PHYSICS

BOOKS - BITSAT GUIDE PHYSICS (HINGLISH)

SIMPLE HARMONIC MOTION

Practice Exercise

1. A particle executing simple harmonic motion has amplitude of $1m$ and time period $2s$ at $t = 0$,

net force on the particle is zero. Find the equation of displacement of the particle.

A. $x = \sin \pi t$

B. $x = \cos \pi t$

C. $x = \sin 2\pi t$

D. $x = \cos 2\pi t$

Answer: A

Watch Video Solution

2. In the previous question, find maximum velocity and maximum acceleration.

A. $1m/s, \pi m/s^2$

B. $\pi m/s$ and $\pi^2 m/s^2$

C. $\pi m/s$ and $\pi m/s^2$

D. None of these

Answer: B

Watch Video Solution

3. A particle executes simple harmonic motion. The amplitude of vibration of particle is 2 cm. The displacement of particle in one time period is

A. 1 cm

B. 2 cm

C. 4 cm

D. zero

Answer: D

Watch Video Solution

4. The distance travelled by the particle is

A. 8 cm

B. 2 cm

C. 4 cm

D. zero

Answer: A

Watch Video Solution

5. A particle move along y-axis according to equation $y = 3 + 4\cos \omega t$. The motion of the particle is

A. not SHM

B. oscillatory but not SHM

C. SHM

D. None of these

Answer: C

Watch Video Solution

6. In the amplitude of vibration is

A. 3 units

B. 4 units

C. 5 units

D. None of these

Answer: B

 Watch Video Solution

7. If s=a $\sin\omega t\hat{i} + b\cos\omega t\hat{j}$, the equation of path of particle is

A. $x^2 + y^2 = \sqrt{a^2 + b^2}$

B. $\frac{x^2}{b^2} + \frac{y^2}{a^2} = 1$

C. $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$

D. None of these

Answer: C

Watch Video Solution

8. In previous question, the amplitude of vibration is

A. 4 units

B. 8 units

C. 10.58 units

D. None of these

Answer: C

View Text Solution

9. The motion of a particle varies with time according to the relation $y = a(\sin \omega t + \cos \omega t)$,then

A. the motion is oscillatory but not SHM

B. the motion is SHM with amplitude a

C. the motion is SHM with amplitude $\sqrt{2}a$

D. None of these

Answer: C

Watch Video Solution

10. A particle executes SHM along a straight line so that its period is 12 s. The time it takes in traversing a distance equal to half its amplitude from its equilibrium position is

A. 6 s

B. 4 s

C. 2 s

D. 1 s

Answer:

Watch Video Solution

11. A particle executes SHM with an amplitude of $10cm$ and frequency $2Hz$. At $t = 0$, the particle is at a point where potential energy and kinetic energy are same. The equation for its displacement is

A. $0.1\sin\left(4\pi t + \frac{\pi}{4}\right)$

B. $0.1\sin 4\pi t$

C. $0.1\cos\left(4\pi t + \frac{\pi}{4}\right)$

D. None of above

Answer: A

Watch Video Solution

12. A particle executes simple harmonic motion with a frequency f. The frequency with which the potential. Energy oscillates is

A. f

B. f/2

C. 2f

D. zero

Answer: C

Watch Video Solution

13. A particle of mass (m) is executing oscillations about the origin on the (x) axis. Its potential energy is $V(x) = k|x|^3$ 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 of a

C. proportional to $\sqrt{a}$

D. proportaional to $a^{3/2}$

Answer: A

Watch Video Solution

14. A particle free to move along the (x - axis) hsd potential energy given by $U(x) = k\left[1 - \exp\left(-x^2\right)\right] f$ or $-oo \leq x \leq +oo$, where (k) is a positive constant of appropriate dimensions. Then.

