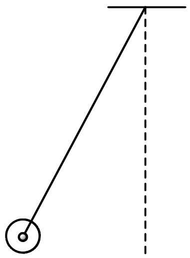
GPLUS EDUCATION

Date :
Time : **PHYSICS**
Marks :

OSCILLATIONS

Single Correct Answer Type

1. The minimum phase difference between two simple harmonic oscillations,
   $y_1 = \frac{1}{2}\sin\omega t + \frac{\sqrt{3}}{2}\cos\omega t$
   $y_2 = \sin\omega t + \cos\omega t$, is
   a) $\frac{7\pi}{12}$ b) $\frac{\pi}{12}$ c) $-\frac{\pi}{6}$ d) $\frac{\pi}{6}$
2. A mass m is vertically suspended from a spring of negligible mass; the system oscillates with a frequency n. What will be the frequency of the system if a mass 4 m is suspended from the same spring
   a) $n/4$ b) $4n$ c) $n/2$ d) $2n$
3. Two simple pendulums first of bob mass M_1 and length L_1 second of bob mass M_2 and length L_2. $M_1 = M_2$ and $L_1 = 2L_2$. If the vibrational energy of both is same. Then which is correct
   a) Amplitude of B greater than A b) Amplitude of B smaller than A
   c) Amplitude will be same d) None of these
4. Two particles P and Q start from origin and execute Simple Harmonic Motion along X-axis with same amplitude but with period 3 *seconds* and 6 *seconds* respectively. The ratio of the velocities of the velocities of P and Q when they meet is
   a) 1 :2 b) 2 :1 c) 2 :3 d) 3 :2
5. A mass m is suspended from a spring of length l and force constant K. The frequency of vibration of the mass is f_1. The spring is cut into two equal parts and the same mass is suspended from one of the parts. The new frequency of vibration of mass is f_2. Which of the following relations between the frequencies is correct
   a) $f_1 = \sqrt{2}f_2$ b) $f_1 = f_2$ c) $f_1 = 2f_2$ d) $f_2 = \sqrt{2}f_1$
6. A mass m is suspended from the two coupled springs connected in series. The force constant for springs are K_1 and K_2. The time period of the suspended mass will be
   a) $T = 2\pi\sqrt{\left(\frac{m}{K_1 + K_2}\right)}$ b) $T = 2\pi\sqrt{\left(\frac{2m}{K_1 + K_2}\right)}$
   c) $T = 2\pi\sqrt{\left(\frac{m(K_1 + K_2)}{K_1K_2}\right)}$ d) $T = 2\pi\sqrt{\left(\frac{mK_1K_2}{K_1 + K_2}\right)}$
7. The total energy of a particle, executing simple harmonic motion is
   Where x is the displacement from the mean position.
   a) $\propto x$ b) $\propto x^2$ c) Independent of x d) $\propto x^{1/2}$
8. A metal rod of length L and mass m is pivoted at one end. A thin disk of mass M and radius $R(< L)$ is attached at its centre to the free end of the rod. Consider two ways the disc is attached **case *A*-** the disc is not free to rotate about its centre and **case *B*** – the disc is free to rotate about its centre. The rod-disc system performs SHM in vertical plane after being released from the same displaced position. Which of the following statement(s) is/are true?



a) Restoring torque in case A=Restoring torque in case B
b) Restoring torque in case A<Restoring torque in case B
c) Angular frequency for case A<Angular frequency for case B
d) Angular frequency for case A<Angular frequency for case B

9. There is a simple pendulum hanging from the ceiling of a lift. When the lift is stand still, the time period of the pendulum is T. If the resultant acceleration becomes g/4, then the new time period of the pendulum is

a) 0.8 T b) 0.25 T c) 2 T d) 4 T

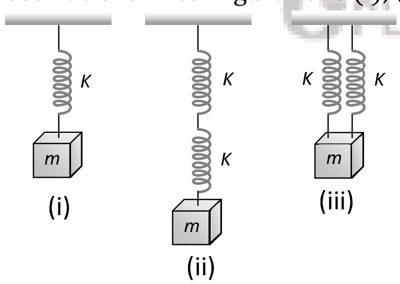
10. If a body is executing simple harmonic motion then

a) At extreme positions, the total energy is zero
b) At equilibrium position, the total energy is in the form of potential energy
c) At equilibrium position, the total energy is in the form of kinetic energy
d) At extreme position, the total energy is infinite

11. A particle moves in $x-y$ plane according to rule $x = a\sin\omega t$ and $y = a\cos\omega t$. The particle follows

a) An elliptical path
b) A circular path
c) A parabolic path
d) A straight line path inclined equally to x and $y-axis$

12. Five identical springs are used in the following three configurations. The time periods of vertical oscillations in configurations (i), (ii) and (iii) are in the ratio



a) $1 : \sqrt{2} : \frac{1}{\sqrt{2}}$ b) $2 : \sqrt{2} : \frac{1}{\sqrt{2}}$ c) $\frac{1}{\sqrt{2}} : 2 : 1$ d) $2 : \frac{1}{\sqrt{2}} : 1$

13. A simple pendulum has time period T. The bob is given negative charge and surface below it is given positive charge. The new time period will be

a) Less than T b) Greater than T c) Equal to T d) Infinite

14. A particle of mass 200 g executes SHM. The restoring force is provided by a spring of force constant 80 N/m. The time period of oscillation is

a) 0.31 s b) 0.15 s c) 0.05 s d) 0.02 s

15. The equation of a damped simple harmonic motion is $m\frac{d^2x}{dt^2} + b\frac{dx}{dt} + kx = 0$. Then the angular frequency of oscillation is

a) $\omega = \left(\frac{k}{m} - \frac{b^2}{4m^2}\right)^{1/2}$ b) $\omega = \left(\frac{k}{m} - \frac{b}{4m}\right)^{1/2}$ c) $\omega = \left(\frac{k}{m} - \frac{b^2}{4m}\right)^{1/2}$ d) $\omega = \left(\frac{k}{m} - \frac{b^2}{4m^2}\right)$

16. The time period of a simple pendulum in a lift descending with constant acceleration g is

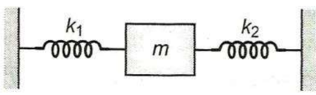
a) $T = 2\pi\sqrt{\frac{l}{g}}$ b) $T = 2\pi\sqrt{\frac{l}{2g}}$ c) Zero d) Infinite

17. Displacement between maximum potential energy position and maximum kinetic energy position for a particle executing S.H.M. is
a) $-a$ b) $+a$ c) $\pm a$ d) $\pm a/4$

18. The graph between the time period and the length of a simple pendulum is
a) Straight line b) Curve c) Ellipse d) Parabola

19. The maximum velocity and the maximum acceleration of a body moving in a simple harmonic oscillator are 2 m/s and 4 m/s^2. Then angular velocity will be
a) 3 rad/s b) 0.5 rad/s c) 1 rad/s d) 2 rad/s

20. Two springs, of force constants k_1 and k_2, are connected to a mass m as shown. The frequency of the mass is f. If both k_1 and k_2 are made four times their original values, the frequency of oscillation becomes



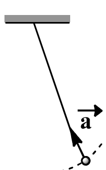
a) $f/2$ b) $f/4$ c) $4f$ d) $2f$

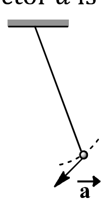
21. The motion of a particle executing S.H.M. is given by $x = 0.01 \sin 100\pi(t + .05)$, where x is in $metres$ and time is in seconds. The time period is
a) 0.01 s b) 0.02 s c) 0.1 s d) 0.2 s

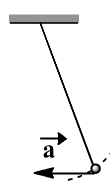
22. Two particles are executing simple harmonic motion of the same amplitude A and frequency ω along the x-axis. Their mean position is separated by distance $x_0 (x_0 > A)$. If the maximum separation between them is $(x_0 + A)$, the phase difference between their motions is
a) $\frac{\pi}{3}$ b) $\frac{\pi}{4}$ c) $\frac{\pi}{6}$ d) $\frac{\pi}{2}$

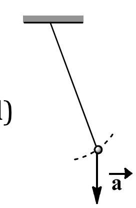
23. The amplitude of a damped oscillator becomes $\left(\frac{1}{3}\right)$ rd in 2 s. If its amplitude after 6 s is $\frac{1}{n}$ times the original amplitude, the value of n is
a) 3^2 b) $3\sqrt{2}$ c) $3\sqrt{3}$ d) 3^3

24. A simple pendulum is oscillating without damping. When the displacement of the bob is less than maximum, its acceleration vector $\vec{a}$ is correctly show in figure.

a) 

b) 

c) 

d) 

25. The pendulum bob has a speed of $3 ms^{-1}$ at its lowest position. The pendulum is 0.5 m long. The speed of the bob, when the length makes an angle of 60° to the vertical will be $(g = 10 ms^{-2})$
a) $\frac{1}{2} ms^{-1}$ b) $\frac{1}{3} ms^{-1}$ c) $3 ms^{-1}$ d) $2 ms^{-1}$

26. If a body oscillates at the angular frequency ω_d of the driving force, then the oscillations are called
a) Free oscillations b) Coupled oscillations
c) Forced oscillations d) Maintained oscillations

27. A horizontal platform with an object placed on it is executing SHM in the vertical direction. The amplitude of oscillation is $30.92 \times 10^{-3} m$. What must be the least period of these oscillations, so that the object is not detached from the platform?

a) 0.1256 s b) 0.1356 s c) 0.1456 s d) 0.1556 s

28. A uniform spring of force constant k is cut into two pieces, the lengths of which are in the ratio 1: 2. The ratio of the force constants of the shorter and longer piece is
a) 1 : 2 b) 2 : 1 c) 1 : 3 d) 2 : 3

29. The displacement x(in metre) of a particle in simple harmonic motion is related to time t(in second) as
$$x = 0.01 \cos\left(\pi t + \frac{\pi}{4}\right)$$
The frequency of the motion will be
a) 0.5 Hz b) 1.0 Hz c) $\frac{\pi}{2}$ Hz d) π Hz

30. How does time period of a pendulum very with length?
a) $\sqrt{l}$ b) $\sqrt{\frac{l}{2}}$ c) $\frac{1}{\sqrt{l}}$ d) $2l$

31. A particle, with restoring force proportional to displacement and resisting force proportional to velocity is subjected to a force.
$F = F_0 \sin \omega t$
If the amplitude of the particle is maximum for $\omega = \omega_1$ and the energy of the particle is maximum for $\omega = \omega_2$ then
a) $\omega_1 = \omega_0$ and $\omega_2 \neq \omega_0$ b) $\omega_1 = \omega_0$ and $\omega_2 = \omega_0$
c) $\omega_1 \neq \omega_0$ and $\omega_2 = \omega_0$ d) $\omega_1 \neq \omega_0$ and $\omega_2 \neq \omega_0$

32. To make the frequency double of a spring oscillator, we have to
a) Reduce the mass to one fourth b) Quardruple the mass
c) Double of mass d) Half of the mass

33. A simple pendulum is set up in a trolley which moves to the right with an acceleration a on a horizontal plane. Then the thread of the pendulum in the mean position makes an angle θ with the vertical
a) $\tan^{-1}\frac{a}{g}$ in the forward direction b) $\tan^{-1}\frac{a}{g}$ in the backward direction
c) $\tan^{-1}\frac{g}{a}$ in the backward direction d) $\tan^{-1}\frac{g}{a}$ in the forward direction

34. Time period of a simple pendulum of length l *is* T_1 and time period of a uniform rod of the same length l pivoted about one end and oscillating in a vertical plane is T_2. Amplitude of oscillations in both the cases is small. Then T_1/T_2 is
a) $\frac{1}{\sqrt{3}}$ b) 1 c) $\sqrt{\frac{4}{3}}$ d) $\sqrt{\frac{3}{2}}$

35. A piece of wood has dimensions a, b and c. Its relative density is d. It is floating in water such that the side c is vertical. It is now pushed down gently and released. The time period is
a) $T = 2\pi\sqrt{\left(\frac{abc}{g}\right)}$ b) $T = 2\pi\sqrt{\left(\frac{b\,a}{dg}\right)}$ c) $T = 2\pi\sqrt{\left(\frac{g}{dc}\right)}$ d) $T = 2\pi\sqrt{\left(\frac{a\,c}{g}\right)}$

36. A particle of mass m is executing oscillations about the origin on the x-axis. Its potential energy is $U(x) = k[x]^3$, where k is a positive constant. If the amplitude of oscillation is a, then its time period T is
a) Proportional to $\frac{1}{\sqrt{a}}$ b) Independent to a c) Proportional to $\sqrt{a}$ d) Proportional to $a^{3/2}$

37. A particle starts S.H.M. from the mean position. Its amplitude is A and time period is T. At the time when its speed is half of the maximum speed, its displacement y is
a) $\frac{A}{2}$ b) $\frac{A}{\sqrt{2}}$ c) $\frac{A\sqrt{3}}{2}$ d) $\frac{2A}{\sqrt{3}}$

38. A pendulum has time period T. If it is taken on to another planet having acceleration due to gravity half and mass 9 times that of the earth then its time period on the other planet will be

a) $\sqrt{T}$ b) T c) $T^{1/3}$ d) $\sqrt{2}$ T

39. A wooden cube (density of wood d) of slide l floats in a liquid of density ρ with its upper and lower surfaces horizontal. If the cube is pushed slightly down and released, its performs simple harmonics motion of period T, then T is equal

a) $2\pi\sqrt{\frac{l\rho}{(\rho-d)g}}$ b) $2\pi\sqrt{\frac{ld}{\rho g}}$ c) $2\pi\sqrt{\frac{l\rho}{dg}}$ d) $2\pi\sqrt{\frac{ld}{(\rho-d)g}}$

40. The displacement of a particle varies according to the relation $x = 4(\cos\pi t + \sin\pi t)$. The amplitude of the particle is

a) -4 b) 4 c) $4\sqrt{2}$ d) 8

41. The displacement y of a particle executing periodic motion is given by $y = 4\cos^2(t/2)\sin(1000t)$. This expression may be considered to be a result of the superposition of…….. independent harmonic motions

a) Two b) Three c) Four d) Five

42. A pendulum of length 1 m is released from $\theta = 60°$. The rate of change of speed of the bob at $\theta = 30°$ is $(g = 10\ ms^{-2})$

a) $10\ ms^{-2}$ b) $7.5\ ms^{-2}$ c) $5\ ms^{-2}$ d) $5\sqrt{3}\ ms^{-2}$

43. The displacement x (in *metres*) of a particle performing simple harmonic motion is related to time t (in *seconds*) as $x = 0.05\cos\left(4\pi t + \frac{\pi}{4}\right)$. The frequency of the motion will be

a) 0.5 Hz b) 1.0 Hz c) 1.5 Hz d) 2.0 Hz

44. Which one of the following statements is true for the speed v and the acceleration a of a particle executing simple harmonic motion

a) When v is maximum, a is maximum
b) Value of a is zero, whatever may be the value of v
c) When v is zero, a is zero
d) When v is maximum, a is zero

45. Two simple harmonic motions are represented by $y_1 = 4\sin(4\pi t + \frac{\pi}{2})$ and $y_2 = 3\cos(4\pi t)$. The resultant amplitude is

a) 7 b) 1 c) 5 d) $2 + \sqrt{3}$

46. A particle is moving in a circle with uniform speed. Its motion is

a) Periodic and simple harmonic
b) Periodic but no simple harmonic
c) A periodic
d) None of the above

47. The total energy of a simple harmonic oscillator is proportional to

a) Square root of displacement
b) Velocity
c) Frequency
d) Square of the amplitude

48. A block is resting on a piston which is moving vertically with SHM of period 1.0 s. At what amplitude of motion will the block and piston separate?

a) 0.2 m b) 0.25 m c) 0.3 m d) 0.35 m

49. 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) $a^2T^2 + 4\pi^2v^2$ b) $\frac{aT}{x}$ c) $aT + 2\pi v$ d) $\frac{aT}{v}$

50. A simple pendulum is suspended from the ceiling of a lift. When the lift is at rest its time period is T. With what acceleration should the lift be accelerated upwards in order to reduce its period to $T/2$? (g is acceleration due to gravity)

a) 2 g b) 3 g c) 4 g d) g

51. A hollow sphere is filled with water through the small hole in it. It is then hung by a long thread and made to oscillate. As the water slowly flow out of the hole at the bottom, the period of oscillation will

a) Continuously decrease b) Continuously increase
c) First decrease then increase d) First increase then decrease

52. Two simple harmonic motions are represented by

$$y_1 = 5[\sin 2\pi t + \sqrt{3}\cos 2\pi t]$$

and $$y_2 = 5\sin\left(2\pi t + \frac{\pi}{4}\right)$$

The ratio of their amplitudes is

a) 1: 1 b) 2: 1 c) 1: 3 d) $\sqrt{3}$: 1

53. Two simple pendulum of length 0.5 m and 20 m respectively are given small linear displacement in one direction at the same time. They will again be in the phase when the pendulum of shorter length has completed... oscillations.

a) 5 b) 1 c) 2 d) 3

54. While driving around a curve of 200 m radius the driver noted that pendulum in the car hangs at an angle of 15^0 to the vertical. The speedometer of the car reads (in ms^{-1})

a) 20 b) 23 c) 230 d) 236

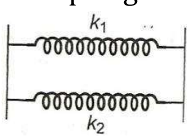
55. The equation of SHM is given by

$x = 3\sin 20\pi t + 4\cos 20\pi t$

Where x is in cm and t is I second. The amplitude is

a) 7 cm b) 4 cm c) 5 cm d) 3 cm

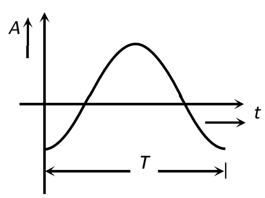
56. Two springs of force constant k_1 and k_2 are connected as shown.



