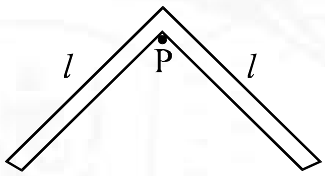
PHYSICS

31. A particle executes SHM on a straight line path. The amplitude of oscillation is 2 cm. When the displacement of the particle from the mean position is 1 cm, the numerical value of magnitude of acceleration is equal to the numerical value of magnitude of velocity. The frequency of SHM (in second^{-1}) is:
1) $2\pi\sqrt{3}$ 2) $2\pi/\sqrt{3}$ 3) $\sqrt{3}/(2\pi)$ 4) $1/2\pi\sqrt{3}$

32. A particle of mass 4 kg moves between two points A and B on a smooth horizontal surface under the action of two forces such that when it is at a point P, the forces are $2\overrightarrow{PA}$ N and $2\overrightarrow{PB}$ N. If the particle is released from rest at A, find the time it takes to travel a quarter of the way from A to B.
1) $\frac{\pi}{2}s$ 2) $\frac{\pi}{3}s$ 3) πs 4) $\frac{\pi}{4}s$

33. A system of two identical rods (L-shaped) of mass *m* and length *l* are resting on a peg P as shown in the figure. If the system is displaced in its plane by a small angle θ, find the period of oscillations:

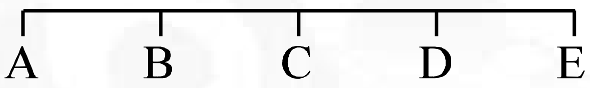


1) $2\pi\sqrt{\frac{\sqrt{21}}{3g}}$ 2) $2\pi\sqrt{\frac{2\sqrt{21}}{3g}}$ 3) $2\pi\sqrt{\frac{21}{3g}}$ 4) $3\pi\sqrt{\frac{1}{3g}}$

34. A circular disc has a tiny hole in it, at a distance z from its center. Its mass is M and radius R (R>z). A horizontal shaft is passed through the hole and held fixed so that the disc can freely swing in the vertical plane. For small disturbance, the disc performs SHM whose time period is minimum for z =

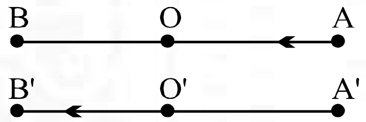
1) R/2 2) R/3 3) $R/\sqrt{2}$ 4) $R/\sqrt{3}$

35. A body performs simple harmonic oscillations along the straight line ABCDE with C as the midpoint of AE. Its kinetic energies at B and D are each one fourth of its maximum value. If AE = 2R, the distance between B and D is



1) $\frac{\sqrt{3}R}{2}$ 2) $\frac{R}{\sqrt{2}}$ 3) $\sqrt{3}\,R$ 4) $\sqrt{2}\,R$

36. Two particles undergo SHM along parallel lines with the same time period (T) and equal amplitudes. At a particular instant, one particle is at its extreme position while the other is at its mean position. They move in the same direction. They will cross each other after a further time



1) T/8 2) 3T/8 3) T/6 4) 4T/3

37. If the potential energy of a harmonic oscillator of mass 2 kg on its equilibrium position is 5 joules and the total energy is 9 joules when the amplitude is one meter the period of the oscillator (in sec) is:

1) 1.5 2) 3.14 3) 6.28 4) 4.67

38. A wire frame in the shape of an equilateral triangle is hinged at one vertex so that it can swing freely in a vertical plane, with the plane of the Δ always remaining vertical. The side of the frame is $1/\sqrt{3}$ m. The time period in seconds of small oscillations of the frame will be

1) $\frac{\pi}{\sqrt{2}}$ 2) $\pi\sqrt{2}$ 3) $\frac{\pi}{\sqrt{6}}$ 4) $\frac{\pi}{\sqrt{5}}$

39. Two particles execute SHM of same amplitude of 20 cm with same period along the same line about the same equilibrium position. The maximum distance between the two is 20 cm. Their phase difference in radians is

1) $\frac{2\pi}{3}$ 2) $\frac{\pi}{2}$ 3) $\frac{\pi}{3}$ 4) $\frac{\pi}{4}$

40. A particle executes SHM with time period T and amplitude A. The maximum possible average velocity in time $\frac{T}{4}$ is

1) $\frac{2A}{T}$ 2) $\frac{4A}{T}$ 3) $\frac{8A}{T}$ 4) $\frac{4\sqrt{2}A}{T}$

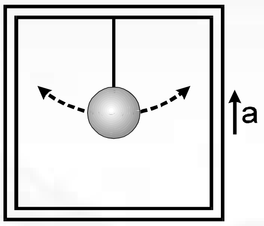
41. A person weighing M kg stands on a board which vibrates up and down simple harmonically at a frequency ν Hz. If the span is d m, the acceleration at top position is

