A. If both assertion and reson are true and reason is the correct explanation of assertion

B. If both assertion and reason are true but reason is not the correct explanation of assertion.

C. If assertion is true but reason is false.

D. If both assertion and reason are false.

Answer: A

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9. Assertion: In damped oscillation, the energy of the system is dissipated continuously.

Reason: For small damping, the oscillations remain approximately periodic.

A. If both assertion and reson are true and reason is the correct explanation of assertion

B. If both assertion and reason are true but reason is not the correct explanation of assertion.

C. If assertion is true but reason is false.

D. If both assertion and reason are false.

Answer: B

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10. Assertion: In forced oscillations, th steady state motion of the particle is simpl harmonic.

Reason: The frequency of particle after the free oscillations die out, is the natural frequency of the particle.

A. If both assertion and reson are true and reason is the correct explanation of assertion

B. If both assertion and reason are true but reason is not the correct explanation of assertion.

C. If assertion is true but reason is false.

D. If both assertion and reason are false.

Answer: C

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11. Assertion: An earthquake will not cause uniform damage to all building in an affected area, even if they are built with the same strength and materials.

Reason: The one with its natural frequency close to the frequency of seismic wave is likely to be damaged less.

A. If both assertion and reson are true and reason is the correct explanation of assertion

B. If both assertion and reason are true but reason is not the correct explanation of assertion.

C. If assertion is true but reason is false.

D. If both assertion and reason are false.

Answer: C

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12. Assertion: A child in a garden swing periodically presses his feet against the ground to maintain the oscillations.

Reason: All free oscillations eventually die out because of the ever present damping force.

A. If both assertion and reson are true and reason is the correct explanation of assertion

B. If both assertion and reason are true but reason is not the correct explanation of assertion.

C. If assertion is true but reason is false.

D. If both assertion and reason are false.

Answer: A

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13. Assertion: The skill in swinging to greater heights lies in the synchronisation of the rhythm of pushing against the ground with the natural frequency of the swing.

Reason: The phenomenon behind this is resonance.

A. If both assertion and reson are true and reason is the correct explanation of assertion

B. If both assertion and reason are true but reason is not the correct explanation of assertion.

C. If assertion is true but reason is false.

D. If both assertion and reason are false.

Answer: A

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14. Assertion: In the ideal case of zero damping, the amplitude of simpl harmonic motion at resonance is is infinite.

Reason: All real sysmtems have some damping.

A. If both assertion and reson are true and reason is the correct explanation of assertion

B. If both assertion and reason are true but reason is not the correct explanation of assertion.

C. If assertion is true but reason is false.

D. If both assertion and reason are false.

Answer: B

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15. Assertion : The amplitude of oscillation can never be infinite. Reason : The energy of oscillator is continuously dissipated.

A. If both assertion and reson are true and reason is the correct explanation of assertion

B. If both assertion and reason are true but reason is not the correct explanation of assertion.

C. If assertion is true but reason is false.

D. If both assertion and reason are false.

Answer: A

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