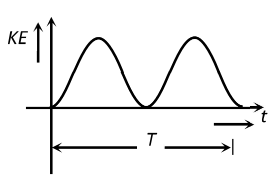
The effective spring constant k is

a) $k_1 + k_2$ b) $\frac{k_1}{k_2}$ c) k_1k_2 d) $2k_1k_2$

57. Acceleration A and time period T of a body in S.H.M. is given by a curve shown below. Then corresponding graph, between identic energy (K.E) and time t is correctly represented by



a)



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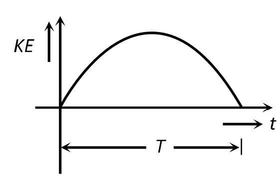
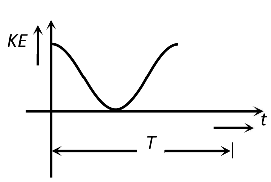
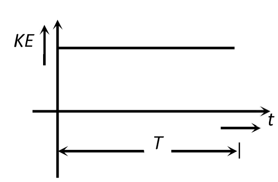


c)



d)



58. If a simple pendulum of length l has maximum angular displacement θ, then the maximum kinetic energy of bob of mass m is

a) $\frac{1}{2} \times \left(\frac{l}{g}\right)$ b) $\frac{1}{2} \times \frac{mg}{l}$

c) $mgl \times (1 - \cos\theta)$ d) $\frac{1}{2} \times mgl \sin\theta$

59. The displacement of two identical particle executing SHM are represented by equations $x_1 = 8\sin(10t + \pi/6)$ and $x_2 = 5\sin\omega t$.
For what value of ω energy of both the particle is same?
a) 4 units b) 8 units c) 16 units d) 20 units

60. The time period of a mass suspended from a spring is T. If the spring is cut into four equal parts and the same mass is suspended from one of the parts, then new time period will be
a) T b) $T/2$ c) $2T$ d) $T/4$

61. A simple pendulum of length l and mass (bob) m is suspended vertically. The string makes an angle θ with the vertical. The restoring force acting on the pendulum is
a) $mg\tan\theta$ b) $-mg\sin\theta$ c) $mg\sin\theta$ d) $-mg\cos\theta$

62. The bob of a pendulum of length l is pulled aside from its equilibrium position through an angle θ and then released. The bob will then pass through its equilibrium position with a speed v, where v equals
a) $\sqrt{2gl(1-\cos\theta)}$ b) $\sqrt{2gl(1+\sin\theta)}$
c) $\sqrt{2gl(1-\sin\theta)}$ d) $\sqrt{2gl(1+\cos\theta)}$

63. A particle executes harmonic motion with an angular velocity and maximum acceleration of 3.5 rad/s and 7.5 m/s^2 respectively. The amplitude of oscillation is
a) 0.28 m b) 0.36 m c) 0.53 m d) 0.61 m

64. The total energy of a particle executing SHM is 80 J. What is the potential energy when the particle is at a distance of 3/4 of amplitude from the mean position?
a) 60 J b) 10 J c) 40 J d) 45 J

65. The angular velocities of three bodies in simple harmonic motion are $\omega_1, \omega_2, \omega_3$ with their respective amplitudes as A_1, A_2, A_3,. If all the bodies have same mass and velocity, then
a) $A_1\omega_1 = A_2\omega_2 = A_3\omega_3$ b) $A_1\omega_1^2 = A_2\omega_2^2 = A_3\omega_3^2$
c) $A_1^2\omega_1 = A_2^2\omega_2 = A_3^2\omega_3$ d) $A_1^2\omega_1^2 = A_2^2\omega_2^2 = A^2$

66. Mark the wrong statement
a) All S.H.M.'s have fixed time period
b) All motions having same time period are S.H.M.
c) In S.H.M. total energy is proportional to square of amplitude
d) Phase constant of S.H.M. depends upon initial conditions

67. Consider the following statements :
The total energy of a particle executing simple harmonic motion depends on its
I. Amplitude
II. Period
III. Displacement
Of these statements
a) I and II are correct b) II and III are correct
c) I and III are correct d) I , II and III are correct

68. A simple pendulum of length L and mass of bob M is oscillating in a plane about a vertical line between angular limits $-\phi$ and $+\phi$. For an angular displacement $|\theta| < \phi$. the tension in the string and the velocity of the bob are T and v respectively. Which of the following relation holds good under the above conditions?
a) $T\cos\theta = Mg$ b) $T - Mg\cos\theta = Mv^2/L$
c) $T + Mg\cos\theta = Mv^2/L$ d) $T = Mg\cos\theta$

69. A point mass is subjected to two simultaneous sinusoidal displacements in x-direction, $x_1(t) = A\sin\omega t$

and $x_2(t) = A\sin\left(\omega t + \frac{2\pi}{3}\right)$. Adding a third sinusoidal displacement $x_3(t) = B\sin(\omega t + \phi)$ brings the mass to a complete rest. The values of B and ϕ

a) $\sqrt{2}A, \frac{3\pi}{4}$ b) $A, \frac{4\pi}{3}$ c) $\sqrt{3}A, \frac{5\pi}{6}$ d) $A, \frac{\pi}{3}$

70. What is constant in S.H.M.

a) Restoring force b) Kinetic energy c) Potential energy d) Periodic time

71. Two particles A and B of equal masses are suspended from two massless springs of spring constants k_1 and k_2, respectively. If the maximum velocities, during oscillations are equal, the ratio of amplitudes of A and B is

a) $\sqrt{k_1/k_2}$ b) k_1/k_2 c) $\sqrt{k_2/k_1}$ d) k_2/k_1

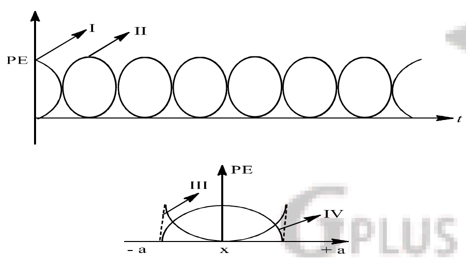
72. Time period of mass m suspended by a spring is T. If the spring is cut to one-half and made to oscillate by suspending double mass, the time period of the mass will be

a) $8T$ b) $4T$ c) $\frac{T}{2}$ d) T

73. The amplitude of SHM y
$= 2(\sin 5\pi t + \sqrt{2}\cos \pi t)$ is

a) 2 b) $2\sqrt{2}$ c) 4 d) $2\sqrt{3}$

74. For a particle executing SHM the displacement x is given by $x = A\cos\omega t$. Identify the graph which represents the variation of potential energy (PE) as a function of time t and displacement x.



a) I, III b) II, IV c) II, III d) I, IV

75. Identify correct statement among the following

a) The greater the mass of a pendulum bob, the shorter is its frequency of oscillation

b) A simple pendulum with a bob of mass M swings with an angular amplitude of 40°. When its angular amplitude is 20°, the tension in the string is less than $Mg\cos 20°$.

c) As the length of a simple pendulum is increased, the maximum velocity of its bob during its oscillation will decrease

d) The fractional change in the time period of a pendulum on changing the temperature is independent of the length of the pendulum

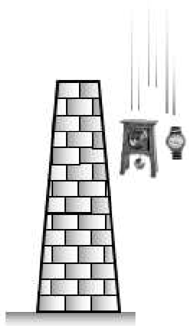
76. If a watch with a wound spring is taken on to the moon, it

a) Runs faster b) Runs slower c) Does not work d) Shown no change

77. A simple harmonic wave having an amplitude A and time period T is represented by the equation $y = 5\sin\pi(t+4)$m. Then the value of A in (metre) and T in (second) are

a) $A = 10, T = 2$ b) $A = 5, T = 1$ c) $A = 10, T = 1$ d) $A = 5, T = 2$

78. A man having a wrist watch and a pendulum clock rises on a TV tower. The wrist watch and pendulum clock by chance fall from the top of the tower. Then

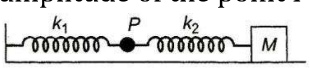


a) Both will keep correct time during the fall
b) Both will kept incorrect time during the fall
c) Wrist watch will keep correct time and clock will become fast
d) Clock will stop but wrist watch will function normally

79. A mass M is suspended from a light spring. An additional mass m added displaces the spring further by a distance x. Now the combined mass will oscillate on the spring with period

a) $T = 2\pi\sqrt{\frac{mg}{X(M+m)}}$ b) $T = 2\pi\sqrt{\frac{(M+m)X}{mg}}$
c) $T = \pi/2\sqrt{\frac{mg}{X(M+m)}}$ d) $T = 2\pi\sqrt{\frac{(M+m)}{mg}}$

80. The mass M shown in the figure oscillates in simple harmonic motion with amplitude A. The amplitude of the point P is



a) $\frac{k_1 A}{k_2}$ b) $\frac{k_2 A}{k_1}$ c) $\frac{k_1 A}{k_1+k_2}$ d) $\frac{k_2 A}{k_1+k_2}$

81. A particle has simple harmonic motion. The equation of its motion is $x = 5\sin\left(4t - \frac{\pi}{6}\right)$, where x is its displacement. If the displacement of the particle is 3 units, then it velocity is

a) $\frac{2\pi}{3}$ b) $\frac{5\pi}{6}$ c) 20 d) 16

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

a) Halved b) Doubled c) Becomes eight times d) No effect

83. A point performs simple harmonic oscillation of period T and the equation of motion is given by $x = a\sin(w + \pi/6)$. After the elapse of what fraction of the time period the velocity of the point will be equal to half its maximum velocity

a) $\frac{T}{3}$ b) $\frac{T}{12}$ c) $\frac{T}{8}$ d) $\frac{T}{6}$

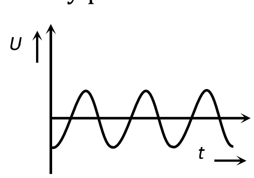
84. Two simple harmonic motions are represented by the equations

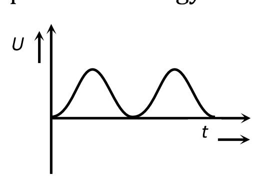
$y_1 = 0.1\sin\left(100\,\pi t + \frac{\pi}{3}\right)$ and $y_2 = 0.1\cos \pi t$.

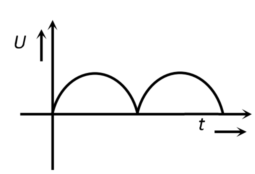
The phase difference of the velocity of particle 1, with respect to the velocity of particle 2 is

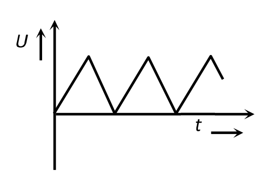
a) $\frac{-\pi}{6}$ b) $\frac{\pi}{3}$ c) $\frac{-\pi}{3}$ d) $\frac{\pi}{6}$

85. As a body performs S.H.M., its potential energy U. Varies with time as indicated in

a) 

b) 

c) 

d) 

86. Time period of a spring mass system is T. If this spring is cut into two parts whose lengths are in the ratio 1:3 and the same mass is attached to the longer part, the new time period will be

a) $\sqrt{\frac{3}{2}}\,T$ b) $\frac{T}{\sqrt{3}}$ c) $\frac{\sqrt{3}T}{2}$ d) $\sqrt{3}T$

87. A body of mass 4 kg hangs from a spring and oscillates with a period 0.5 s on the removel of the body, the spring is shortented by

a) 6.3 cm b) 0.63 cm c) 6.25 cm d) 6.3 cm

88. If the mass of an oscillator is numerically equal to its force constant, then the frequency is

a) π b) 2π c) $\frac{1}{\pi}$ d) $\frac{1}{2\pi}$

89. A particle is moving with constant angular velocity along the circumference of a circle. Which of the following statements is true

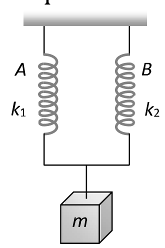
a) The particle so moving executes S.H.M.

b) The projection of the particle on any one of the diameters executes S.H.M.

c) The projection of the particle on any of the diameters executes S.H.M.

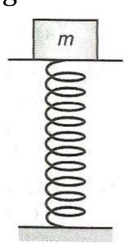
d) None of the above

90. A mass m is suspended by means of two coiled spring which have the same length in unstretched condition as in figure. Their force constant are k_1 and k_2 respectively. When set into vertical vibrations, the period will be



a) $2\pi\sqrt{\left(\frac{m}{k_1k_2}\right)}$ b) $2\pi\sqrt{m\left(\frac{k_1}{k_2}\right)}$ c) $2\pi\sqrt{\left(\frac{m}{k_1-k_2}\right)}$ d) $2\pi\sqrt{\left(\frac{m}{k_1+k_2}\right)}$

91. A mass of 2.0 kg is put on a flat pan attached to a vertical spring fixed on the ground as shown in the figure. The mass of the spring and the pan is negligible. When pressed slightly and released the mass executes slightly and released the mass executes a simple harmonic motion. The spring constant is 200 Nm^{-1}. What should be the minimum amplitude of the motion, so that the mass gets detached from the pan? (Take g=10 ms^{-2})



a) 8.0 cm b) 10.0 cm

c) Any value less than 12.0 cm d) 4.0 cm

92. The periodic time of a particle doing simple harmonic motion is 4 s. The taken by it to go from its mean position to half the maximum displacement (amplitude)

a) 2s b) 1s c) $\frac{2}{3}$s d) $\frac{1}{3}$s

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

a) $\frac{2\pi}{\alpha}$ b) $\frac{2\pi}{\sqrt{\alpha}}$ c) $2\pi\alpha$ d) $2\pi\sqrt{\alpha}$

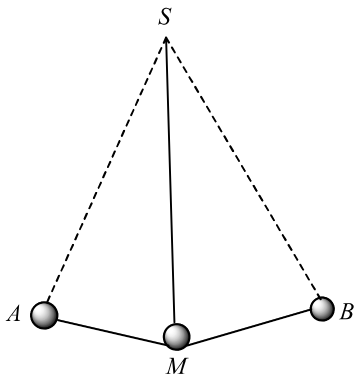
94. The ratio of frequencies of two pendulum are 2:3, then their lengths are in ratio

a) $\sqrt{2/3}$ b) $\sqrt{3/2}$ c) $4/9$ d) $9/4$

95. A particle executes a simple harmonic motion of time period T. Find the time taken by the particle to go directly from its mean position to half the amplitude

a) $T/2$ b) $T/4$ c) $T/8$ d) $T/12$

96. What is the velocity of the bob of a simple pendulum at its mean position, if it is able to rise to vertical height of 10 cm?
(g=9.8 ms^{-2})



a) 2.2 ms^{-1} b) 1.8 ms^{-1} c) 1.4 ms^{-1} d) 0.6 ms^{-1}

97. A particle is executing S.H.M. Then the graph of acceleration as a function of displacement is

a) A straight line b) A circle c) A ellipse d) A hyperbola

98. Two SHMs are represented by the equations $y_1 = 0.1\sin(100\pi t + \pi/3$ and $y_2 = 0.1cos100\pi t$. The phase difference of velocity of particle 2 with respect to the velocity of particle 1 is

a) $-\pi/3$ b) $\pi/6$ c) $-\pi/6$ d) $\pi/3$

99. Two identical springs are connected to mass m as shown ($k =$ spring constant). If the period of the configuration in (a) is 2 s, the period of the configuration in (b) is

a) $2\sqrt{2}$ s b) 1 s c) $\frac{1}{\sqrt{2}}$ s d) $\sqrt{2}$ s

100. If $< E >$ and $< U >$ denote the average kinetic and the average potential energies respectively of mass describing a simple harmonic motion, over one period, then the correct relation is

a) $< E >=< U >$ b) $< E >= 2 < U >$ c) $< E >= -2 < U >$ d) $< E >= -< U >$

101. A particle of mass m is executing oscillations about the origin on the x-axis with amplitude A. Its PE is given as $U_{(x)} = \alpha x^4$, where α is positive constant. The$x$- coordinate of mass where potential energy is one-third of the KE of particle, is

a) $\pm\frac{A}{\sqrt{3}}$ b) $\pm\frac{A}{\sqrt{2}}$ c) $\pm\frac{A}{3}$ d) $\pm\frac{A}{2}$

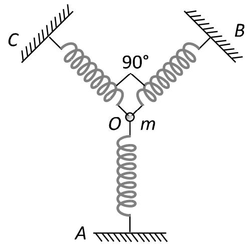
102. The motion of a particle executing SHM is given by$x = 0.01\sin 100p(t + 0.05)$, where x is in metre and time t is in second. The time period is

a) 0.2 s b) 0.1 s c) 0.02 s d) 0.01 s

103. The displacement of tow particles executing SHM are represented equations $y_1 = 2\sin(10t + \theta), y_2 = 3\cos 10t$. The phase difference between the velocity of these particles is

a) θ b) $-\theta$ c) $\theta + \pi/2$ d) $\theta - \pi/2$

104. A particle of mass m is attached to three identical springs A, B and C each of force constant k a shown in figure. If the particle of mass m is pushed slightly against the spring A and released then the time period of oscillations is



a) $2\pi\sqrt{\frac{2m}{k}}$ b) $2\pi\sqrt{\frac{m}{2k}}$ c) $2\pi\sqrt{\frac{m}{k}}$ d) $2\pi\sqrt{\frac{m}{3k}}$

105. Two pendulums of lengths 1m and 1.21m respectively start swinging together with same amplitude. The number of vibrations that will be executed by the longer pendulum before the two will swing together again are

a) 9 b) 10 c) 11 d) 12

106. The bob of a simple pendulum is a spherical hollow ball filled with water. A plugged hole near the bottom of the oscillating bob gets suddenly unplugged. During observation, till water is coming out, the time period of oscillation would

a) First increase and then decrease to the origin value
b) First decrease and then increase to the origin value
c) Remain unchanged
d) Increase towards a saturation value

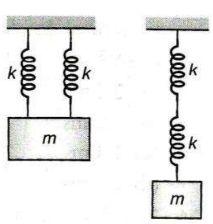
107. Two pendulums of length 1 m and 16 m start vibrating one behind the other from the same stand. At some instant, the two are in the mean position in the same phase. The time period of shorter pendulum is T. the minimum time after which the two threads of the pendulum will be one behind the other is?

a) $T/4$ b) $T/3$ c) $4T/3$ d) $4T$

108. 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:$a = A\cos(\omega t + \delta)$, then

a) $A = x_0, \delta = -\pi/4$ b) $A = x_0\omega^2, \delta = \pi/4$
c) $A = x_0\omega^2, \delta = -\pi/4$ d) $A = x_0\omega^2, \delta = 3\pi/4$

109. Two identical springs are connected in series and parallel as shown in the figure. If f_s and f_p are frequencies of arrangements, what is $\frac{f_s}{f_p}$?



a) 1:2 b) 2:1 c) 1:3 d) 3:1

110. Two masses m_1 and m_2 are suspended together by a massless spring of constant k. When the masses are in equilibrium, m_1 is removed without disturbing the system. Then the angular frequency of oscillation of m_2 *is*

a) $\sqrt{k/m_1}$ b) $\sqrt{k/m_2}$
c) $\sqrt{k/(m_1 + m_2)}$ d) $\sqrt{k/(m_1 - m_2)}$

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

a) Maximum at extreme position b) Maximum at mean position

c) Minimum at mean position
d) Same at all position

112. A particle executes simple harmonic motion with a time period of 16 s. At time $t = 2$ s, the particle crosses the mean position while at $t = 4$ s, velocity is 4 ms^{-1}. The amplitude of motion in metre is

a) $\sqrt{2}\pi$
b) $16\sqrt{2}\pi$
c) $24\sqrt{2}\pi$
d) $\frac{32\sqrt{2}}{\pi}$

113. If the displacement of a particle executing SHM is given by $y = 0.30\sin(220t + 0.64)$ in $metre$, then the frequency and maximum velocity of the particle is

a) $35\ Hz, 66\ m/s$
b) $45\ Hz, 66\ m/s$
c) $58\ Hz, 113\ m/s$
d) $35\ Hz, 132\ m/s$

114. The potential energy of a particle (U_x) executing SHM is given by

a) $U_x = \frac{k}{2}(x-a)^2$
b) $U_x = k_1x + k_2x^2 + k_3x^3$
c) $U_x = Ae^{-bx}$
d) $U_x =$ a constant

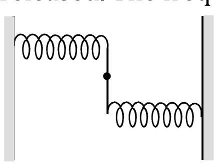
115. A body is moving in a room with a velocity of 20 m/s perpendicular to the two walls separated by 5 $meters$. There is no friction and the collisions with the walls are elastic. The motion of the body is

a) Not periodic
b) Periodic but not simple harmonic
c) Periodic and simple harmonic
d) Periodic with variable time period

116. The mass and diameter of a planet are twice those of earth. The period of oscillation of pendulum on this planet will be
(If it is a second's pendulum on earth)

a) $\frac{1}{\sqrt{2}}s$
b) $2\sqrt{2}\ s$
c) $2\ s$
d) $\frac{1}{2}s$

117. A uniform rod of length L and mass M is pivoted at the centre. Its two ends are attached to two springs of equal spring constant k. The springs are fixed to rigid supports as shown in the 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

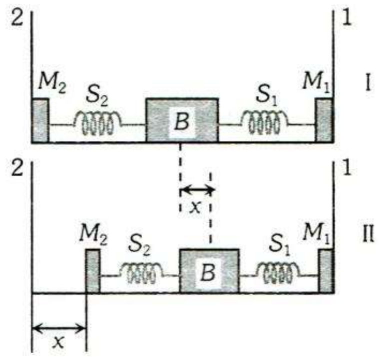


a) $\frac{1}{2\pi}\sqrt{\frac{2k}{M}}$
b) $\frac{1}{2\pi}\sqrt{\frac{k}{M}}$
c) $\frac{1}{2\pi}\sqrt{\frac{6k}{M}}$
d) $\frac{1}{2\pi}\sqrt{\frac{24k}{M}}$

118. The equation of a simple harmonic wave is given by $y = 6\sin 2\pi(2t - 0.1x)$, where x and y are in mm and t is in seconds. The phase difference between two particles 2 mm apart at any instant is

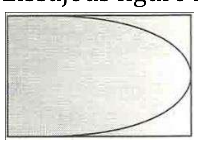
a) 54°
b) 72°
c) 18°
d) 36°

119. A block (B) is attached to two unstretched springs S_1 and S_2 with spring constants k and 4 k, respectively (see figure I). The other ends are attached to identical supports M_1 and M_2 not attached to the walls. The springs and supports have negligible mass. There is no friction anywhere. The block B is displaced towards wall 1 by a small distance x (figure II) and released. The block returns and moves a maximum distance y towards wall 2. Displacements x and y are measured with respect to the equilibrium position of the block B. The ratio $\frac{y}{x}$ is



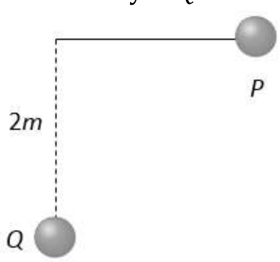
a) 4
b) 2
c) $\frac{1}{2}$
d) $\frac{1}{4}$

120. Lissajous figure shown in figure. Corresponds to which one of the following?



a) Phase difference $\pi/2$ and period 1 : 2
b) Phase difference $3\pi/4$ and period 1 : 2
c) Phase difference $\pi/4$ and period 2 : 1
d) Phase difference $2\pi/3$ and period 2 : 1