1) g 2) $-4\pi^2\nu^2 d$ 3) $-2\pi^2\nu^2 d$ 4) $\frac{2\pi^2\nu d}{M}$

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

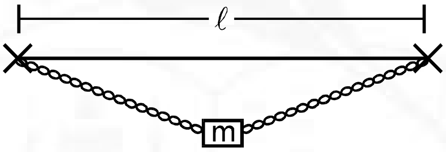
1) 0° 2) 120° 3) 180° 4) 135°

43. A scientist measures the time period of a simple pendulum as T in a lift at rest. If the lift moves up with acceleration as one fourth of the acceleration of gravity, the new time period is



1) $\frac{T}{4}$ 2) 4 T 3) $\frac{2}{\sqrt{5}}$T 4) $\frac{\sqrt{5}}{2}$T

44. A massless rope is stretched between two fixed points a distance ℓ apart in such a way that the tension in it is T. A mass m is attached to the middle of the rope and given a slight displacement from its equilibrium position. If tension T remains uchanged during the motion, the period of oscillation of the rope is

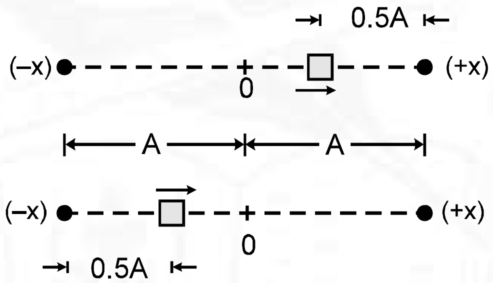


1) $2\pi\sqrt{\frac{m}{T}}$ 2) $2\pi\sqrt{\frac{m\ell}{2T}}$ 3) $2\pi\left(\frac{m\ell}{T}\right)^2$ 4) $\pi\left(\frac{m\ell}{T}\right)^{1/2}$

45. The bob of a simple pendulum executes simple harmonic motion in water with a period t, while the period of oscillation of the bob in air is t_0. If the density of the material of the bob is (4/3) × 1000 kg m^{-3}, and the viscosity of water is neglected, the relationship between t and t_0 is

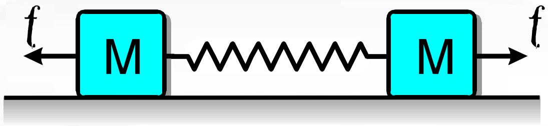
1) $t = t_0$ 2) $t = \frac{t_0}{2}$ 3) $t = 2t_0$ 4) $t = 4t_0$

46. Two bodies performing SHM have same amplitude and frequency. Their phases at a certain instant are as shown in the figure. The phase difference between them is



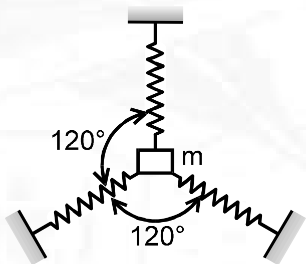
1) $\frac{11}{6}\pi$ 2) π 3) $\frac{5}{3}\pi$ 4) $\frac{3}{5}\pi$

47. A spring of force constant α has two blocks of same mass M connected to each end of the spring. Same force f extends each end of the spring. If the masses are released, then period of vibration is



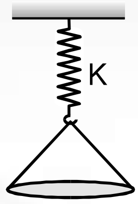
1) $2\pi\sqrt{\frac{M}{2\alpha}}$ 2) $2\pi\sqrt{\frac{M}{\alpha}}$ 3) $2\pi\sqrt{\frac{2\alpha M}{\alpha^2}}$ 4) $2\pi\sqrt{\frac{M\alpha^2}{2\alpha}}$

48. Three springs of force constant k each are connected to a mass m and placed on horizontal surface such that angle between any two springs is 120°. The time period of vibrations of the mass is, if it is displaced slightly against one of the spring.



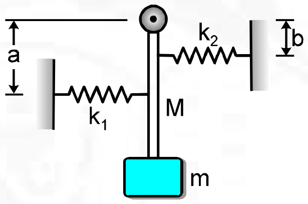
1) $2\pi\sqrt{\frac{2m}{3k}}$ 2) $2\pi\sqrt{\frac{2k}{m}}$ 3) $\pi\sqrt{\frac{m}{k}}$ 4) $2\pi\sqrt{\frac{m}{2k}}$

49. A solid ball of mass m is made to fall from a height H to a pan suspended through a spring of spring constant K. If the ball does not rebound and the pan is massless, then amplitude of oscillation is