121. A pendulum of length $2m$ lift at P. When it reaches Q, it losses 10% of its total energy due to air resistance. The velocity at Q is



a) 6 m/s
b) 1 m/s
c) 2 m/s
d) 8 m/s

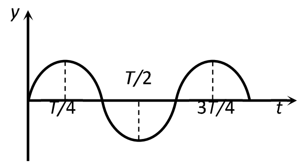
122. To show that a simple pendulum executes simple harmonic motion, it is necessary to assume that
a) Length of the pendulum is small
b) Mass of the pendulum is small
c) Amplitude of oscillation is small
d) Acceleration due to gravity is small

123. A spring of spring constant k is cut into two equal parts. A block of mass m is attached with one part of spring. What is the frequency of the system if α is frequency of block with original spring?
a) $\sqrt{2}$ α
b) α/2
c) 2α
d) α

124. Length of a simple pendulum is l and its maximum angular displacement is θ, then its maximum K.E. is
a) $mgl \sin\theta$
b) $mgl(1 + \sin\theta)$
c) $mgl(1 + \cos\theta)$
d) $mgl(1 - \cos\theta)$

125. The potential energy of a particle with displacement X is $U(X)$. The motion is simple harmonic, when (K is a positive constant)
a) $U = \frac{KX^2}{2}$
b) $U = KX^2$
c) $U = K$
d) $U = KX$

126. The graph shows the variation of displacement of a particle executing S.H.M. with time. We infer from this graph that

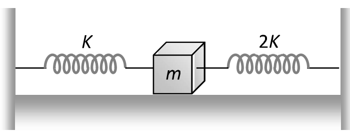


a) The force is zero at time $3T/4$
b) The velocity is maximum at time $T/2$
c) The acceleration is maximum at time T
d) The P.E. is equal to total energy at time $T/2$

127. The acceleration of a particle performing SHM is 12 cms^{-2} at a distance of 3 cm from the mean position. Its time period is
a) 2.0 s
b) 3.14 s
c) 0.5 s
d) 1.0 s

128. A block of mass m, attached to a spring of spring constant k, oscillates on a smooth horizontal table. The other end of the spring is fixed to a wall. The block has a speed v when the spring is at its natural length. Before coming to an instantaneous rest, if the block moves a distance x from the mean position, then
a) $x = \sqrt{m/k}$
b) $x = \frac{1}{v}\sqrt{m/k}$
c) $x = v\sqrt{m/k}$
d) $x = \sqrt{mv/k}$

129. Two springs of force constant K and $2K$ are connected to a mass as shown below. The frequency of oscillation of the mass is

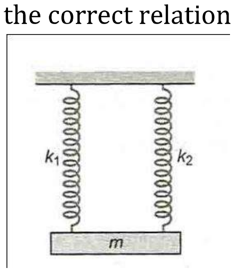


a) $(1/2\pi)\sqrt{(K/m)}$
b) $(1/2\pi)\sqrt{(2K/m)}$
c) $(1/2\pi)\sqrt{(3K/m)}$
d) $(1/2\pi)\sqrt{(m/K)}$

130. A body of mass 20 g connected to spring of constant k executes simple harmonic motion with a frequency of $\left(\frac{5}{\pi}\right)$ Hz. The value of spring constant is
a) 4 Nm^{-1}
b) 3 Nm^{-1}
c) 2 Nm^{-1}
d) 5 Nm^{-1}

131. A particle oscillating under a force $\vec{F} = -k\vec{x} - b\vec{v}$ is a (k and b are constant)
a) Simple harmonic oscillator
b) No linear oscillator
c) Damped oscillator
d) Forced oscillator

132. A mass m is suspended separately by two different springs in successive order then a time period is $t_1$and t_2 respectively. If m is connected by both spring as shown in figure, then time period is t_0, the correct relation is

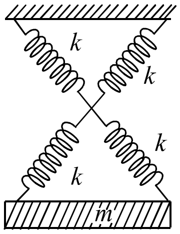


a) $t_0^2 = t_1^2 + t_2^2$
b) $t_0^{-2} = t_1^{-2} + t_2^{-2}$
c) $t_0^{-1} = t_1^{-1} + t_2^{-1}$
d) $t_0 = t_1 + t_2$

133. A 0.10 kg block oscillates back and forth along a horizontal surface. Its displacement from the origin is given by: $x = (10cm)\cos[(10rad/s)t + \pi/2rad]$. What is the maximum acceleration experienced by the block
a) 10 m/s^2
b) 10 π m/s^2
c) $\frac{10\pi}{2} m/s^2$
d) $\frac{10\pi}{3} m/s^2$

134. A pendulum clock is placed on the moon, where object weighs only one-sixth as much as on earth, how many seconds the clock tick out in an actual time of 1 minute the clock keeps good time on earth?
a) 12.25
b) 24.5
c) 2.45
d) 0.245

135. As shown in figure, a simple harmonic motion oscillator having identical four springs has time period

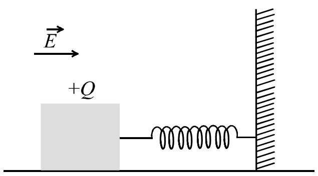


a) $T = 2\pi\sqrt{\frac{m}{4k}}$ b) $T = 2\pi\sqrt{\frac{m}{2k}}$ c) $T = 2\pi\sqrt{\frac{m}{k}}$ d) $T = 2\pi\sqrt{\frac{2m}{k}}$

136. If a body is released into a tunnel dug across the diameter of earth, it executes simple harmonic motion with time period

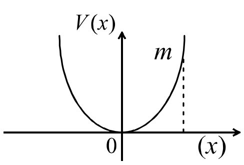
a) $T = 2\pi\sqrt{\frac{R_e}{g}}$ b) $T = 2\pi\sqrt{\frac{2R_e}{g}}$ c) $T = 2\pi\sqrt{\frac{R_e}{2g}}$ d) $T = 2$ seconds

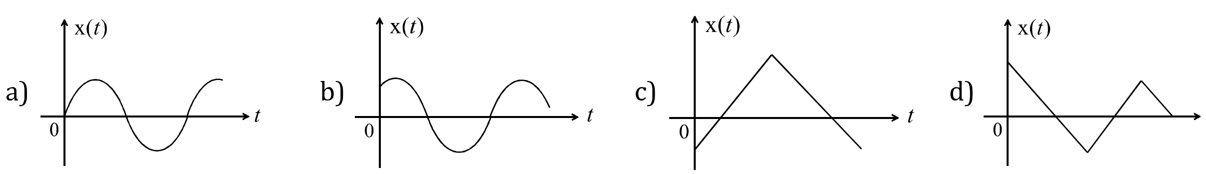
137. A wooden block performs SHM on a frictionless surface with frequency, v_0. The block carries a change +Q on its surface. If now a uniform electric field $\vec{E}$ is switched-on as shown, then SHM of the block will be



a) Of the same frequency and with shifted mean position
b) Of the same frequency and with the same mean position
c) Of changed frequency and with shifted mean position
d) Of changed frequency and with the same mean position

138. A particle of mass m is released from rest and follows a parabolic path as shown. Assuming that the displacement of the mass from the origin is small, which graph correctly depicts the position of the particle as a function of time





139. A particle is executing SHM of period $24x$ and of amplitude 41 cm with O as equilibrium position. The minimum time in seconds taken by the particle to go from P to Q. where OP = −9 cm and OQ =40 cm is
a) 5 b) 6 c) 7 d) 9

140. Which one of the following is a simple harmonic motion
a) Wave moving through a string fixed at both ends
b) Earth spinning about its own axis
c) Ball bouncing between two rigid vertical walls
d) Particle moving in a circle with uniform speed

141. The bob of a simple pendulum of length L is released at time t = 0 from a position of small angular displacement. Its linear displacement at time t is given by

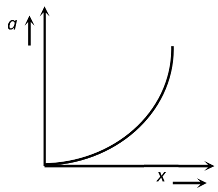
a) $X = a\sin 2\pi\sqrt{\frac{L}{g}} \times t$ b) $X = a\cos 2\pi\sqrt{\frac{g}{L}} \times t$

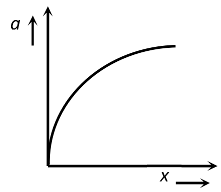
c) $X = a \sin\sqrt{\frac{g}{L}} \times t$ d) $X = a \cos\sqrt{\frac{g}{L}} \times t$

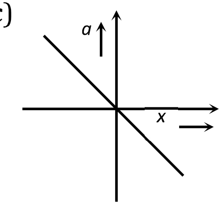
142. The metallic bob of a simple pendulum has the relative density ρ. The time period of this pendulum is T. If the metallic bob is immersed in water, then the new time period is given by

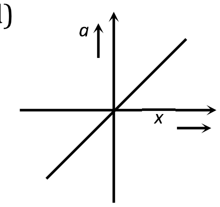
a) $T\frac{\rho - 1}{\rho}$ b) $T\frac{\rho}{\rho - 1}$ c) $T\sqrt{\frac{\rho - 1}{\rho}}$ d) $T\sqrt{\frac{\rho}{\rho - 1}}$

143. The variation of the acceleration a of the particle executing S.H.M. with displacement y is as shown in the figure

a) 

b) 

c) 

d) 

144. Two particles execute SHM of the same amplitude and frequency along the same straight line. If they pass one another when going in opposite directions, each time their displacement is half their amplitude, the phase difference between them is

a) $\frac{\pi}{3}$ b) $\frac{\pi}{4}$ c) $\frac{\pi}{6}$ d) $\frac{2\pi}{3}$

145. Two particles executes S.H.M. of same amplitude and frequency along the same straight line. They pass one another when going in opposite directions, and each time their displacement is half of their amplitude. The phase difference between them is

a) 30° b) 60° c) 90° d) 120°

146. A particle executing a simple harmonic motion has a period of 6 s. The time taken by the particle to move from the mean position to half the amplitude, starting from the mean position is

a) $\frac{1}{4}$ s b) $\frac{3}{4}$ s c) $\frac{1}{2}$ s d) $\frac{3}{2}$ s

147. The velocity of simple pendulum is maximum at

a) Extremes b) Half displacement c) Mean position d) Every where

148. The amplitude of vibration of a particle is given by $a_m = (a_0)/(a\omega^2 - b\omega + c)$; where a_0, a, b and c are positive. The condition for a single resonant frequency is

a) $b^2 = 4ac$ b) $b^2 > 4ac$ c) $b^2 = 5ac$ d) $b^2 = 7ac$

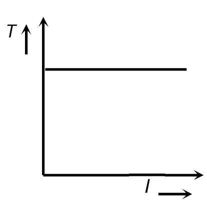
149. If a simple pendulum of length, L has maximum angular displacement α, then the maximum kinetic energy of bob of mass M is

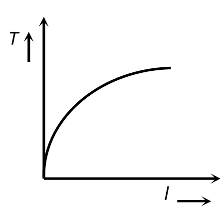
a) $\frac{1}{2}\frac{ML}{g}$ b) $\frac{Mg}{2L}$ c) $MgL(1 - \cos\alpha)$ d) $\frac{MgL\sin\alpha}{2}$

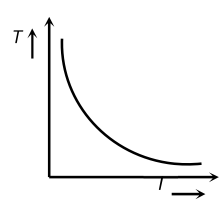
150. A simple pendulum is suspended from the ceiling of a stationary elevator and its period of oscillation is T. The elevator is then set into motion and the new time period is found to be longer. Then the elevator is

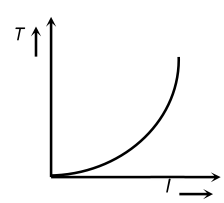
a) Accelerated upward b) Accelerated downward
c) Moving downward with nonuniform speed d) Moving downward with uniform speed

151. In case of a simple pendulum, time period versus length is depicted by

a) 

b) 

c) 

d) 

152. A simple pendulum has a length l and the mass of the bob is m. The bob is given a charge q

coulomb. The pendulum is suspended between the vertical plates of a charged parallel plate capacitor. If E is the electric field strength between the plates, the time period of the pendulum is given by

a) $2\pi\sqrt{\frac{l}{g}}$ b) $2\pi\sqrt{\frac{l}{\sqrt{g+\frac{qE}{m}}}}$ c) $2\pi\sqrt{\frac{l}{\sqrt{g-\frac{qE}{m}}}}$ d) $2\pi\sqrt{\frac{l}{\sqrt{g^2+\left(\frac{qE}{m}\right)^2}}}$

153. A body of mass 5 g is executing SHM about a fixed point O. with an amplitude of 10 cm, its maximum velocity is 100 cms^{-1}. Its velocity will be 50 cms^{-1} at a distance (in cm)

a) 5 b) $5\sqrt{2}$ c) $5\sqrt{3}$ d) $10\sqrt{2}$

154. The bob of a simple pendulum of mass m and total energy E will have maximum linear momentum equal to

a) $\sqrt{\frac{2E}{m}}$ b) $\sqrt{2mE}$ c) $2mE$ d) mE^2

155. The period of oscillation of a simple pendulum of length l suspended from the roof of a vehicle, which moves without friction down an inclined plane of inclination α is given by

a) $2\pi\sqrt{\frac{1}{g\cos\alpha}}$ b) $2\pi\sqrt{\frac{1}{g\sin\alpha}}$ c) $2\pi\sqrt{\frac{l}{g}}$ d) $2\pi\sqrt{\frac{1}{g\tan\alpha}}$

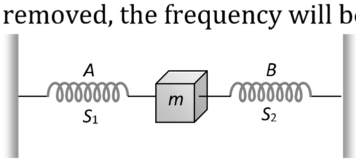
156. The periodic time of a simple pendulum of length 1 m and amplitude 2 cm is 5 seconds. If the amplitude is made 4 cm. Its periodic time in seconds will be

a) 2.5 b) 5 c) 10 d) $5\sqrt{2}$

157. One-fourth length of a spring of force constant K is cut away. The force constant of the remaining spring will be

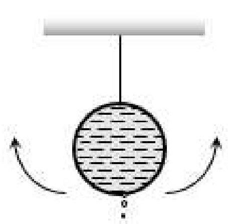
a) $\frac{3}{4}K$ b) $\frac{4}{3}K$ c) K d) $4K$

158. In the figure, S_1 and S_2 are identical springs. The oscillation frequency of the mass m is f. If one spring is removed, the frequency will become



a) f b) $f\times 2$ c) $f\times\sqrt{2}$ d) $f/\sqrt{2}$

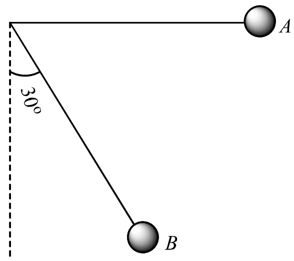
159. A simple pendulum is made of a body which is a hollow sphere containing mercury suspended by means of a wire. If a little mercury is drained off, the period of pendulum will



a) Remains unchanged
b) Increase
c) Decrease
d) Become erratic

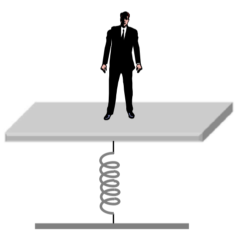
160. A simple pendulum is released from A shown.
If m and l represent the mass of the bob and
Length of the pendulum, the gain kinetic energy

at B is



a) $\frac{mgl}{2}$ b) $\frac{mgl}{\sqrt{2}}$ c) $\frac{\sqrt{3}}{2}mgl$ d) $\frac{2}{\sqrt{3}}mgl$

161. A man weighing 60 kg stands on the horizontal platform of a spring balance. The platform starts executing simple harmonic motion of amplitude 0.1 m and frequency $\frac{2}{\pi}Hz$. Which of the following statements is correct



a) The spring balance reads the weight of man as 60 kg
b) The spring balance reading fluctuates between 60 kg and 70 kg
c) The spring balance reading fluctuates between 50 kg and 60 kg
d) The spring balance reading fluctuates between 50 kg and 70 kg

162. The periodic time of a body executing simple harmonic motion is 3 s. After how much interval from time $t = 0$, its displacement will be half of its amplitude

a) $\frac{1}{8}s$ b) $\frac{1}{6}s$ c) $\frac{1}{4}s$ d) $\frac{1}{3}s$

163. The displacement equation of a particle is $x = 3\sin 2t + 4\cos 2t$. The amplitude and maximum velocity will be respectively

a) 5, 10 b) 3, 2 c) 4, 2 d) 3, 4

164. A block is placed on a frictionless horizontal table. The mass of the block is m and springs are attached on either side with force constants K_1 and K_2. If the block is displaced a little and left to oscillate, then the angular frequency of oscillation will be

a) $\left(\frac{K_1 + K_2}{m}\right)^{1/2}$ b) $\left[\frac{K_1K_2}{m(K_1 + K_2)}\right]^{1/2}$ c) $\left[\frac{K_1K_2}{(K_1 - K_2)m}\right]^{1/2}$ d) $\left[\frac{K_1^2 + K_2^2}{(K_1 + K_2)m}\right]^{1/2}$

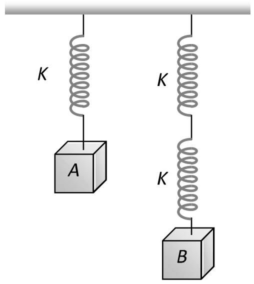
165. Velocity at mean position of a particle S.H.M. is v, they velocity of the particle at a distance equal to half of the amplitude

a) $4v$ b) $2v$ c) $\frac{\sqrt{3}}{2}v$ d) $\frac{\sqrt{3}}{4}v$

166. If the length of a pendulum is made 9 times and mass of the bob is made 4 times then the value of time period becomes

a) $3T$ b) $3/2T$ c) $4T$ d) $2T$

167. The springs shown are identical. When $A = 4kg$, the elongation of spring is 1 cm. If $B = 6kg$, the elongation produced by it is



a) 4 cm b) 3 cm c) 2 cm d) 1 cm

168. A simple pendulum has a time period T in vacuum. Its time period when it is completely immersed in a liquid of density one-eight of the density of material of the bob is

a) $\sqrt{\frac{7}{8}}T$ b) $\sqrt{\frac{5}{8}}T$ c) $\sqrt{\frac{3}{8}}T$ d) $\sqrt{\frac{8}{7}}T$

169. If a body of mass 0.98 kg is made to oscillate on a spring of force constant 4.84 N/m, the angular frequency of the body is

a) 1.22 rad/s b) 2.22 rad/s c) 3.22 rad/s d) 4.22 rad/s

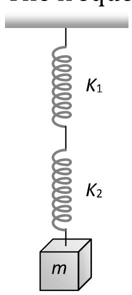
170. The length of the second's pendulum is decreased by 0.3 cm when it is shifted to Chennai from London. If the acceleration due to gravity at London is 981 cms^{-2}, the acceleration due to gravity at Chennai is (assume $\pi^2 = 10$)

a) 981 cms^{-2} b) 978 cms^{-2} c) 984 cms^{-2} d) 975 cms^{-2}

171. The circular motion of a particle with constant speed is

a) Simple harmonic but not periodic
b) Periodic and simple harmonic
c) Neither periodic nor simple harmonic
d) Periodic but not simple harmonic

172. The frequency of oscillation of the springs shown in the figure will be

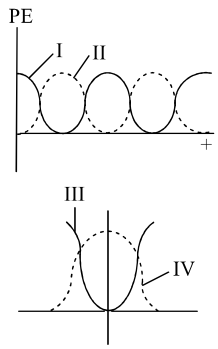


a) $\frac{1}{2\pi}\sqrt{\frac{K}{m}}$ b) $\frac{1}{2\pi}\sqrt{\frac{(K_1+K_2)m}{K_1K_2}}$ c) $2\pi\sqrt{\frac{K}{m}}$ d) $\frac{1}{2\pi}\sqrt{\frac{K_1K_2}{m(K_1+K_2)}}$

173. Starting from $y = A\sin\omega t\ or\ y = A\cos\omega t$

a) acceleration lags the displacement by a phase $\pi/4$
b) acceleration lags the displacement by a phase $\pi/2$
c) acceleration leads the displacement by a phase $\pi/2$
d) acceleration leads the displacement by a phase π

174. For a particle executing SHM the displacement x is given by $x = A\cos\omega t$. Identify the graph which represents the variation of potential energy (PE) as a function of time and displacement x.



a) I,III b) II,III c) I,IV d) II,IV

175. A simple pendulum has time period T_1. The point of suspension is now moved upward according to the relation $y = k\,t^2, (k = 1\ \text{ms}^{-2})$ where y is the vertical displacement. The time period now becomes T_2. The ratio of $\frac{T_1^2}{T_2^2}$ is $(\text{g} = 10\ \text{ms}^{-2})$

a) $6/5$ b) $5/6$ c) 1 d) $4/5$

176. A particle is executing simple harmonic motion with frequency f. The frequency at which its kinetic energy change into potential energy is

a) $f/2$ b) f c) $2\,f$ d) $4\,f$

177. Two simple pendulums whose lengths are $100cm$ and $121cm$ are suspended side by side. Their bobs are pulled together and then released. After how many minimum oscillations of the longer pendulum, will the two be in phase again

a) 11 b) 10 c) 21 d) 20

178. A horizontal platform vibrates with simple harmonic motion in the horizontal direction with a period 2 s. A body of mass 0.5 kg is placed on the platform. The coefficient of static friction between the body and platform is 0.3. What is the maximum frictional force on the body when the platform is oscillating with amplitude 0.2 m? Assume $\pi^2 = 10 = g$.

a) 0.5 N b) 1 N c) 1.5 N d) 2 N

179. The amplitude of an oscillating simple pendulum is $10cm$ and its period is 4 s. Its speed after 1 s after it passes its equilibrium position, is

a) Zero b) $0.57m/s$ c) $0.212m/s$ d) $0.32m/s$

180. A particle is moving with constant angular velocity along the circumference of a circle. Which is the following statements is true

a) The particle so moving executes SHM

b) The projection of the particle of any one of the diameters executes SHM

c) The projection of the particle of any one of the diameters executes SHM

d) None of the above

181. The average acceleration of a particle performing SHM over one complete oscillation is

a) $\frac{\omega^2 A}{2}$ b) $\frac{\omega^2 A}{\sqrt{2}}$ c) Zero d) $A\omega^2$

182. A tunnel is made across the earth of radius R, passing through its centre. A ball is dropped from a height h in the tunnel. The motion will be periodic with time period.

a) $2\pi\sqrt{\frac{R}{g}} + 4\sqrt{\frac{h}{g}}$

b) $2\pi\sqrt{\frac{R}{g}} + 4\sqrt{\frac{2h}{g}}$

c) $2\pi\sqrt{\frac{R}{g}} + \sqrt{\frac{h}{g}}$

d) $2\pi\sqrt{\frac{R}{g}} + \sqrt{\frac{2h}{g}}$

183. The kinetic energy of a particle executing S.H.M. is 16 J when it is at its mean position. If the mass of the particle is 0.32 kg, then what is the maximum velocity of the particle

a) 5 m/s b) 15 m/s c) 10 m/s d) 20 m/s

184. Two simple harmonic motion are represented by
$y_1 = 5(\sin 2\pi t + \sqrt{3}\cos 2\pi t)$
$y_2 = 5\sin\left(2\pi t + \frac{\pi}{4}\right)$
The ratio of the amplitudes of two SHM's is
a) 1 :1 b) 1 :2 c) 2 :1 d) 1 : $\sqrt{3}$

185. A particle of mass 1 kg is moving in SHM with an amplitude 0.02 m and a frequency of 60 Hz. The maximum force in newton acting on the particle is
a) 188 π^2 b) $144\pi^2$ c) $288\pi^2$ d) None of these

186. A particle is oscillating in SHM. What fraction of total energy is kinetic when the particle is at $A/2$ from the mean position? (A is the amplitude of oscillation)
a) $\frac{3E}{2}$ b) $\frac{3}{4}E$ c) $\frac{E}{2}$ d) $3E$

187. The time period of a simple pendulum is T. When the length is increased by 10 cm, its period is T_1. When the length is decreased by 10 cm, its period is T_2. Then, relation between T, T_1 and T_2 is
a) $\frac{2}{T^2} = \frac{1}{T_1^2} + \frac{1}{T_2^2}$ b) $\frac{2}{T^2} = \frac{1}{T_1^2} - \frac{1}{T_2^2}$ c) $2T^2 = T_1^2 + T_2^2$ d) $2T^2 = T_1^2 - T_2^2$

188. The motion of a particle varies with time according to the relation $y = a(\sin\omega t + \cos\omega t)$.
a) The motion is oscillatory but not SHM
b) The motion is SHM with amplitude a
c) The motion is SHM with amplitude $a\sqrt{2}$
d) The motion is SHM with amplitude $2a$

189. The vertical extension in a light spring by a weight of 1 kg suspended from the wire is 9.8 cm. The period of oscillation
a) $20\pi s$ b) $2\pi s$ c) $2\pi/10s$ d) $200\pi s$

190. The function $\sin^2(\omega t)$ represents
a) A periodic, but not simple harmonic, motion with a period $2\pi/\omega$
b) A periodic, but not simple harmonic, motion with a period π/ω
c) a simple harmonic motion with a period $2\pi/\omega$
d) a simple harmonic motion with a period π/ω

191. A particle is executing SHM at mid-point of mean position and extremely. What is the potential energy in terms of total energy (E)?
a) $\frac{E}{4}$ b) $\frac{E}{16}$ c) $\frac{E}{2}$ d) $\frac{E}{8}$

192. The restoring force of SHM is maximum when particle
a) Displacement is maximum
b) Is half way between the mean and extreme position
c) Crosses mean position
d) Is at rest

193. A particle is executing simple harmonic motion with an amplitude A and time period T. The displacement of the particle after $2T$ period from its initial position is
a) A b) $4A$ c) $8A$ d) Zero

194. Two springs have spring constants K_A and K_B and $K_A > K_B$. The work required to stretch them by same extension will be
a) More in spring A b) More in spring B c) Equal in both d) Nothing can be said

195. A spring having a spring constant $'K'$ is loaded with a mass $'m'$. The spring is cut into two equal parts and one of these is loaded again with the same mass. The new spring constant is
a) $K/2$ b) K c) $2K$ d) K^2

196. A highly rigid cubical block A of small mass M and side L is fixed rigidly on the cubical block of same

dimensions and low modulus of rigidity η such that the lower face of A completely covers the upper face of B. the lower face of B is rigidly held on a horizontal surface. A small force F is applied perpendicular to one of the side faces of A. after the force is withdrawn, block A executes small oscillations, the time period of which is given by

a) $2\pi\sqrt{ML\eta}$ b) $2\pi\sqrt{M\eta/L}$ c) $2\pi\sqrt{ML/\eta}$ d) $2\pi\sqrt{M/\eta L}$

197. A particle is executing SHM with amplitude a. when the PE of a particle is one-fourth of its maximum value during the oscillation, its displacement from the equilibrium position will be

a) a/4 b) a/3 c) a/2 d) 2a/3

198. The time period of a simple pendulum of length L as measured in an elevator descending with acceleration $\frac{g}{3}$ is

a) $2\pi\sqrt{\frac{3L}{g}}$ b) $\pi\sqrt{\left(\frac{3L}{g}\right)}$ c) $2\pi\sqrt{\left(\frac{3L}{2g}\right)}$ d) $2\pi\sqrt{\left(\frac{2L}{3g}\right)}$

199. The potential energy of a simple harmonic oscillator when the particle is half way to its end point is (where E is the total energy)

a) $\frac{1}{8}E$ b) $\frac{1}{4}E$ c) $\frac{1}{2}E$ d) $\frac{2}{3}E$

200. A particle executing S.H.M. of amplitude 4 cm and $T = 4\ s$. The time taken by it to move from positive extreme position to half the amplitude is

a) 1 s b) 1/3 s c) 2/3 s d) $\sqrt{3/2}\ s$

201. For any S.H.M. amplitude is 6 cm. If instantaneous potential energy is half the total energy then distance of particle from its mean position is

a) 3 cm b) 4.2 cm c) 5.8 cm d) 6 cm

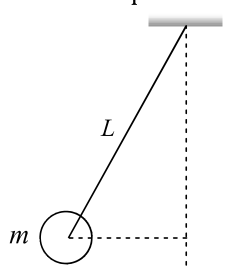
202. If the displacement equation of a particle be represented by $y = A\sin PT + B\cos PT$, the particle executes

a) A uniform circular motion b) A uniform elliptical motion
c) A S.H.M. d) A rectilinear motion

203. A simple pendulum oscillates in air with time period T and amplitude A. As the time passes

a) T and A both decreases b) T increases and A is constant
c) T remains same and A decreses d) T decreases and A is constant

204. A ball of mass (m)0.5 kg is attached to the end of a string having length (L)0.5 m. The ball is rotated on a horizontal circular path about vertical axis. The maximum tension that the string can bear is 324 N. The maximum possible value of angular velocity of ball (in radian/s) is



a) 9 b) 18 c) 27 d) 36

205. Displacement-time equation of a particle executing SHM is, $x = 4\sin\omega t + 3\sin(\omega t + \pi/3)$. Here x is in centimeter and t in second. The amplitude of oscillation of the particle is approximately

a) 5 cm b) 6 cm c) 7 cm d) 9 cm

206. A simple pendulum has a time period T_1 when on the earth's surface and T_2 when taken to a height $2R$ above the earth's surface where R is the radius of the earth. The value of (T_1/T_2) is

a) 1/9 b) 1/3 c) $\sqrt{3}$ d) 3

207. A uniform spring of force constant k is cut into two pieces whose lengths are in the ratio of 1:2. What is the force constant of second piece in terms of k?

a) $\frac{k}{2}$ b) $\frac{2k}{2}$ c) $\frac{3k}{2}$ d) $\frac{4k}{2}$

208. A particle of mass m is executing oscillations about the origin on the x-axis with amplitude A. Its potential energy $U(x) = ax^4$ where a is positive constant. The x-coordinate of mass where potential energy is one-third of the kinetic energy of particle is

a) $\frac{\pm A}{\sqrt{3}}$ b) $\frac{\pm A}{\sqrt{2}}$ c) $\frac{\pm A}{3}$ d) $\frac{\pm A}{2}$

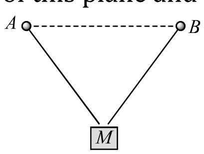
209. A particle moves so that its acceleration a is given by $a = -bx$, where x is displacement from equilibrium position and b is a non-negative real constant. The time period of oscillation of the particle is

a) $2\pi\sqrt{b}$ b) $\frac{2\pi}{b}$ c) $\frac{2\pi}{\sqrt{b}}$ d) $2\sqrt{\frac{\pi}{b}}$

210. The amplitude of a damped oscillator becomes half in one minute. The amplitude after 3 $minute$ will be $\frac{1}{X}$ times the original, where X is

a) 2×3 b) 2^3 c) 3^2 d) 3×2^2

211. A and B are fixed points and the mass M is tied by strings at A and B. If the mass M is displaced slightly out of this plane and released, it will execute oscillations with period (given $AM = BM = L, AB = 2$d)



a) $2\sqrt{\frac{L}{g}}\pi$ b) $2\pi\sqrt{\frac{(L^2 - d^2)^{1/2}}{g}}$

c) $2\pi\sqrt{\frac{(L^2 + d^2)^{1/2}}{g}}$ d) $2\pi\sqrt{\frac{(2d^2)^{3/2}}{g}}$

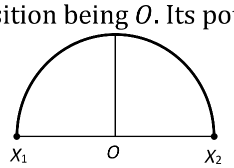
212. The kinetic energy of a particle executing S.H.M. is 16 J when it is in its mean position. If the amplitude of oscillations is 25 cm and the mass of the particle is 5.12 kg, the time period of its oscillation is

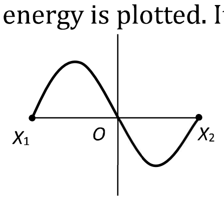
a) $\frac{\pi}{5} s$ b) $2\pi\ s$ c) $20\pi\ s$ d) $5\pi\ s$

213. A simple pendulum is hanging from a peg inserted in a vertical wall. Its bob is stretched in horizontal position from the wall and is left free to move. The bob hits on the wall the coefficient of restitution is $\frac{2}{\sqrt{5}}$. After how many collisions the amplitude of vibration will become less than 60°

a) 6 b) 3 c) 5 d) 4

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

a)


b)


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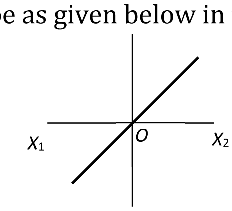

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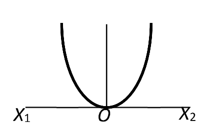


215. A particle is subjected simultaneously to two SHM's one along the x-axis and the other along the y-axis. The two vibrations are in phase and have unequal amplitudes. The particle will execute

a) Straight line motion b) Circular motion c) Elliptic motion d) Parabolic motion

216. The total energy of a simple harmonic oscillator is proportional to

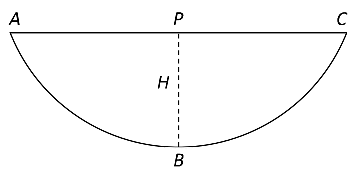
a) Square root of displacement b) Velocity

c) Frequency d) Square of the amplitude

217. A mass of 10 kg is suspended from a spring balance. It is pulled aside by a horizontal string so that it makes angle of 60° with the vertical. The new reading of the balance is

a) $10\sqrt{3}\ kg\ wt$ b) $20\sqrt{3} kg\ wt$ c) $20\ kg\ wt$ d) $10\ kg\ wt$

218. A simple pendulum with a bob of mass $'m'$ oscillates from A to C and back to A such that PB is H. If the acceleration due to gravity is $'g'$, then the velocity of the bob as it passes through B is



a) mgH b) $\sqrt{2gH}$ c) $2gH$ d) Zero

219. Two identical pendulum are oscillating with amplitudes 4 cm and 8 cm. the ratio of their energies of oscillation will be

a) 1/3 b) 1/4 c) 1/9 d) 1/2

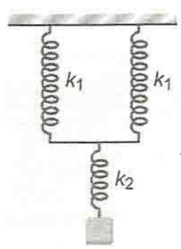
220. A simple pendulum is taken from the equator to the pole. Its period

a) Decreases b) Increases
c) Remains the same d) Decreases and then increases

221. U is the PE of an oscillating particle and F is the force acting on it at a given instant. Which of the following is true?

a) $\frac{U}{F}+x=0$ b) $\frac{2U}{F}+x=0$ c) $\frac{F}{U}+x=0$ d) $\frac{F}{2U}+x=0$

222. What will be the force constant of the spring system shown in figure?



a) $\frac{k_1}{2}+k_2$ b) $\left[\frac{1}{2k_1}+\frac{1}{k_2}\right]^{-1}$ c) $\frac{1}{2k_1}+\frac{1}{k_2}$ d) $\left[\frac{2}{k_1}+\frac{1}{k_2}\right]^{-1}$

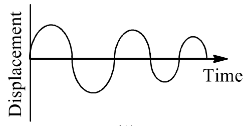
223. A particle executes SHM in a line 4 cm long. Its velocity when passing through the centre of line is 12 cm/s. The period will be

a) 2.047 s b) 1.047 s c) 3.047 s d) 0.047 s

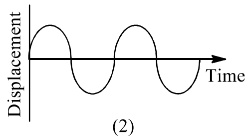
224. Let $T_1$and T_2 be the time period of spring A and B when mass $M$is suspended from one end of each spring. If both springs are taken in series and the same mass M is suspended from the series combination, the time period is T, then

a) $T=T_1+T_2$ b) $\frac{1}{T}=\frac{1}{T_1}+\frac{1}{T^2}$ c) $T^2=T_1^2+T_2^2$ d) $\frac{1}{T^2}=\frac{1}{T_1^2}+\frac{1}{T_2^2}$

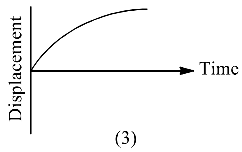
225. Which of the following figure represent(s) damped simple harmonic motions?



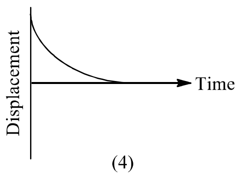
(1)



(2)



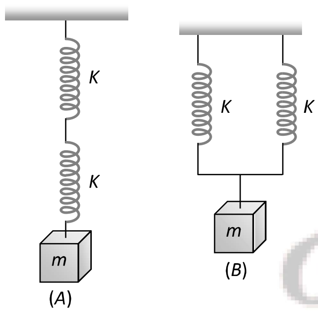
(3)



(4)

a) Fig. 1 alone b) Fig. 2 alone c) Fig. 4 alone d) Fig. 3 and 4

226. Two identical springs of constant K are connected in series and parallel as shown in figure. A mass m is suspended from them. The ratio of their frequencies of vertical oscillations will be



a) 2 :1 b) 1 :1 c) 1 :2 d) 4 :1

227. A disc of radius R and mass M is pivoted at the rim and is set for small oscillations. If simple pendulum has to have the same period as that of the disc, the length of the simple pendulum should be

a) $\frac{5}{4}R$ b) $\frac{2}{3}R$ c) $\frac{3}{4}R$ d) $\frac{3}{2}R$

228. A particle executing simple harmonic motion of amplitude 5 cm has maximum speed of 31.4 cm/s. The frequency of its oscillation is

a) 3 Hz b) 2 Hz c) 4 Hz d) 1 Hz

229. The P.E. of a particle executing SHM at a distance x from its equilibrium position is

a) $\frac{1}{2}m\omega^2x^2$ b) $\frac{1}{2}m\omega^2a^2$ c) $\frac{1}{2}m\omega^2(a^2-x^2)$ d) Zero

230. A particle free to move along the x-axis has potential energy given as

$$U(x) = k[1-\exp(-x^2)] \qquad (\text{for} -\infty \leq +\infty)$$

Where k is a positive constant of appropriate dimensions. Then

a) At points away from origin, the particle is in equilibrium
b) For any finite non-zero value of x, there is a force directed away from the origin
c) Its total mechanical energy is $k/2$ and it is equal to its kinetic energy at origin
d) At $x = 0$, the motion of the particle is simple harmonic

231. A mass m attached to a spring oscillates every 2 s. If the mass is increased by 2 kg, then time-period increases by 1 s. The initial mass is

a) 1.6 kg b) 3.9 kg c) 9.6 kg d) 12.6 kg

232. The amplitude of a particle executing SHM is 4 cm. At the mean position the speed of the particle is 16cms^{-1} . The distance of the particle from the mean position at which the speed of the particle become $8\sqrt{3}$ cms^{-1}, will be

a) $2\sqrt{3}$ cm b) $\sqrt{3}$ cm c) 1 cm d) 2 cm

233. Two springs with spring constants $K_1 = 1500\ N/m$ and $K_2 = 3000N/m$ are stretched by the same force. The ratio of potential energy stored in spring will be

a) 2 :1 b) 1 :2 c) 4 :1 d) 1 :4

234. A particle executes S.H.M. with a period of 6 second and amplitude of 3 cm. Its maximum speed in cm/s is

a) $\pi/2$ b) π c) 2π d) 3π

235. A large horizontal surface moves up and down in SHM with an amplitude of 1 cm. if a mass of 10 kg (which is placed on the surface) id to remain continuously is in contact with it. The maximum frequency of SHM will be

a) 5 Hz b) 0.5 Hz c) 1.5 Hz d) 10 Hz

236. 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 $F\ (t)$ 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) $\frac{m}{\omega_0^2 + \omega^2}$

237. A mass M, attached to a spring, Oscillates with a period of 2 s. If the mass is increased by 4 kg, the time period increases by 1 s. Assuming that Hooke's law is obeyed, the initial mass M was

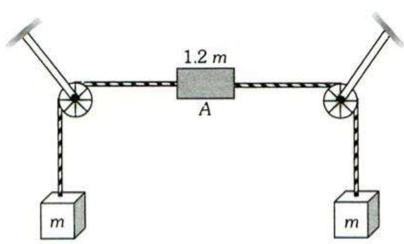
a) 3.2 kg b) 1 kg c) 2 kg d) 8 kg

238. The displacement of a particle executing SHM is given by $y = 5 \sin\left(4t + \frac{\pi}{3}\right)$

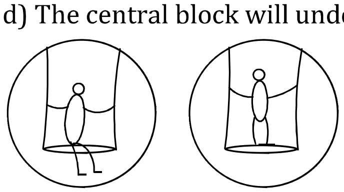
If T is the time period and mass of the particle is $2g$, the kinetic energy of the particle when $t = \frac{T}{4}$ is given by

a) 0.4 J b) 0.5 J c) 3 J d) 0.3 J

239. In the figure, the vertical sections of the string are long. A is released from rest from the position shown. Then



a) The system will remain in equilibrium
b) The central block will move down continuously
c) The central block will undergo simple harmonic motion
d) The central block will undergo periodic motion but not simple harmonic motion

240. 