1) $\frac{mg}{K}$ 2) $\frac{mg}{k}\left(1+\frac{2HK}{mg}\right)^{1/2}$ 3) $\frac{mg}{K}+\left(\frac{2HK}{mg}\right)^{1/2}$ 4) $\frac{mg}{K}\left[1+\left(1+\frac{2HK}{mg}\right)^{1/2}\right]$

50. A rod of mass M and length L is hinged at its one end and carries a block of mass m at its lower end. A spring of force constant k_1 is installed at distance a from the hinge and another of force constant k_2 at a distance b as shown in the figure. If the whole arrangement rests on a smooth horizontal table top, the frequency of vibration is

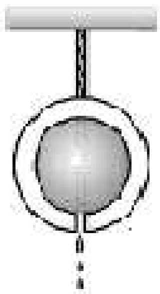


1) $\frac{1}{2\pi}\sqrt{\frac{k_1a^2+k_2b^2}{L^2(m+\frac{M}{3})}}$ 2) $\frac{1}{2\pi}\sqrt{\frac{k_2+k_1}{M+m}}$ 3) $\frac{1}{2\pi}\sqrt{\frac{k_2+k_1\frac{a^2}{b^2}}{4\frac{M}{3}+m}}$ 4) $\frac{1}{2\pi}\sqrt{\frac{k_1+\frac{k_2b^2}{a^2}}{\frac{4}{3}m+M}}$

51. An infinite number of springs having force constants as K, 2K, 4K, 8K, ... ∞ respectively are connected in series; then equivalent spring constant is

1) K 2) 2K 3) $\frac{K}{2}$ 4) α

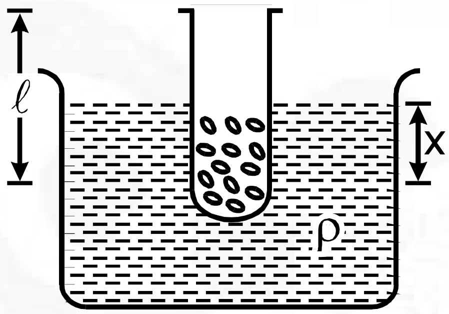
52. A simple pendulum has a hollow bob filled with a liquid of density p. If the liquid drains out of a small hole in the bottom of the bob, then frequency of oscillations



1) goes on increasing 2) goes on decreasing

3) remains same 4) first decreases and then increases

53. A test tube of length l and area of cross-section A has some iron filings of mass M. The test tube floats normally in a liquid of density ρ with length x dipped in the liquid. A disturbing force makes the tube oscillate in the liquid. The time period of oscillation is given by T =



1) $2\pi\sqrt{\frac{M\rho}{Ag}}$ 2) $2\pi\sqrt{\frac{x}{g}}$ 3) $2\pi\sqrt{\frac{\ell}{g}}$ 4) $2\pi\sqrt{\frac{M}{g}}$

54. A particle moves in the x-y plane according to the equation, $\vec{r} = (\hat{i} + 2\hat{j})$ A$\cos\omega$t. Mark wrong statement about the motion of the particle is:

1) on a straight line 2) on an ellipse

3) periodic 4) simple harmonic

55. If y, v, and a represent displacement, velocity and acceleration at any instant for a particle executing SHM, which of the following statement is false?

1) v and y may have same direction

2) v and a may have same direction

3) a and y may have same direction

4) a and v may have opposite direction

56. An air bubble of radius 1 cm rises up in a liquid column with terminal velocity of 0.21 cm/s, If the density of liquid be 1.47×10^{3} kg/m^3, then calculate the coefficient of viscosity of The liquid (in poise). Density of air is negligible. (g=9.8 m/s^2)

1) 0.32×10^{3} 2) 2.75×10^{3} 3) 1.52×10^{3} poise 4) 5.18×10^{3}

57 The force of viscosity is

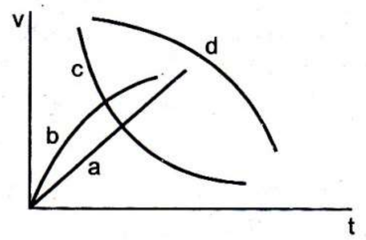
1) electromagnetic 2) gravitational

3) nuclear 4) weak.

58. The viscous force acting between two layers of a liquid is given by $\frac{F}{A} = -\eta \frac{dv}{dz}$.
This F/A may be called
1) pressure 2) longitudinal stress
3) tangential stress 4) volume stress.

59. A solid sphere falls with a terminal velocity of 20 m s^{-1} in air. If is allowed to fall in vacuum,
1) terminal velocity will be 20 m s^{-1}
2) terminal velocity will be less than 20 m s^{-1}
3) terminal velocity will be more then 20 m s^{-1}
4) there will be no terminal velocity.

60. A spherical ball is dropped in a long column of a viscous liquid. The speed of the ball as a function of time may be best represented by the graph



1) A 2) B 3) C 4) D