A child swings sitting and standing inside swing as shown in figure, then period of oscillations have the relation

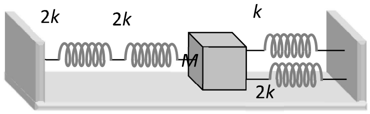
a) $(T)_{Sitting} = (T)_{\text{Standing}}$ b) $(T)_{Sitting} > (T)_{\text{Standing}}$
c) $(T)_{Sitting} < (T)_{\text{Standing}}$ d) $2(T)_{Sitting} = (T)_{\text{Standing}}$

241. A coin is placed on a horizontal platform, which undergoes horizontal SHM about a mean position O. the

coin placed on platform dies not slip, coefficient of friction between the coin and the platform isμ. The amplitude of oscillation is gradually increased. The coin will begin to slip on the platform for the first time

a) at the mean position
b) at the extreme position of oscillations
c) for an amplitude of $\mu g/\omega^2$
d) for an amplitude of $g/\mu\,\omega^2$

242. Four massless springs whose force constants are $2k, 2k, k$ and $2k$ respectively are attached to a mass M kept on a frictionless plane (as shown in figure). If the mass M is displaced in the horizontal direction, then the frequency of oscillation of the system is



a) $\frac{1}{2\pi}\sqrt{\frac{k}{4M}}$
b) $\frac{1}{2\pi}\sqrt{\frac{4k}{M}}$
c) $\frac{1}{2\pi}\sqrt{\frac{k}{7M}}$
d) $\frac{1}{2\pi}\sqrt{\frac{7k}{M}}$

243. A body having natural frequency v' is executing forced oscillations under a driving force of frequency. The system will vibrate

a) with frequency of driving force v
b) with its natural frequency v'
c) with mean frequency of the two $[(v+v')/2$
d) None of the above

244. A particle is executing simple harmonic motion with a period of T *seconds* and amplitude a *metre*. The shortest time it takes to reach a point $\frac{a}{\sqrt{2}}m$ from its mean position in *seconds* is

a) T
b) $T/4$
c) $T/8$
d) $T/16$

245. A particle of mass m is located in a one dimensional potential field where potential energy is given by $(x) = A(1 - \cos px)$, where A and p are constants. The period of small oscillations of the particle is

a) $2\pi\sqrt{\frac{m}{A\,p}}$
b) $2\pi\sqrt{\frac{m}{A\,p^2}}$
c) $2\pi\sqrt{\frac{m}{A}}$
d) $\frac{1}{2\pi}\sqrt{\frac{AR}{m}}$

246. A simple pendulum is suspended from the roof of a trolley which moves in a horizontal direction with an acceleration a, then the time period is given by $T = 2\pi\sqrt{\frac{1}{g'}}$, where g' is equal to

a) g
b) $g - a$
c) $g + a$
d) $\sqrt{g^2 + a^2}$

247. A clock which keeps correct time at 20°C, is subjected to 40°C. If coefficient of linear expansion of the pendulum is 12×10^{-6}/°C. How much will it gain or loose in time

a) 10.3 *seconds/day*
b) 20.6 *seconds/day*
c) 5 *seconds/day*
d) 20 *minutes/day*

248. The displacement of a particle executing SHM is given by y=0.25 sin 200t cm. the maximum speed of the particle is

a) 200 cms^{-1}
b) 100 cms^{-1}
c) 50 cms^{-1}
d) 5.25 cms^{-1}

249. A particle of mass 10 g is describing S.H.M. along a straight line with period of 2 s and amplitude of 10 cm. Its kinetic energy when it is at 5 cm from its equilibrium position is

a) $37.5\pi^2 ergs$
b) $3.75\pi^2 ergs$
c) $375\pi^2 ergs$
d) $0.375\pi^2 ergs$

250. A simple pendulum has a length l. The inertial and gravitational masses of the bob are m_i *and* m_g respectively. Then the time period T is given by

a) $T = 2\pi\sqrt{\frac{m_g l}{m_i g}}$
b) $T = 2\pi\sqrt{\frac{m_i l}{m_g g}}$
c) $T = 2\pi\sqrt{\frac{m_i \times m_g \times l}{g}}$
d) $T = 2\pi\sqrt{\frac{l}{m_i \times m_g \times g}}$

251. An instantaneous displacement of a simple harmonic oscillator is $x = a\cos(\omega t\ \pi/4)$. Its speed will be maximum at time

a) $\pi/4\omega$ b) $\pi/2\omega$ c) π/ω d) $2\pi/\omega$

252. A body has a time period T_1 under the action of one force and T_2 under the action of another force, the square of the time period when both the forces are acting in the same direction is
a) $T_1^2 T_2^2$ b) T_1^2/T_2^2 c) $T_1^2 + T_2^2$ d) $T_1^2 T_2^2/(T_1^2 + T_2^2)$

253. In case of a forced vibration, the resonance wave becomes very sharp when the
a) Restoring force is small b) Applied periodic force is small
c) Quality factor is small d) Damping force is small

254. If a spring extends by x on loading then the energy stored in the spring is (if T is the tension and k is the force constant of the of the spring).
a) $\frac{T^2}{2x}$ b) $\frac{T^2}{2k}$ c) $\frac{2k}{T^2}$ d) $\frac{2T^2}{k}$

255. A particle of mass m executes simple harmonic motion with amplitude a and frequency v. The average kinetic energy during its motion from the position of equilibrium to the end is
a) $\pi^2 ma^2 v^2$ b) $\frac{1}{4}ma^2 v^2$ c) $4\pi^2 ma^2 v^2$ d) $2\pi^2 ma^2 v^2$

256. A particle executes simple harmonic motion 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) $T_1 = 2T_2$

257. This time period of a particle undergoing SHM is 16 s. It starts motion from the mean position. After 2 s, its velocity is 0.4 ms^{-1}. The amplitude is
a) 1.44 m b) 0.72 m c) 2.88 m d) 0.36 m

258. The period of oscillation of a mass m suspended from a spring is 2 s. If along with it another mass 2 kg is also suspended, the period of oscillation increases by 1 s. the mass m will be
a) 2 kg b) 1 kg c) 1.6 kg d) 2.6 kg

259. The motion which is not simple harmonic is
a) Vertical oscillations of a spring b) Motion of simple pendulum
c) Motion of a planet around the sun d) Oscillation of liquid column in a U-tube

260. The displacement of a particle performing simple harmonic motion is given by, $x = 8 \sin \omega t + 6 \cos \omega t$, where distance is in cm and time is in second. The amplitude of motion is
a) 10 cm b) 2 cm c) 14 cm d) 3.5 cm

261. A man measures the period of a simple pendulum inside a stationary lift ad finds it to be T second. If the lift accelerates upwards with an acceleration g/4, then the period of pendulum will be
a) $2T\sqrt{5}$ b) T c) $\frac{2T}{\sqrt{5}}$ d) $\frac{T}{4}$

262. A particle executing simple harmonic motion along y-axis has the its motion described by the equation $y = A \sin(\omega t) + B$. The amplitude of the simple harmonic motion is
a) A b) B c) $A + B$ d) $\sqrt{A + B}$

263. A uniform cylinder of length L and mass M having cross sectional area A is suspended with its vertical length, from a fixed point by a massless spring, such that it is half submerged in a liquid of density d at equilibrium position. When released, it starts oscillating vertically with a small amplitude. If the force constant of the spring is k, the frequency of oscillation of the cylinder is
a) $\frac{1}{2\pi}\left(\frac{k - A\,d\,g}{M}\right)^{1/2}$ b) $\frac{1}{2\pi}\left(\frac{k + A\,d\,g}{M}\right)^{1/2}$
c) $\frac{1}{2\pi}\left(\frac{k - d\,g\,L}{M}\right)^{1/2}$ d) $\frac{1}{2\pi}\left(\frac{k + A\,g\,L}{A\,d\,g}\right)^{1/2}$

264. A chimpanzee swinging on a swing in a sitting position, stands up suddenly, the time period will
a) Become infinite b) Remain same c) Increase d) Decrease

265. A S.H.M. has amplitude 'a' and time period T. The maximum velocity will be

a) $\frac{4a}{T}$ b) $\frac{2a}{T}$ c) $2\pi\sqrt{\frac{a}{T}}$ d) $\frac{2\pi a}{T}$

266. Which of the following combination of Lissajous' figure will be like eight (8)?
a) $x = a\sin 4\omega t, y = b\sin\omega t$ b) $x = a\sin 2\omega t, y = b\sin\omega t$
c) $x = a\sin 2\omega t, y = b\sin 2\omega t$ d) $x = a\sin\omega t, y = b\sin 4\omega t$

267. A girl swings on cradle in a sitting position. If she stands what happens to the time period of girl and cradle?
a) Time period decreases b) Time period increases
c) Remains constant d) First increases and then remains constant

268. The displacement of a particle of mass 3 g executing simple harmonic motion is given by $Y = 3\sin(0.2t)$ in SI units. The KE of the particle at a point which is at a distance equal to 1/3 of its amplitude from its mean position is
a) 12×10^{-3} J b) 25×10^{-3} J c) 0.48×10^{-3} J d) 0.24×10^{-3} J

269. When the amplitude of a body executing SHM become twice what happens?
a) Maximum potential energy is doubled b) Maximum kinetic energy is doubled
c) Total energy is doubled d) Maximum velocity is doubled

270. A heavy sphere of mass m is suspended by string of length l. The spear is made to revolve above a vertical line passing through the point of suspension in a horizontal circle such that the string always remains inclined to the vertical at $\angle\theta$. What is its period of revolution?
a) $T = 2\pi\sqrt{\frac{l}{g}}$ b) $T = 2\pi\sqrt{\frac{l\cos\theta}{g}}$
c) $T = 2\pi\sqrt{\frac{l\sin\theta}{g}}$ d) $T = 2\pi\sqrt{\frac{l\tan\theta}{g}}$

271. The length of simple pendulum is increased by 1%. Its time period will
a) increase by 2% b) increase by 1%
c) increase by 0.5% d) decrease by 0.5%

272. A particle starts SHM form the mean position. Its amplitude is a and total energy E. At one instant its kinetic energy is $3E/4$ its displacement at this instant is
a) $y = a/\sqrt{2}$ b) $y = \frac{a}{2}$ c) $y = \frac{a}{\sqrt{3/2}}$ d) y = a

273. In SHM restoring force is $F = -k\,x$, where k is force constant, x is displacement and A is amplitude of motion, then total energy depends upon
a) k, A and M b) k, x, M c) k, A d) k, x

274. A particle moves according to the law, $= r cos\frac{\pi t}{2.}$ The distance covered by it the time interval between t= 0 to t=3s is
a) r b) 2r c) 3r d) 4r

275. A particle executes simple harmonic motion with a frequency f. The frequency with which its kinetic energy oscillates is
a) $f/2$ b) f c) $2f$ d) $4f$

276. When the kinetic energy of a body executing S.H.M. is 1/3 of the potential energy. The displacement of the body is x percent of the amplitude, where x is
a) 33 b) 87 c) 67 d) 50

277. A body is vibrating in simple harmonic motion. If its acceleration is 12 cm s^{-2} at a displacement 3 cm, then time period is
a) 6.28 s b) 3.14 s c) 1.57 s d) 2.57 s

278. A bottle weighing 220 g and of area of cross-section 50 cm^2 and height 4 cm oscillates on the surface of water in vertical position. Its frequency of oscillation is
a) 1.5 Hz b) 2.5 Hz c) 3.5 Hz d) 4.5 Hz
279. A body of mass 500 g is attached to a horizontal spring of spring constant $8\pi^2$ N m^{-1}. If the body is pulled to a distance of 10 cm from its mean position, then its frequency of oscillation is
a) 2 Hz b) 4 Hz c) 8 Hz d) 0.5 Hz
280. A simple pendulum is set into vibrations. The bob of the pendulum comes to rest after some time due to
a) Air friction b) Moment of inertia
c) Weight of the bob d) Combination of all the above
281. The force constant of two springs are K_1 and K_2. Both are stretched till their elastic energies are equal. If the stretching forces are F_1 and F_2, then $F_1 : F_2$ is
a) $K_1 : K_2$ b) $K_2 : K_1$ c) $\sqrt{K_1} : \sqrt{K_2}$ d) $K_1^2 : K_2^2$
282. A particle moving along the x-axis executes simple harmonic motion, then the force acting on it is given by
a) $-A\,Kx$ b) $A\cos(Kx)$ c) $A\exp(-Kx)$ d) $A\,Kx$
283. A simple spring has length l and force constant k. It is cut into two spring of length l_1 and l_2 such that $l_1 = nl_2$ ($n =$ an integer). the force constant of the spring of length l_2 is
a) $k(1+n)$ b) $(k/n)\,(1+n)$ c) k d) $k/(n+1)$
284. A particle starts SHM from the mean position. Its amplitude is a and total energy E. At one instant its kinetic energy is $3\frac{E}{4}$. Its displacement at that instant is
a) $\frac{a}{\sqrt{2}}$ b) $\frac{a}{2}$ c) $\frac{a}{\sqrt{\left(\frac{3}{2}\right)}}$ d) $\frac{a}{\sqrt{3}}$
285. For a particle executing SHM, the kinetic energy k is given by $k = k_0\cos^2\omega t$. The equation of its displacement can be
a) $\left(\frac{k_0}{m\omega^2}\right)^{1/2}\sin\,\omega t$ b) $\left(\frac{2k_0}{m\omega^2}\right)^{1/2}\sin\,\omega t$ c) $\left(\frac{2\omega^2}{m\,k_0}\right)^{1/2}\sin\,\omega t$ d) $\left(\frac{2k_0}{m\omega}\right)^{1/2}\sin\,\omega t$
286. A particle is executing SHM with amplitude a. When the PE of a particle is one-fourth of its maximum value during the oscillation, its displacement from the equilibrium position will be
a) $a/4$ b) $a/3$ c) $a/2$ d) $2a/3$
287. A second's pendulum is placed in a space laboratory orbiting around the earth at a height $3R$, where R is the radius of the earth. The time period of the pendulum is
a) Zero b) $2\sqrt{3}\ s$ c) 4 s d) Infinite
288. A particle in SHM is described by the displacement function $x\,(t) = A\cos(\omega t + \theta)$. If the initial (t = 0) position of the particle is 1 cm and its initial velocity is πcms^{-1} , what is its amplitude? The angular frequency of the particle is $\pi\ s^{-1}$.
a) 1 cm b) $\sqrt{2\ cm}$ c) 2 cm d) 2.5 cm
289. A spring has a certain mass suspended from it and its period for vertical oscillation is T. The spring is now cut into two equal halves and the same mass is suspended from one of the halves. The period of vertical oscillation is now
a) $\frac{T}{2}$ b) $\frac{T}{\sqrt{2}}$ c) $\sqrt{2}T$ d) $2T$
290. A body is executing simple harmonic motion with an angular frequency 2 rad/s. The velocity of the body at 20 mm displacement, when the amplitude of motion is 60 mm, is
a) 40 mm/s b) 60 mm/s c) 113 mm/s d) 120 mm/s
291. A particle of amplitude A is executing simple harmonic motion. When the potential energy of particle is half of its maximum potential energy, then displacement from its equilibrium position is

a) $\frac{A}{4}$ b) $\frac{A}{3}$ c) $\frac{A}{2}$ d) $\frac{A}{\sqrt{2}}$

292. A body executes simple harmonic motion. The potential energy (PE), the kinetic energy (KE) and total energy (TE) are measured as function of displacement x. Which of the following statement is true?
a) KE is maximum when x=0
b) TE is zero when x=0
c) KE is maximum when x is maximum
d) PE is maximum when x=0

293. A point particle of mass 0.1 kg is executing SHM of amplitude 0.1m. When the particle passes through the mean position, its KE is 8×10^{-3}J. The equation of motion of this particle, if its initial phase of oscillation is 45^0 is
a) $y = 0.1 \sin\left(\frac{r}{4} + \frac{\pi}{4}\right)$
b) $y = 0.1 \sin\left(\frac{t}{2} + \frac{\pi}{4}\right)$
c) $y = 0.1 \sin\left(4t - \frac{\pi}{4}\right)$
d) $y = 0.1 \sin\left(4t + \frac{\pi}{4}\right)$

294. The displacement of a particle along the x axis is given by $x = a \sin^2 \omega t$. The motion of the particle corresponds to
a) Simple harmonic motion of frequency $\omega/2\pi$
b) Simple harmonic motion of frequency ω/π
c) Simple harmonic motion of frequency $3\omega/2\pi$
d) Non simple harmonic motion

295. The height of a swing changes during its motion from 0.1 m to 2.5 m. The minimum velocity of a boy who swings in this swing is
a) 5.4 m/s b) 4.95 m/s c) 3.14 m/s d) Zero

296. The time period of a simple pendulum, when it is made to oscillate on the surface of moon
a) Increases
b) Decreases
c) Remains unchanged
d) Becomes infinite

297. Two points are located at a distance of 10 m and 15 m from the source of oscillation. The period of oscillation is 0.05 sec and the velocity of the wave is 300 m/sec. What is the phase difference between the oscillations of two points
a) π b) $\frac{\pi}{6}$ c) $\frac{\pi}{3}$ d) $\frac{2\pi}{3}$

298. A particle starts oscillating simple harmonically from its equilibrium position with time period T. The ratio of KE and PE of other particle at the $t = T/12$ is
a) 1:4 b) 2:1 c) 3:1 d) 4:1

299. A pendulum bob of mass m is hanging from a fixed point by a light thread of length l. A horizontal speed v_0 is imparted to the bob so that it takes up horizontal position. If g is the acceleration due to gravity, then v_0 is
a) mgl b) $\sqrt{2gl}$ c) $\sqrt{gl}$ d) gl

300. Infinite springs with force constants k, $2k$, $4k$ and $8k$ ….. respectively are connected in series. The effective force constant of the spring will be
a) $2k$ b) k c) $k/2$ d) 2048

301. The displacement of a particle in SHM various according to the relation $x = 4\,(\cos\pi\, t + \sin\pi\, t)$. The amplitude of the particle is
a) -4 b) 4 c) $4\sqrt{2}$ d) 8

302. For a simple pendulum the graph between L and T will be
a) Hyperbola b) Parabola c) A curved line d) A straight line

303. A mass of 4 kg suspended from a spring of force constant 800 Nm^{-1} executes simple harmonic oscillations. If the total energy of the oscillator is $4J$, the maximum acceleration (in ms^{-2}) of the mass is

a) 5 b) 15 c) 45 d) 20

304. Two equations of two S.H.M. are $y = a\sin(\omega t - \alpha)$ and $y = b\cos(\omega t - \alpha)$. The phase difference between the two is

a) 0° b) $\alpha°$ c) 90° d) 180°

305. For a particle in SHM, if the amplitude of the displacement is a and the amplitude of velocity is v' the amplitude of acceleration is

a) va b) $\frac{v^2}{a}$ c) $\frac{v^2}{2a}$ d) $\frac{v}{a}$

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

a) $\frac{\pi A\sqrt{3}}{T}$ b) $\frac{\pi A}{T}$ c) $\frac{\pi A\sqrt{3}}{2T}$ d) $\frac{3\pi^2 A}{T}$

307. A uniform rod of length 2.0 m is suspended through an end is set into oscillation with small amplitude under gravity. The time period of oscillation is approximately

a) 1.60 s b) 1.80 s c) 2.0 s d) 2.40 s

308. In simple harmonic motion, the ratio of acceleration of the particle to its displacement at any time is a measure of

a) Spring constant b) Angular frequency c) $(\text{Angular frequency})^2$ d) Restoring force

309. There is a body having mass m and performing S.H.M. with amplitude a. There is a restoring force $F = -Kx$, where x is the displacement. The total energy of body depends upon

a) K, x b) K, a c) K, a, x d) K, a, v

310. A particle performing SHM has time period $\frac{2\pi}{\sqrt{3}}$ and path length 4 cm. The displacement from mean position at which acceleration is equal to velocity is

a) Zero b) 0.5 cm c) 1 cm d) 1.5 cm

311. A particle executes SHM of amplitude 25 cm and time period 3 s. What is the minimum time required for the particle to move between two points 12.5 cm on either side of the mean position?

a) 0.5 s b) 1.0 s c) 1.5 s d) 2.0 s

312. Two identical blocks A and B, each of mass m resting on smooth floor, are connected by a light spring of natural length L and the spring constant k, with the spring at its natural length. A third identical block at C (mass m) moving with a speed (v) along the line joining A and B collides with A. The maximum compression in the spring is proportional to

a) $v\sqrt{\frac{m}{2k}}$ b) $m\sqrt{\frac{v}{2k}}$ c) $\sqrt{\frac{mv}{k}}$ d) $\frac{mv}{2k}$

313. Resonance is an example of

a) Tuning fork b) Forced vibration c) Free vibration d) Damped vibration

314. A simple pendulum hanging from the ceiling of a stationary lift has time period t_1. When the lift moves downward with constant velocity, the time period is t_2, then

a) t_2 is infinity b) $t_2 > t_1$ c) $t_2 < t_1$ d) $t_2 = t_1$

315. The KE and PE of a particle executing SHM of amplitude a will be equal when displacement is

a) $\frac{a}{2}$ b) $a\sqrt{2}$ c) $2a$ d) $a/\sqrt{2}$

316. A particle is vibrating in a simple harmonic motion with an amplitude of 4 cm. At what displacement from the equilibrium position, is its energy half potential and half kinetic

a) 1 cm b) $\sqrt{2}$ cm c) 3 cm d) $2\sqrt{2}$ cm

317. 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

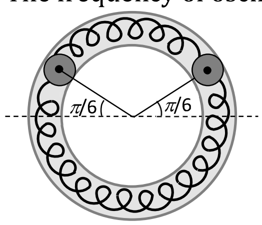
a) $T \propto \frac{1}{\rho}$ b) $T \propto \frac{1}{\sqrt{m}}$ c) $T \propto \sqrt{\rho}$ d) $T \propto \frac{1}{\sqrt{A}}$

318. The angular amplitude of a simple pendulum is θ_0. The maximum tension in its string will be
a) $mg(1-\theta_0)$ b) $mg(1+\theta_0)$ c) $mg(1-\theta_0^2)$ d) $mg(1+\theta_0^2)$

319. Graph between velocity and displacement of a particle, executing S.H.M. is
a) A straight line b) A parabola c) A hyperbola d) An ellipse

320. Ratio of kinetic energy at mean position to potential energy at $A/2$ of a particle performing SHM
a) 2:1 b) 4:1 c) 8:1 d) 1:1

321. Two identical balls A and B each of mass 0.1 kg are attached to two identical massless springs. The spring mass system is constrained to move inside a rigid smooth pipe bent in the form of circle as shown in the figure. The pipe is fixed in a horizontal plane. The centres of the balls can move in a circle of radius 0.06 m. Each spring has a natural length of 0.06π m and force constant $0.1 N/m$. Initially both the balls are displaced by an angle $\theta = \pi/6$ radian with respect to the diameter PQ of the circle and released from rest. The frequency of oscillation of the ball B is

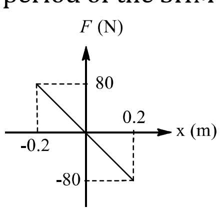


a) π Hz b) $\frac{1}{\pi} Hz$ c) 2π Hz d) $\frac{1}{2\pi} Hz$

322. The acceleration of a particle in S.H.M. is
a) Always zero
b) Always constant
c) Maximum at the extreme position
d) Maximum at the equilibrium position

323. Two blocks with masses $m_1 = 1$kg and $m_2 = 2$ kg are connected by a spring constant $k = 24\ Nm^{-1}$ and placed on a frictionless horizontal surface. The block m_1 is imparted an initial velocity $v_0 = 12$ cms $^{-1}$ to the right, the amplitude of oscillation is
a) 1 cm b) 2 cm c) 3 cm d) 4 cm

324. A body of mass 0.01 kg executes SHM about $x = 0$, under the influence of force shown in the figure The period of the SHM is



a) 1.05 s b) 0.52 s c) 0.25 s d) 0.03 s

325. Two pendulums of length 212 cm and 100 cm start vibrating. At same instant the two are in the mean position in the same phase. After how many vibrations of the shorter pendulum, the two will be in phase in the mean position?
a) 10 b) 11 c) 20 d) 21

326. A particle is oscillating according to the equation $X = 7\cos 0.5\pi t$, where t is in second. The point moves from the position of equilibrium to maximum displacement in time
a) 4.0 s b) 2.0 s c) 1.0 s d) 0.5 s

327. The maximum speed of a particle executing SHM is 1 ms^{-1} and maximum acceleration is 1.57 ms^{-2}. Its frequency is
a) 0.25 s^1 b) 2 s^1 c) 1.57 s^1 d) 2.57 s^1

328. A particle executes linear simple harmonic motion with an amplitude of 2 cm. When the particle is at 1 cm from the mean position the magnitude of its velocity is equal to that of its acceleration.

Then its time period in second is

a) $\frac{1}{2\pi\sqrt{3}}$ b) $2\pi\sqrt{3}$ c) $\frac{2\pi}{\sqrt{3}}$ d) $\frac{\sqrt{3}}{2\pi}$

329. The period of a simple pendulum inside a stationary lift is T. The lift accelerates upwards with an acceleration of g/3. The time period of pendulum will be

a) $\sqrt{2}\,T$ b) $\frac{T}{\sqrt{2}}$ c) $\frac{\sqrt{3}}{2}T$ d) $\frac{T}{3}$

330. The total energy of a particle executing S.H.M. is proportional to

a) Displacement from equilibrium position b) Frequency of oscillation
c) Velocity in equilibrium position d) Square of amplitude of motion

331. A particle is performing simple harmonic motion with amplitude A and angular velocity ω. The ratio of maximum velocity to maximum acceleration is

a) ω b) $1/\omega$ c) ω^2 d) $A\omega$

332. The kinetic energy and potential energy of a particle executing simple harmonic motion will be equal, when displacement

a) $\frac{a}{2}$ b) $a\sqrt{2}$ c) $\frac{a}{\sqrt{2}}$ d) $\frac{a\sqrt{2}}{3}$

333. A simple pendulum, suspended from the ceiling of a stationary van, has time period T. If the van starts moving with a uniform velocity the period of the pendulum will be

a) Less than T b) Equal to $2T$ c) Greater than T d) Unchanged

334. A body executing simple harmonic motion has a maximum acceleration equal to 24 ms^{-2} and maximum velocity of 16 ms^{-1}, the amplitude of the simple harmonic motion is

a) $\frac{1024}{9}$ m b) $\frac{32}{3}$ m c) $\frac{64}{9}$ m d) $\frac{3}{32}$m

335. How does the time period of pendulum vary with length

a) $\sqrt{L}$ b) $\sqrt{\frac{L}{2}}$ c) $\frac{1}{\sqrt{L}}$ d) $2L$

336. A plate oscillates with time period $'T'$. Suddenly, another plate put on the first time, then time period

a) Will decrease b) Will increase c) Will be same d) None of these

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

(1) $y = \sin\omega t - \cos\omega t$ (2) $y = \sin^3\omega t$

(3) $y = 5\cos\left(\frac{3\pi}{4} - 3\omega t\right)$ (4) $y = 1 + \omega t + \omega^2 t^2$

a) Only (1) and (2) b) Only (1)
c) Only (4) does not represent SHM d) Only (1) and (3)

338. A $1.00 \times 10^{-20} kg$ particle is vibrating with simple harmonic motion with a period of $1.00 \times 10^{-5} s$ and a maximum speed of $1.00 \times 10^3 m/s$. The maximum displacement of the particle is

a) 1.59 mm b) 1.00 m c) 10 m d) None of these

339. The maximum velocity of a particle executing SHM is V. If the amplitude is doubled and the time period of oscillation decreased to 1/3 of its original value, the maximum velocity becomes

a) 18 V b) 12 V c) 6 V d) 3 V

340. If the length of second's pendulum is increased by 2% How many seconds it will lose per day?

a) 3927 s b) 3427 s c) 3737 s d) 864 s

341. A body is vibrating in simple harmonic motion with an amplitude of 0.06 m and frequency of 15 Hz. The velocity and acceleration of body is

a) 5.65 m/s and $5.32 \times 10^2 m/s^2$ b) 6.82 m/s and $7.62 \times 10^2 m/s^2$
c) 8.91 m/s and $8.21 \times 10^2 m/s^2$ d) 9.82 m/s and $9.03 \times 10^2 m/s^2$

342. A simple harmonic oscillator has an amplitude a and time period T. The time required by it to travel from $x = a$ to $x = a/2$ is

a) $T/6$ b) $T/4$ c) $T/3$ d) $T/2$

343. When the displacement is half the amplitude, the ratio of potential energy to the total energy is

a) $\frac{1}{2}$ b) $\frac{1}{4}$ c) 1 d) $\frac{1}{8}$

344. A spring of force constant k is cut into two pieces such that one piece is double the length of the other. Then the long piece will have a force constant of

a) $(2/3)k$ b) $(3/2)k$ c) $3k$ d) $6k$

345. Two mutually perpendicular simple harmonic vibrations have same amplitude, frequency and phase. When they superimpose, the resultant from of vibration will be

a) A circle b) An ellipse c) A straight line d) A parabola

346. For Simple Harmonic Oscillator, the potential energy is equal to kinetic energy

a) Once during each cycle b) twice during each cycle
c) when $x = a/2$ d) when $x = a$

347. If the differential equation given by

$$\frac{d^2y}{dt^2} + 2k\frac{dy}{dt} + \omega^2 y = F_0 \sin pt$$

Describes the oscillatory motion of body in a dissipative medium under the influence of a periodic force, then the state of maximum amplitude of the oscillation is a measure of

a) Free vibration b) Damped vibration c) Forced vibration d) Resonance

348. A light spiral spring supports a 200 g weight at its lower end. It oscillates up and down with a period of 1 s. How much weight (in gram) must be removed from the lower end to reduce the period to 0.5 s?

a) 53 b) 100 c) 150 d) 200

349. When a body of mass 1.0 kg is suspended from a certain light spring hanging vertically, its length increases by 5 cm. By suspending 2.0 kg block to the spring and if the block is pulled through 10 cm and released, the maximum velocity of it in ms^{-1} is ($g = 10\ ms^{-2}$)

a) 0.5 b) 1 c) 2 d) 4

350. An elastic string has a length l when tension in it is 5 N. Its length is h when tension is of 4 N. on subjecting the string to a tension of 9 N, its length will be

a) $l + h$ b) $l - h$ c) $(5\,l - 4\,h)$ d) $(l + h)/(h - l)$

351. A pendulum has time period T in air. When it is made to oscillate in water, it acquired a time period $T' = \sqrt{2}T$. The density of the pendulum bob is equal to (density of water = 1)

a) $\sqrt{2}$ b) 2 c) $2\sqrt{2}$ d) None of these

352. One end of a long metallic wire of length L is tied to the ceiling. The other end is tied to massless spring of spring constant K. A mass m hangs freely from the free end of the spring. The area of cross-section and Young's modulus of the wire are A and Y respectively. If the mass is slightly pulled down and released, it will oscillate with a time period T equal to

a) $2\pi\left(\frac{m}{K}\right)$ b) $2\pi\left\{\frac{(YA + KL)m}{YAK}\right\}^{1/2}$ c) $2\pi\frac{mYA}{KL}$ d) $2\pi\frac{mL}{YA}$

353. If a simple pendulum oscillates with an amplitude of 50 nm and time period of 2 s, then its maximum velocity is

a) $0.10\ ms^{-1}$ b) $0.15\ ms^{-1}$ c) $0.8\ ms^{-1}$ d) $0.26\ ms^{-1}$

354. When the displacement is half of the amplitude, then when fraction of the total energy of a simple harmonic oscillator is kinetic?

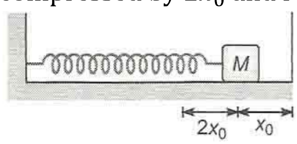
a) 2/7th b) 3/4th c) 2/9th d) 5/7th

355. A particle of mass 10 g is executing simple harmonic motion with an amplitude of 0.5 m and periodic time of $(\pi/5)$ s. The maximum value of the force acting on the particle is

a) 25 N b) 5 N c) 2.5 N d) 0.5 N

356. One end of a spring of force constant k is fixed to a vertical wall and the other to a block of mass m resting on a smooth horizontal surface. There is another wall at a distance x_0 from the black. The spring is then

compressed by $2x_0$ and released. The time taken to strike the wall is



a) $\frac{1}{6}\pi\sqrt{\frac{k}{m}}$ b) $\sqrt{\frac{k}{m}}$ c) $\frac{2\pi}{3}\sqrt{\frac{m}{k}}$ d) $\frac{\pi}{4}\sqrt{\frac{k}{m}}$

357. A particle in SHM is described by the displacement function $x(t) = A\cos(\omega t + \phi)$, $\omega = 2\pi/T$. If the initial (t=0)position of the particle is 1 cm, its initial velocity is $\pi\ cm\ s^{-1}$ 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

358. For a body of mass m attached to the spring, the spring factor is given by (ω, the angular frequency)

a) m/ω^2 b) $m\ \omega^2$ c) $m^2\omega$ d) $m^2\omega^2$

359. The time period of a mass suspended from a spring is 5 s. The spring is cut into four equal parts and the same mass is now suspended from one of its parts. The period is now

a) 5 s b) 2.5 s c) 1.25 s d) $\frac{1}{16}\ s$

360. The length of a spring is l and its force constant is k. When a weight W is suspended from it, its length increases by x. If the spring is cut into two equal parts and put in parallel and the same weight W is suspended from them, then the extension will be

a) $2x$ b) x c) $\frac{x}{2}$ d) $\frac{x}{4}$

361. A force of 6.4 N stretches a vertical spring by 0.1 m. The mass that must be suspended from the spring so that it oscillates with a period of $\left(\frac{\pi}{4}\right) s$. is

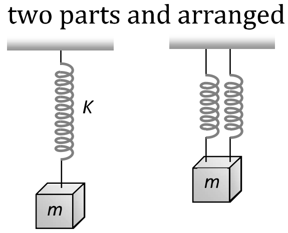
a) $\left(\frac{\pi}{4}\right) kg$ b) $1kg$ c) $\left(\frac{1}{\pi}\right) kg$ d) $10kg$

362. Which of the following equations does not represent a simple harmonic motion

a) $y = a\sin\omega\ t$ b) $y = a\cos\omega\ t$

c) $y = a\sin\omega t + b\cos\omega t$ d) $y = a\tan\omega\ t$

363. A mass m performs oscillations of period T when hanged by spring of force constant K. If spring is cut in two parts and arranged in parallel and same mass is oscillated by them, then the new time period will be



a) $2T$ b) T c) $\frac{T}{\sqrt{2}}$ d) $\frac{T}{2}$

364. A particle executing simple harmonic motion with amplitude of 0.1 m. At a certain instant when its displacement is 0.02 m, its acceleration is 0.5 m/s^2. The maximum velocity of the particle is (in m/s)

a) 0.01 b) 0.05 c) 0.5 d) 0.25

365. Two springs are joined and attached to a mass of 16 kg. This system is then suspended vertically from a rigid support. The spring constant of the two springs are k_1 and k_2 respectively. The period of vertical oscillations of the system will be

a) $\frac{1}{8\pi}\sqrt{k_1 + k_2}$ b) $8\pi\sqrt{\frac{k_1 + k_2}{k_1 k_2}}$ c) $\frac{\pi}{2}\sqrt{k_1 - k_2}$ d) $\frac{\pi}{2}\sqrt{\frac{k_1}{k_2}}$

366. Two simple harmonic motions of angular frequency 100 and 1000 rad/s have the same

displacement amplitude. The ratio of their maximum acceleration is

a) 1:10 b) $1:10^2$ c) $1:10^3$ d) $1:10^4$

367. A particle executes SHM with a period of 8 s and amplitude 4 cm. Its maximum speed in cms^{-1}, is

a) π b) $\frac{\pi}{2}$ c) $\frac{\pi}{3}$ d) $\frac{\pi}{4}$

368. A simple pendulum of length l has a bob of mass m, with a charge q on it. A vertical sheet of change, with surface charge density σ passes through the point of suspension. At equilibrium, the spring makes an angle θ with the vertical. Its time period of oscillations is T in this position. Then

a) $\tan\theta = \frac{\sigma q}{2\varepsilon_0 mg}$ b) $\tan\theta = \frac{\sigma q}{\varepsilon_0 mg}$ c) $T > 2\pi\sqrt{\frac{1}{g}}$ d) $T = 2\pi\sqrt{\frac{1}{g}}$

369. An electric motor of mass 40 kg is mounted on four vertical springs each having constant at 4000 Nm^{-1}. The period with which the motor vibrates vertically is

a) 0.314 s b) 3.14 s c) 0.628 s d) 0.56 s

370. An ideal spring with spring constant $K = 200\ N/m$ is fixed on one end on a wall. If the spring is pulled with a force 10 N at the other end along its length, how much it will extended?

a) 5 cm b) 2 m c) 2 cm d) 5 m

371. The motion 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 $\sqrt{a^2 + b^2}$

372. The maximum velocity of a simple harmonic motion represented by $y = 3\sin(100t + \frac{\pi}{6})$m is given by

a) 300 ms^{-1} b) $\frac{3\pi}{6}$ ms^{-1} c) 100 ms^{-1} d) $\frac{\pi}{6}$ ms^{-1}

373. If a spring has time period T, and is cut into n equal parts, then the time period of each part will be

a) $T\sqrt{n}$ b) $T/\sqrt{n}$ c) nT d) T

374. Masses m and 3 m are attached to the two ends of a spring of constant k. If the system vibrates freely. The period of oscillation will be

a) $\pi\sqrt{\frac{m}{k}}$ b) $2\pi\sqrt{\frac{m}{k}}$ c) $\pi\sqrt{\frac{3m}{k}}$ d) $2\pi\sqrt{\frac{3m}{k}}$

375. A mass 1 kg suspended from a spring shoes force constant is 400 Nm^{-1}, executes simple harmonic oscillation. When the total energy of the oscillator is 2j, the maximum acceleration experienced by the mass will be

a) 2 ms^{-2} b) 4 ms^{-2} c) 40 ms^{-2} d) 400 ms^{-2}

376. Two simple harmonic motions act on a particle. These harmonic motions are $x = A\cos(\omega t + \delta)$; $A\cos(\omega t + \alpha)$ when

a) an ellipse and the actual motion is counter clockwise
b) an ellipse and the actual motion is clockwise
c) a circle and the actual motion is counter clockwise
d) a circle and the actual motion is clockwise

377. In a simple harmonic motion maximum velocity is at

a) Extreme position
b) Half of extreme position
c) Equilibrium position
d) Between extreme and equilibrium position

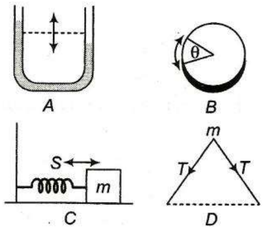
378. The angular velocity and the amplitude of a simple pendulum is ω and a respectively. At a displacement x from the mean position if its kinetic energy is T and potential energy is V, then the ratio of T to V is

a) $(a^2 - x^2\omega^2)/x^2\omega^2$
b) $x^2\omega^2/(a^2 - x^2\omega^2)$
c) $(a^2 - x^2)/x$
d) $x^2/(a^2 - x^2)$

379. A pendulum is made to hang from the ceiling of an elevator. It has period of T s (for small angles). The elevator is made to accelerate upwards with $10m/s^2$. The period of the pendulum now will be (assume $g = 10m/s^2$)

a) $T\sqrt{2}$ b) Infinite c) $T/\sqrt{2}$ d) Zero

380. Consider the mechanical vibrating systems shown in figure A, B, C and D. The vibrations are simple harmonic in



a) A, C b) A, B, C c) B, D d) A, B, C, D

381. A solid cylinder of mass 3 kg is rolling on a horizontal surface with velocity $4ms^{-1}$. It collides with a horizontal spring of force constant $200Nm^{-1}$. The maximum compression produced in the spring will be

a) 0.5 m b) 0.6 m c) 0.7 m d) 0.2 m

382. In a simple harmonic oscillator, at the mean position

a) Kinetic energy is minimum, potential energy is maximum
b) Both kinetic and potential energies are maximum
c) Kinetic energy is maximum, potential energy is minimum
d) Both kinetic and potential energies are minimum

383. What is time period of pendulum hanged in satellite?
(T is time period on earth)

a) Zero b) T c) Infinite d) $T/\sqrt{6}$

384. In a simple pendulum, the period of oscillation T is related to length of the pendulum l as

a) $\frac{l}{T} =$ constant b) $\frac{l^2}{T} =$ constant c) $\frac{l}{T^2} -$ constant d) $\frac{l^2}{T^2} =$ constant

385. A mass M, attached to a horizontal spring, executes SHM with amplitude A_1. When the mass M passes through its mean position then a smaller mass m is placed over it and both of them move together with amplitude A_2. The ratio of $\left(\frac{A_1}{A_2}\right)$ is

a) $\frac{M+m}{M}$ b) $\left(\frac{M}{M+m}\right)^{1/2}$ c) $\left(\frac{M+m}{M}\right)^{1/2}$ d) $\frac{M}{M+m}$

386. On a planet a freely falling body takes 2 s when it is dropped from a height of 8 m, the time period of simple pendulum of length 1 m on that planet is

a) 3.14 s b) 16.28 s c) 1.57 s d) None of these

387. The displacement of an object attached to a spring and executing simple harmonic motion is given by $x = 2 \times 10^{-2} \cos \pi t$ metre. The time at which the maximum speed first occurs is

a) 0.5 s b) 0.75 s c) 0.125 s d) 0.25 s

388. A mass M is suspended from a spring of negligible mass. The spring is pulled a little and then released so that the mass executes SHM of time period T. If the mass is increased by m, the time period become $5T/3$. Then the ratio of $\frac{m}{M}$ is

a) 3/5 b) 25/9 c) 16/9 d) 5/3

389. The period of oscillation of a simple pendulum of length L suspended from the roof of a vehicle which moves without friction down an inclined plane of inclination α is given by

a) $2\pi\sqrt{\frac{L}{g \cos \alpha}}$ b) $2\pi\sqrt{\frac{L}{g \sin \alpha}}$ c) $2\pi\sqrt{\frac{L}{g}}$ d) $2\pi\sqrt{\frac{L}{g \tan \alpha}}$

390. A brass cube of side a and density σ is floating in mercury of density ρ. If the cube is displaced a bit vertically, it executes S.H.M. Its time period will be

a) $2\pi\sqrt{\frac{\sigma a}{\rho g}}$ b) $2\pi\sqrt{\frac{\rho a}{\sigma g}}$ c) $2\pi\sqrt{\frac{\rho g}{\sigma a}}$ d) $2\pi\sqrt{\frac{\sigma g}{\rho a}}$

391. A simple pendulum of length l has a brass bob attached at its lower end. Its period is T. If a steel bob of same size, having density x times that of brass, replaces the brass bob and its length is changed so that period becomes 2 T. then new length is

a) 2 l b) 4 l c) 4 lx d) 4 l/x

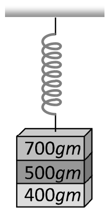
392. The time period of a simple pendulum is 2 s. If its length is increased 4 times, then its period becomes

a) 16 s b) 12 s c) 8 s d) 4 s

393. A body is executing Simple Harmonic Motion. At a displacement x its potential energy is E_1 and at a displacement y its potential energy is E_2. The potential energy E at displacement $(x + y)$ is

a) $\sqrt{E} = \sqrt{E_1} - \sqrt{E_2}$ b) $\sqrt{E} = \sqrt{E_1} + \sqrt{E_2}$ c) $E = E_1 - E_2$ d) $E = E_1 + E_2$

394. Three masses $700g$, $500g$, and $400g$ are suspended at the end of a spring a shown and are in equilibrium. When the $700g$ mass is removed, the system oscillates with a period of 3 seconds, when the $500g$ mass is also removed, it will oscillate with a period of

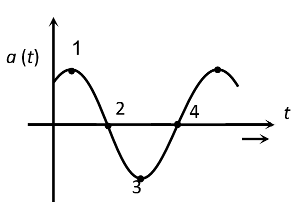


a) 1 s b) 2 s c) 3 s d) $\sqrt{\frac{12}{5}}s$

395. Acceleration of a particle, executing SHM, at it's mean position is

a) Infinity b) Varies c) Maximum d) Zero

396. The acceleration a of a particle undergoing S.H.M. is shown in the figure. Which of the labelled points corresponds to the particle being at $-x_{max}$



a) 4 b) 3 c) 2 d) 1

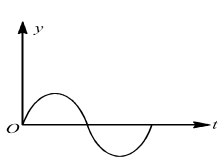
397. Two springs of constant k_1 and k_2 are joined in series. The effective spring constant of the combination is given by

a) $\sqrt{k_1k_2}$ b) $(k_1 + k_2)/2$ c) $k_1 + k_2$ d) $k_1k_2/(k_1 + k_2)$

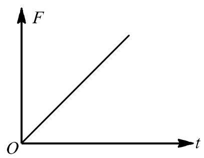
398. An object is attached to the bottom of a light vertical spring and set vibrating. The maximum speed of the object is 15 cm/s and the period is 628 $milli\text{-}seconds$. The amplitude of the motion in centimeters is

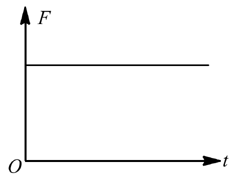
a) 3.0 b) 2.0 c) 1.5 d) 1.0

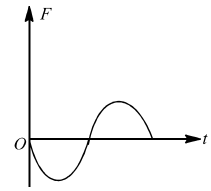
399. The displacement-time graph of a particle executing SHM is as shown in the figure.

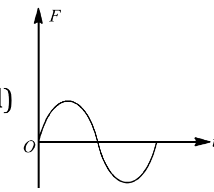


The corresponding force-time graph of the particle is

a) 

b) 

c) 

d) 

400. Two bodies M and N of equal masses are suspended from two separate massless springs of force constants k_1 and k_2 respectively. If the two bodies oscillate vertically such that their maximum velocities are equal, the ratio of the amplitude M to that of N is

a) k_1/k_2 b) $\sqrt{k_1/k_2}$ c) k_2/k_1 d) $\sqrt{k_2/k_1}$

401. A particle at the end of a spring executes simple harmonic motion with a period t_1, while the corresponding period for another spring is t_2. If the period of oscillation with the two springs in series is T, then

a) $T = t_1 + t_2$ b) $T^2 = t_1^2 + t_2^2$ c) $T^{-1} = t_1^{-1} + t_2^{-1}$ d) $T^{-2} = t_1^{-2} + t_2^{-2}$

402. Maximum speed of a particle in SHM is $v_{max.}$ Then average speed of a particle in SHM is equal to

a) $\frac{v_{\max}}{2}$ b) $\frac{\pi v_{\max}}{2}$ c) $\frac{v_{\max}}{2\pi}$ d) $\frac{2v_{\max}}{\pi}$

403. Which one of the following equations does not represent SHM, x = displacement and t = time. Parameters a, b and c are the constants of motion?

a) $x = a \sin bt$
b) $x = a \cos bt + c$
c) $x = a \sin bt + c \cos bt$
d) $x = a \sec bt + c \operatorname{cosec} bt$

404. A weightless spring which has a force constant k oscillates with frequency n when a mass m is suspended from it. The spring is cut into two equal halves and a mass 2 m is suspended from one part of spring. The frequency of oscillation will now become

a) N b) 2n c) $\frac{n}{\sqrt{2}}$ d) $n\,(2)^{1/2}$

405. Average value of KE and PE over entire time 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) $\frac{1}{4} m\, \omega^2 A^2, \frac{1}{4} m\, \omega^2 A^2$

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

a) $\frac{T}{4}$ b) $\frac{T}{8}$ c) $\frac{T}{12}$ d) $\frac{T}{2}$

407. The displacement of a particle from its mean position (in metre) is given by $y = 0.2 \sin(10\pi t + 1.5\pi) \cos(10\pi t + 1.5\pi)$. The motion of particle is

a) Periodic but not S.H.M.
b) Non-periodic
c) Simple harmonic motion with period 0.1 s
d) Simple harmonic motion with period 0.2 s

408. Two equal negative charge –q are fixed points (0, a) and (0,-0) on the Y-axis. A positive charge Q is released from rest at point (2a, 0) on the X-axis. The charge Q will

a) execute SHM about origin
b) move to infinity
c) Move to the origin and remained at rest
d) execute oscillatory but not SHM

409. When a mass m is attached to a spring, it normally extends by 0.2 m. The mass m is given a slight addition extension and released, then its time period will be

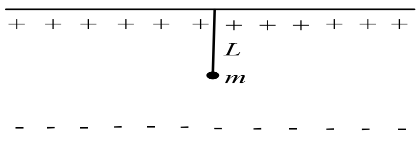
a) $\frac{1}{7} sec$ b) 1 sec c) $\frac{2\pi}{7}\pi$ d) $\frac{2}{3\pi}$ sec

410. The bob of a simple pendulum executes simple harmonic motion in water with a period t, while

the period of oscillation of the bob is t_0 in air. Neglecting frictional force of water and given that the density of the bob is $(4/3 \times 1000\ \text{kg} - \text{m}^3)$. What relationship between t and t_0 is true?

a) $t = t_0$ b) $t = t_0/2$ c) $t = 2t_0$ d) $t = 4t_0$

411. A small sphere carrying a charge q is hanging in between two parallel plates by a string of length L. Time period of pendulum is T_0. When parallel plates are charged, the time period changes to T. The ratio T/T_0 is equal to



a) $\left(\frac{g+\frac{qE}{m}}{g}\right)^{1/2}$ b) $\left(\frac{g}{g+\frac{qE}{m}}\right)^{3/2}$ c) $\left(\frac{g}{g+\frac{qE}{m}}\right)^{1/2}$ d) None of these

412. A point mass m is suspended at the end of a massless wire of length L and cross-section area A. If Y is the Young's modulus for the wire, then the frequency of oscillations for the SHM along the vertical line is

a) $\frac{1}{2\pi}\sqrt{\frac{YA}{mL}}$ b) $2\pi\sqrt{\frac{mL}{YA}}$ c) $\frac{1}{\pi}\sqrt{\frac{YA}{mL}}$ d) $\pi\sqrt{\frac{mL}{YA}}$

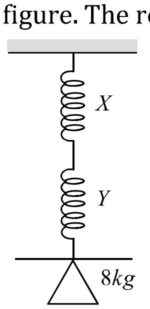
413. When a mass M is attached to the spring of force constant k, then the spring stretches by l. If the mass oscillates with amplitude l, what will be maximum potential energy stored in the spring

a) $\frac{kl}{2}$ b) $2kl$ c) $\frac{1}{2}Mgl$ d) Mgl

414. A simple pendulum is attached to the roof of a lift. If time period of oscillation, when the lift is stationary is T. Then frequency of oscillation, when the lift falls freely, will be

a) Zero b) T c) $1/T$ d) None of these

415. A body of mass 8 kg is suspended through two light springs X and Y connected in series as shown in figure. The readings in X and Y respectively are



a) 8 kg, zero b) zero, 8 kg c) 8 kg, 8 kg d) 2 kg ,6 kg

416. A block of mass M is suspended from a light spring of force constant k. another mass m moving upwards with velocity v hits the mass M and gets embedded in it. What will be the amplitude of the combined mass?

a) $\frac{mv}{\sqrt{(M-m)k}}$ b) $\frac{Mv}{(M-m)k}$ c) $\frac{mv}{\sqrt{(M+m)k}}$ d) $\frac{Mv}{\sqrt{(M+m)k}}$

417. The period of oscillation of a simple pendulum of constant length at earth surface is T. Its period inside a mine is

a) Greater than T b) Less than T c) Equal to T d) Cannot be compared

418. A block whose mass is 650 g is fastened to a spring whose spring constantly is 65 Nm^{-1}. The block is

pulled a distance $x = 11$ cm from its equilibrium position at $x = 0$. On a frictionless surface and released from rest at $t = 0$.The maximum velocity of the vibrating block is

a) 1.1 ms^{-1} b) 0.65 ms^{-1} c) 1.30 ms^{-1} d) 2.6 ms^{-1}

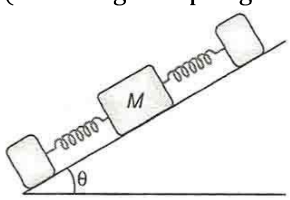
419. The resultant of two rectangular single harmonic motion of the same frequency and unequal amplitudes but differing in phase by $\pi/2$ is

a) Simple harmonic b) Circular c) Elliptical d) Parabolic

420. In a seconds pendulum, mass of the bob is 30 g. If it is replaced by 90 g mass, then its time period will be

a) 1 s b) 2 s c) 4 s d) 3 s

421. On a smooth inclined plane, a body of mass M is attached between two springs. The other ends of the springs are fixed to firm support. If each spring has force constant k, the period of oscillation of the body (assuming the springs as massless) is



a) $2\pi[M/2k]^{1/2}$ b) $2\pi[2M/k]^{1/2}$
c) $2\pi[Mg\sin\theta/2k]^{1/2}$ d) $2\pi[2Mg/k]^{1/2}$

422. A heavy brass sphere is hung from a weightless inelastic spring and as a simple pendulum its time period of oscillation is T. When the sphere is immersed in a non-viscous liquid of density 1/10 that of brass, it will act as a simple pendulum of period

a) T b) $\frac{10}{9}T$ c) $\sqrt{\left(\frac{9}{10}\right)}T$ d) $\sqrt{\left(\frac{10}{9}\right)}T$

423. A particle is executing the motion $x = A\cos(\omega t - \theta)$. The maximum velocity of the particle is

a) $A\omega\cos\theta$ b) $A\omega$ c) $A\omega\sin\theta$ d) None of these

424. A system exhibiting S.H.M. must possess

a) Inertia only b) Elasticity as well as inertia
c) Elasticity, inertia and an external force d) Elasticity only

425. The time period of the variation of potential energy of a particle executing SHM with period T is

a) $\frac{T}{4}$ b) T c) $2T$ d) $\frac{T}{2}$

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

a) 0.5π b) π c) 0.707π d) Zero

427. The potential energy of a particle executing S.H.M. is 2.5 J, when its displacement is half of amplitude. The total energy of the particle be

a) 18 J b) 10 J c) 12 J d) 2.5 J

428. The amplitude of a particle executing SHM is made three-fourth keeping its time period constant. Its total energy will be

a) $\frac{E}{2}$ b) $\frac{3}{4}E$ c) $\frac{9}{16}E$ d) None of these

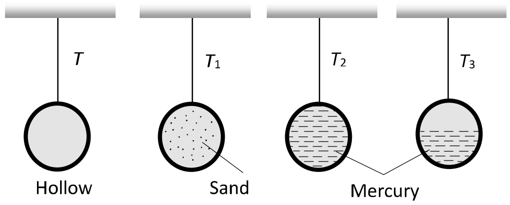
429. A particle is performing simple harmonic motion along x-axis with amplitude 4 cm and time period 1.2 s. The minimum time taken by the particle to move from $x = +2$ to $x = +4$ cm and back again is given by

a) 0.4 s b) 0.3 s c) 0.2 s d) 0.6 s

430. In a simple harmonic oscillator has got a displacement of 0.02 m and acceleration equal to $2.0 ms^{-2}$ at any time, the angular frequency of the oscillator is equal to

a) $10 rad\ s^{-1}$ b) $0.1 rad\ s^{-1}$ c) $100 rad\ s^{-1}$ d) $1 rad\ s^{-1}$

431. The period of a simple pendulum, whose bob is hollow metallic sphere, is T. The period is T_1 when the bob is filled with sand, T_2 when it is filled with mercury and T_3 when it is half filled with mercury. Which of the following is true



a) $T = T_1 = T_2 > T_3$ b) $T_1 = T_2 = T_3 > T$ c) $T > T_3 > T_1 = T_2$ d) $T = T_1 = T_2 < T_3$

432. A S.H.M. is represented by $x = 5\sqrt{2}(\sin 2\pi t + \cos 2\pi t)$. The amplitude of the S.H.M. is

a) 10 cm b) 20 cm c) $5\sqrt{2}cm$ d) 50 cm

433. The scale of a spring balance reading from 0 to 10 kg is 0.25 m long. A body suspended from the balance oscillates vertically with a period of $\pi/10$ second. The mass suspended is (neglect the mass of the spring)

a) 10 kg b) 0.98 kg c) 5 kg d) 20 kg

434. A weightless spring of length 60 cm and force constant 200 N/m is kept straight and unstretched on a smooth horizontal table and its ends are rigidly fixed. A mass of 0.25 kg is attached at the middle of the spring and is slightly displaced along the length. The time period of the oscillation of the mass is

a) $\frac{\pi}{20}s$ b) $\frac{\pi}{10}s$ c) $\frac{\pi}{5}s$ d) $\frac{\pi}{\sqrt{200}}s$

435. 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 double while period remains the same

d) Period remains the same and energy becomes four times

436. In S.H.M. maximum acceleration is at

a) Amplitude

b) Equilibrium

c) Acceleration is constant

d) None of these

437. If two springs A and B with spring constants 2 k and k, are stretched separately by same suspended weight, then the ratio between the work done in stretched A and B is

a) 1:2 b) 1:4 c) 1:3 d) 4:1

438. A mass M is suspended from a spring of negligible mass. The spring is pulled a little and then released so that the mass executes simple harmonic oscillations with a time period T. If the mass is increased by m then the time period becomes $\left(\frac{5}{4}T\right)$. The ratio of $\frac{m}{M}$ is

a) 9/16 b) 25/16 c) 4/5 d) 5/4

439. Two pendulums have time period T and 5T/4. They start SHM at the same time from the mean position. What will be the phase difference between then after the bigger pendulum completed one oscillation?

a) 45^0 b) 90^0 c) 60^0 d) 30^0

440. The differential equation of a particle executing SHM along y-axis is

a) $\frac{d^2y}{dt^2} + \omega^2 y = 0$ b) $\frac{d^2y}{dt^2} + \omega^2 y^2 = 0$ c) $\frac{d^2y}{dt^2} - \omega^2 y = 0$ d) $\frac{d^2y}{dt^2} + \omega y = 0$

441. The velocity of a particle performing simple harmonic motion, when it passes through its mean position is

a) Infinity b) Zero c) Minimum d) Maximum

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

a) 2π s b) $\pi/2$ s c) π s d) $3\pi/2s$

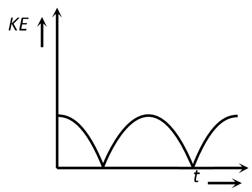
443. The displacement equation of a simple harmonic oscillator is given by

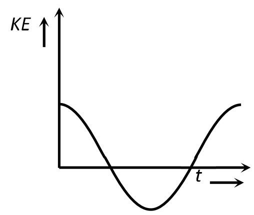
$$y = A \sin \omega t - B \cos \omega t$$

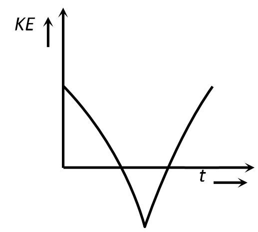
The amplitude of the oscillator will be

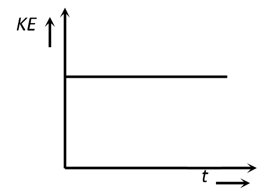
a) $A - B$ b) $A + B$ c) $\sqrt{A^2 + B^2}$ d) $A^2 + B^2$

444. A body performs S.H.M. its kinetic energy K varies with time t as indicated by graph

a) 

b) 

c) 

d) 

445. If a simple pendulum has significant amplitude (up to a factor of $1/e$ of original) only in the period between $t = 0s$ to $t = \tau s$, then τ may be called the average life of the pendulum. When the spherical bob of the pendulum suffers a retardation (due to viscous drag) proportional to its velocity, with $'b'$ as the constant of proportionality, the average life time of the pendulum is (assuming damping is small) in seconds

a) $0.693/b$ b) b c) $1/b$ d) $2/b$

446. Two SHMs are respectively represented by $y_1 = a\sin(\omega t - kx)$ and $y_2 = b\cos(\omega t - kx)$ The phase difference between the two is

a) $\pi/6$ b) $\pi/4$ c) $\pi/2$ d) π

447. A particle doing simple harmonic motion, amplitude $= 4\ cm$, time period $= 12\ s$. The ratio between time taken by it in going from its mean position to $2\ cm$ and from $2\ cm$ to extreme position is

a) 1 b) 1/3 c) 1/4 d) 1/2

448. Two linear SHMs of equal amplitude A and angular frequencies ω *and* 2ω are impressed on a particle along the axes x and y recpectively. If the initial phase difference between them is $\pi/2$, the resultant path followed by the particle is

a) $y^2 = x^2(1 - x^2/A^2)$ b) $y^2 = 2x^2(1 - x^2A^2)$

c) $y^2 = 4x^2(1 - x^2/A^2)$ d) $y^2 = 8x^2(1 - x^2/A^2)$

449. A particle executes simple harmonic motion with an amplitude $4\ cm$. At the mean position the velocity of the particle is $10\ cm/s$. The distance of the particle from the mean position when its speed becomes $5\ cm/s$ is

a) $\sqrt{3}\ cm$ b) $\sqrt{5}\ cm$ c) $2(\sqrt{3})cm$ d) $2(\sqrt{5})cm$

450. A spring with 10 coils has spring constant k. It is exactly cut into two halves, then each of these new springs will have a spring constant

a) $k/2$ b) $3k/2$ c) $2k$ d) $3k$

451. The period of a simple pendulum is doubled, when

a) Its length is doubled b) The mass of the bob is doubled

c) Its length is made four times d) The mass of the bob and the length of the pendulum are doubled

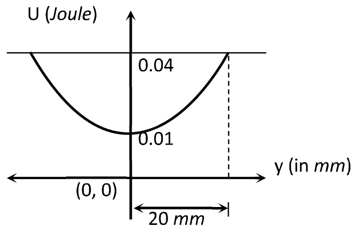
452. Values of the acceleration A of a particle moving in simple harmonic motion as a function of its displacement x are given in the table below

$A(mm\ s^{-2})$	16	8	0	-8	-16
$x\ (mm)$	-4	-2	0	2	4

The period of the motion is

a) $\frac{1}{\pi}s$ b) $\frac{2}{\pi}s$ c) $\frac{\pi}{2}s$ d) $\pi\ s$

453. The variation of potential energy of harmonic oscillator is as shown in figure. The spring constant is



a) $1 \times 10^2 N/m$ b) $150\ N/m$ c) $0.667 \times 10^2 N/m$ d) $3 \times 10^2 N/m$

454. What is the maximum acceleration of the particle doing the SHM?
$y = 2\sin\left[\frac{\pi t}{2} + \emptyset\right]$ where 2 is in cm.

a) $\frac{\pi}{2}$ cms^{-2} b) $\frac{\pi^2}{2}$ cms^{-2} c) $\frac{\pi}{4}$ cms^{-2} d) $\frac{\pi}{4}$ cms^{-2}

455. For a simple pendulum, the graph between T^2 and L is

a) A straight line passing through the origin b) Parabola
c) Circle d) Ellipse

456. The velocity of particle in simple harmonic motion at displacement y from mean position is

a) $\omega\sqrt{a^2 + y^2}$ b) $\omega\sqrt{a^2 - y^2}$ c) ωy d) $\omega^2\sqrt{a^2 - y^2}$

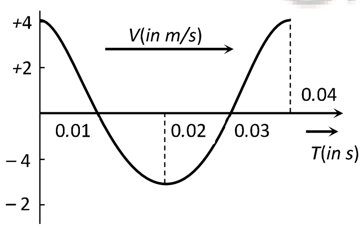
457. Two particles A and B execute simple harmonic motion of period T and $5T/4$. They start from mean position. The phase difference between them when the particle A complete an oscillation will be

a) $\pi/2$ b) Zero c) $2\pi/5$ d) $\pi/4$

458. Which one of the following equations of motion represents simple harmonic motion
Where k, k_0, k_1 and a are all positive

a) Acceleration $= -k_0 x + k_1 x^2$ b) Acceleration $= -k(x + a)$
c) Acceleration $= k(x + a)$ d) Acceleration $= kx$

459. The velocity-time diagram of a harmonic oscillator is shown in the adjoining figure. The frequency of oscillation is

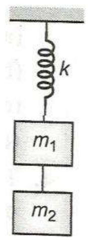


a) 25 Hz b) 50 Hz c) 12.25 Hz d) 33.3 Hz

460. A lift is ascending with an acceleration equal to g/3. Its time period of oscillation is$T$. What will be the time period of a simple pendulum suspended from its ceiling in stationary lift?

a) 2 T b) 3 T c) $(\sqrt{3/4})T$ d) $2T/\sqrt{3}$

461. Two masses m_1 and m_2 are suspended together by a massless spring of constant k. When the masses are in equilibrium, m_1 is removed without disturbing the system. The amplitude of oscillations is



a) $\frac{m_1 g}{k}$ b) $\frac{m_2 g}{k}$ c) $\frac{(m_1+m_2)g}{k}$ d) $\frac{(m_1-m_2)g}{k}$

462. The length of a simple pendulum executing simple harmonic motion is increased by 21%. The percentage increase in the time period of the pendulum of increased length is

a) 11% b) 21% c) 42% d) 10.5%

463. A mass $m = 100\ g$ is attached at the end of a light spring which oscillates on a frictionless horizontal table with an amplitude equal to 0.16 *metre* and time period equal to 2 *sec*. Initially the mass is released from rest at $t = 0$ and displacement $x = -0.16$ *metre*. The expression for the displacement of the mass at any time t is

a) $x = 0.16\cos(\pi t)$
b) $x = -0.16\cos(\pi t)$
c) $x = 0.16\sin(\pi t + \pi)$
d) $x = -0.16\sin(\pi t + \pi)$

464. When a body of mass 1.0 kg is suspended from a certain light spring hanging vertically, its length increases by 5 cm. by suspending 2.0 kg block to the spring and if the block is pulled through 10 cm and released, the maximum velocity in it (in $\mathrm{ms^{-1}}$) is (acceleration due to gravity=10 $\mathrm{ms^{-2}}$)

a) 0.5 b) 1 c) 2 d) 4

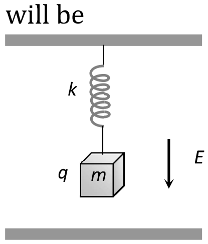
465. The acceleration d^2x/dt^2 of a particle varies with displacement x as $\frac{d^2x}{dt^2} = -kx$ where k is a constant of the motion. The time period T of the motion is equal to

a) $2\pi k$ b) $2\pi\sqrt{k}$ c) $2\pi/\sqrt{k}$ d) $2\pi/k$

466. The time period of a particle in simple harmonic motion is 8 seconds. At $t = 0$, it is at the mean position. The ratio of the distances travelled by it in the first and second seconds is

a) 1/2 b) $1/\sqrt{2}$ c) $1/(\sqrt{2}-1)$ d) $1/\sqrt{3}$

467. Time period of a block suspended from the upper plate of a parallel plate capacitor by a spring of stiffness k is T. When block is uncharged. If a charge q is given to the block then, the new time period of oscillation will be



a) T b) $> T$ c) $< T$ d) $\geq T$

468. A simple pendulum of length l has been set up inside a railway wagon sliding down a frictionless inclined plane having an angle of inclination $\theta = 30^0$ with the horizontal. What will be its period of oscillation as recorded by an observer inside the wagon?

a) $2\pi\sqrt{\frac{2l}{\sqrt{3}\,g}}$ b) $2\pi\sqrt{2l/g}$ c) $2\pi\sqrt{l/g}$ d) $2\pi\sqrt{\frac{\sqrt{3}l}{2g}}$

469. The composition of two simple harmonic motions of equal periods at right angle to each other and with a phase difference of π result in the displacement of the particle along

a) circle b) figure of eight c) straight line d) ellipse

470. The kinetic energy and the potential energy of a particle executing S.H.M. are equal. The ratio of its displacement and amplitude will be

a) $\frac{1}{\sqrt{2}}$ b) $\frac{\sqrt{3}}{2}$ c) $\frac{1}{2}$ d) $\sqrt{2}$

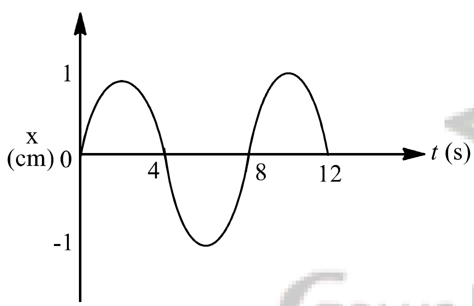
471. Choose the correct statement :
a) Time period of a simple pendulum depends on amplitude
b) Time shown by a spring watch varies with acceleration due to gravity
c) In a simple pendulum time period varies linearly with the length of the pendulum
d) The graph between length of the pendulum and time period is a parabola

472. The equation of S.H.M. is $y = a\sin(2\pi nt + \alpha)$, then its phase at time t is
a) $2\pi nt$ b) α c) $2\pi nt + \alpha$ d) $2\pi t$

473. In damped oscillations, the amplitude of oscillations is reduced to one-third of its initial value a_0 at the end of 100 oscillations. When the oscillator completes 200 oscillations, its amplitude must be
a) $a_0/2$ b) $a_0/4$ c) $a_0/6$ d) $a_0/9$

474. The period of particle in linear SHM is 8 s. At t=0, it is at the mean position. The ratio of the distances travelled by it in Its second and 2nd second is
a) 1.6 : 1 b) 2.4 : 1 c) 3.2 : 1 d) 4.2 : 1

475. The x-t graph of a particle undergoing simple harmonic motion is shown below. The acceleration of the particle at $t = \frac{4}{3}$ s is

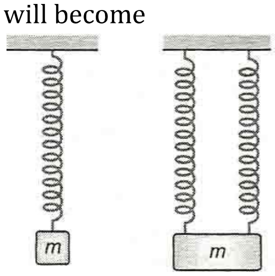


a) $\frac{\sqrt{3}}{32}\pi^2\text{cms}^{-2}$ b) $-\frac{\pi^2}{32}\text{cms}^{-2}$ c) $\frac{\pi^2}{32}\text{cms}^{-2}$ d) $-\frac{\sqrt{3}}{32}\pi^2\text{cms}^{-1}$

476. A simple harmonic oscillator has a period of 0.01 s and an amplitude of 0.2 m. The magnitude of the velocity in $m\sec^{-1}$ at the centre of oscillation is
a) 20π b) 100 c) 40π d) 100π

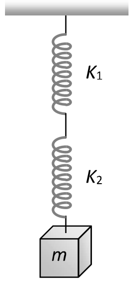
477. A particle is having kinetic energy 1/3 of the maximum value at a distance of 4 cm from the mean position, Find the amplitude of motion.
a) $2\sqrt{6\ cm}$ b) $2/\sqrt{6\ cm}$ c) $\sqrt{2\ cm}$ d) $6\sqrt{2\ cm}$

478. An object suspended from a spring exhibits oscillations of period T. Now the spring is cut in two halves and the same object is suspended with two halves as shown in figure. The new time period of oscillation will become



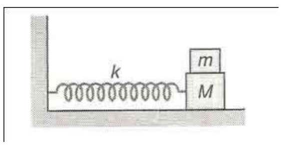
a) $\frac{T}{2\sqrt{2}}$ b) $\frac{T}{2}$ c) $\frac{T}{\sqrt{2}}$ d) 2T

479. A mass M is suspended by two springs of force constants K_1 and K_2 respectively as shown in the diagram. The total elongation (stretch) of the two springs is



a) $\frac{Mg}{K_1+K_2}$ b) $\frac{Mg(K_1+K_2)}{K_1K_2}$ c) $\frac{MgK_1K_2}{K_1+K_2}$ d) $\frac{K_1+K_2}{K_1K_2Mg}$

480. A mass M is attached to a horizontal spring of force constant k fixed on one side to a rigid support as shown in figure. The mass oscillates on a frictionless surface with time period T and amplitude A. When the mass is in equilibrium position. Another mass m is gently placed on it. What will be the new amplitude of oscillations?



a) $A\sqrt{\left(\frac{M}{M-m}\right)}$ b) $A\sqrt{\left(\frac{M-m}{M}\right)}$ c) $A\sqrt{\left(\frac{M}{M+m}\right)}$ d) $A\sqrt{\left(\frac{M+m}{M}\right)}$

481. The displacement y in cm is given in terms of time t sec by the equation
$y = 3\sin 314t + \cos 314t$
The amplitude of SHM is
a) 7 cm b) 3 cm c) 4 cm d) 5 cm

482. The magnitude of maximum acceleration is π times that of maximum velocity of a simple harmonic oscillator. The time period of the oscillator in second is
a) 4 b) 2 c) 1 d) 0.5

483. A simple harmonic motion is represented by $F(t) = 10\sin(20\,t + 0.5)$. The amplitude of the S.H.M. is
a) $a = 30$ b) $a = 20$ c) $a = 10$ d) $a = 5$

484. A simple pendulum is vibrating in an evacuated chamber, it will oscillate with
a) Increasing amplitude b) Constant amplitude c) Decreasing amplitude d) First (c) then (a)

485. The equation of motion of a particle is $\frac{d^2y}{dt^2} + Ky = 0$, where K is positive constant. The time period of the motion is given by
a) $\frac{2\pi}{K}$ b) $2\pi K$ c) $\frac{2\pi}{\sqrt{K}}$ d) $2\pi\sqrt{K}$

486. An ideal spring with spring-constant K is hung from the ceiling and a block of mass M is attached to its lower end. The mass is released with the spring initially unstretched. Then the maximum extension in the spring is
a) $4\,Mg/K$ b) $2\,Mg/K$ c) Mg/K d) $Mg/2K$

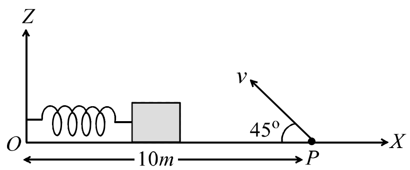
487. The maximum velocity of a particle, executing simple harmonic motion with an amplitude 7 m, is 4.4 ms^{-1}. The period of oscillation is
a) 0.01 s b) 10 s c) 0.1 s d) 100 s

488. Starting from the origin a body oscillates simple harmonically with a period of 2 s. After what time will its kinetic energy be 75% of the total energy?
a) $\frac{1}{6}$s b) $\frac{1}{4}$s c) $\frac{1}{3}$s d) $\frac{1}{12}$s

489. A body of mass $1kg$ is executing simple harmonic motion. Its displacement $y(cm)$ at t seconds is given by $y = 6\sin(100t + \pi/4)$. Its maximum kinetic energy is

a) $6\,J$ b) $18\,J$ c) $24\,J$ d) $36\,J$

490. A small block is connected to one end of a massless spring of un-stretched length $4.9m$. The other end of the spring (see the figure) is fixed. The system lies on a horizontal frictionless surface. The block is stretched by $0.2m$ and released from rest at $t=0$. It then executes simple harmonic motion with angular frequency $\omega=\frac{\pi}{3}rad/s$. Simultaneously at $t=0$, a small pebble is projected with speed v from point P is at angle of 45° as shown in the figure. Point P is at a horizontal distance of $10\,m$ from O. If the pebble hits the block at $t=1s$, the value of v is (take $g=10m/s^2$)



a) $\sqrt{50}m/s$ b) $\sqrt{51}m/s$ c) $\sqrt{52}m/s$ d) $\sqrt{53}m/s$

491. A spring executes SHM with mass of $10kg$ attached to it. The force constant of spring is 10N/m. If at any instant its velocity is 410cm/s, the displacement will be (where amplitude is 0.5m)

a) 0.09 m b) 0.3 m c) 0.03 m d) 0.9 m

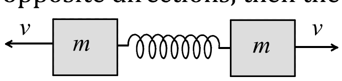
492. The S.H.M. of a particle is given by the equation $y=3\sin\omega t+4\cos\omega t$. The amplitude is

a) 7 b) 1 c) 5 d) 12

493. The amplitude of damped oscillator becomes $\frac{1}{2}$ in 2 s.
Its amplitude after 6 is $1/n$ times the original. Then n is equal to

a) 2^3 b) 3^2 c) $3^{\frac{1}{3}}$ d) 3^3

494. Two blocks each of mass m are connected to a spring of spring constant k. If both are given velocity v in opposite directions, then the maximum elongation of the spring is



a) $\sqrt{\frac{mv^2}{k}}$ b) $\sqrt{\frac{2mv^2}{k}}$ c) $\sqrt{\frac{mv^2}{2k}}$ d) $2\sqrt{\frac{mv^2}{k}}$

495. Which of the following function represents a simple harmonic oscillation

a) $\sin\omega t-\cos\omega t$ b) $\sin^2\omega t$ c) $\sin\omega t+\sin 2\omega t$ d) $\sin\omega t-\sin 2\omega t$

496. The SHM of a particle is given by

$x(t)=5\cos\left(2\pi t+\frac{\pi}{4}\right)$ in MKS units.

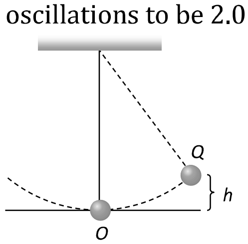
Calculate the displacement and the magnitude of acceleration of the particle at $t=1.5$ s.

a) -3.0 m, 100 m/s^2 b) $+2.54$ m, 200 m/s^2 c) -3.54 m, 140 m/s^2 d) $+3.55$ m, 120 m/s^2

497. The equation of a simple harmonic wave is given by $y=5\sin\frac{\pi}{2}(100t-x)$, where x and y are in metre and time is in second. The period of the wave in second will be

a) 0.04 b) 0.01 c) 1 d) 5

498. The bob of a simple pendulum is displaced from its equilibrium position O to a position Q which is at height h above O and the bob is then released. Assuming the mass of the bob to be m and time period of oscillations to be 2.0 s, the tension in the string when the bob passes through O is

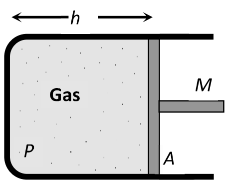


a) $m(g+\pi\sqrt{2gh})$ b) $m(g+\sqrt{\pi^2 gh})$ c) $m\left(g+\sqrt{\frac{\pi^2}{2}gh}\right)$ d) $m\left(g+\sqrt{\frac{\pi^2}{3}gh}\right)$

499. If the period of oscillation of mass m suspended from a spring is 2 s, then the period of mass $4m$ will be
a) 1 s b) 2 s c) 3 s d) 4 s

500. A horizontal plank has a rectangular block placed on it. The plank stars oscillating vertically and simple harmonically with an amplitude of 40 cm. the block just loses contact with the plank when the later is momentary at rest. Then
a) the period of oscillating is $2\pi/5$ s
b) The block weighs double its weight when the plank is at one of the positions of momentary at rest.
c) the block weight 1.5 times its weight on the plank half way down
d) The block weights its true weight on the plank, when the latter moves fastest

501. A cylindrical piston of mass M slides smoothly inside a long cylinder closed at one end, enclosing a certain mass of gas. The cylinder is kept with its axis horizontal. If the piston is disturbed from its equilibrium position, it oscillates simple harmonically. The period of oscillation will be



a) $T=2\pi\sqrt{\left(\frac{Mh}{PA}\right)}$ b) $T=2\pi\sqrt{\left(\frac{MA}{Ph}\right)}$ c) $T=2\pi\sqrt{\left(\frac{M}{PAh}\right)}$ d) $T=2\pi\sqrt{MPhA}$

502. A 15 g ball is shot from a spring gun whose spring has a force constant of 600 N/m. The spring is compressed by 5 cm. The greatest possible horizontal range of the ball for this compression is ($g=10\ m/s^2$)
a) 6.0 m b) 10.0 m c) 12.0 m d) 8.0 m

503. If a simple pendulum is taken to a place where g decreases by 2% then the time period
a) increases by 0.5%
b) increases by 1%
c) increases by 2.0%
d) decreases by 0.5%

504. The total energy of the body executing S.H.M. is E. Then the kinetic energy when the displacement is half of the amplitude, is
a) $\frac{E}{2}$ b) $\frac{E}{4}$ c) $\frac{3E}{4}$ d) $\frac{\sqrt{3}}{4}E$

505. The bob of a simple pendulum is of mass 10 g. It is suspended with a thread of 1 m. If we hold the bob so as to stretch the string horizontally and release it, what will be the tension at the lowest position? (g= 10 ms^{-2})
a) zero b) 0.1 N c) 0.3 N d) 1.0 N

506. Due to some force F_1 a body oscillates with period $4/5\ s$ and due to other force F_2 oscillates with period $3/5\ s$. If both forces act simultaneously, the new period will be
a) 0.72 s b) 0.64 s c) 0.48 s d) 0.36 s

507. A particle is undergoing a one dimensional simple harmonic oscillation of amplitude X_M about the origin on X-axis with time period T and is at $-X_M$ at. What is the position of the particle after a time interval $t=3.15\ T$?
a) Between $-X_M$ and O
b) Between O and $+X_M$
c) At the origin
d) At $+X_M$

508. Two simple pendulums of lengths 1.44 m and 1 m start swinging together. After how many vibrations will they again start swinging together?

a) 5 oscillations of smaller pendulum
b) 6 oscillations of smaller pendulum
c) 4 oscillations of bigger pendulum
d) 6 oscillations of bigger pendulum

509. A spring (spring constant $=k$) is cut into 4 equal parts and two parts are connected in parallel. What is the effective spring constant?

a) $4\ k$
b) $16\ k$
c) $8\ k$
d) $6\ k$

510. The acceleration due to gravity at a place is $\pi^2\ m/s^2$. Then the time period of a simple pendulum of length one $metre$ is

a) $\frac{2}{\pi} s$
b) $2\pi\ s$
c) $2\ s$
d) $\pi\ s$