A. at points away from the origin, the particle is in unstable 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 $\frac{k}{2}$, it has its minimum kinetic energy at origin

D. for small displacement from x=0, motion is SHM

Answer: D

Watch Video Solution

15. A simple harmonic oscillator has amplitude A, angular velocity ω, and mass m . Then, average energy in one time period will be

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

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

C. $m\omega^2A^2$

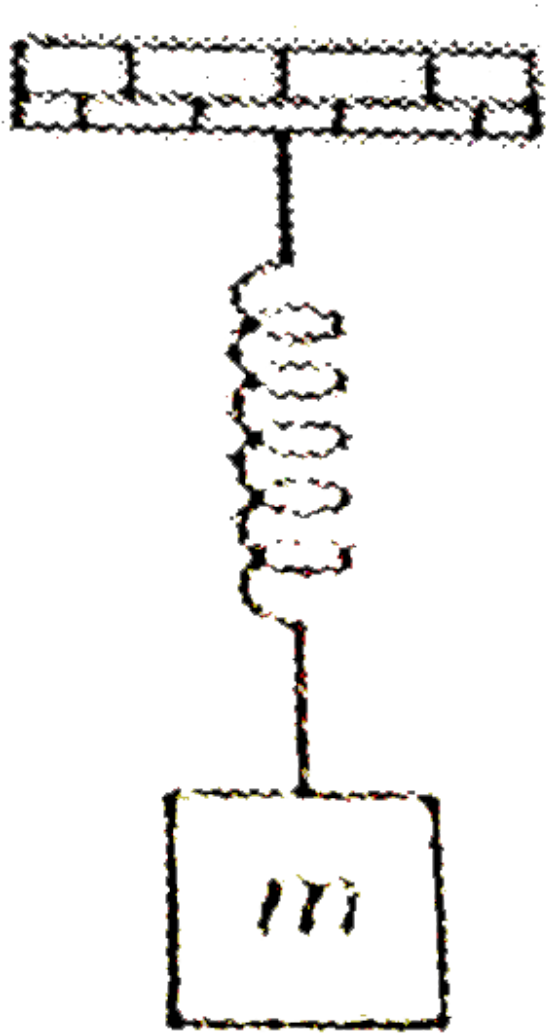
D. zero

Answer: A

Watch Video Solution

16. A point mass x = 20 kg, is suspended by a massless spring of constant 2000 N/m. The point mass is released when elongation in the spring is 15 cm. The equation of displacement of particle

as function of time is (take, g =$10m/s^2$)



A. y = 10 sin 10t

B. Y = 10 cos 10t

C. $y = 10\sin\left(10t + \frac{\pi}{6}\right)$

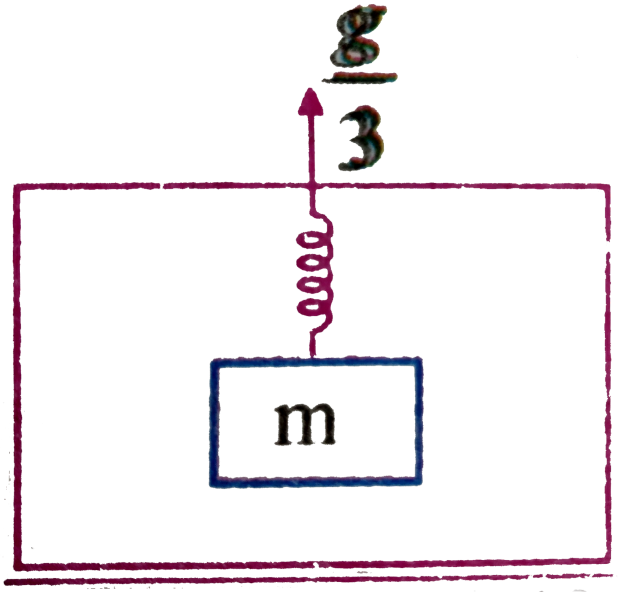
D. None of these

Answer: C

View Text Solution

17. A spring of spring constant $200N/m$ has a block of mass $1kg$ hanging at its one end and other end of spring is attached to ceiling of an elevator. The elevator is rising upwards with an acceleration $g/3$. What should be the angular

frequency and elongation during the time when the elevator is accelerating?



A. 14.14rad/s, 0.07m

B. 14 rad/s, 0.1m

C. 14.14 rad/s, 0.05 m

D. 10 rad/s, 0.07m

Answer: A

Watch Video Solution

18. 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. $\frac{2}{3}k$

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

C. 3k

D. 6k

Answer: B

19. A solid copper sphere is suspended from a massless spring. The time period of oscillation of the system is 4 s. The sphere is now completely immersed in a liquid whose density is 1/8the that of brass. The sphere remains in liquid during oscillation. Now, the time period is

A. 4 s

B. 2 s

C. 3 s

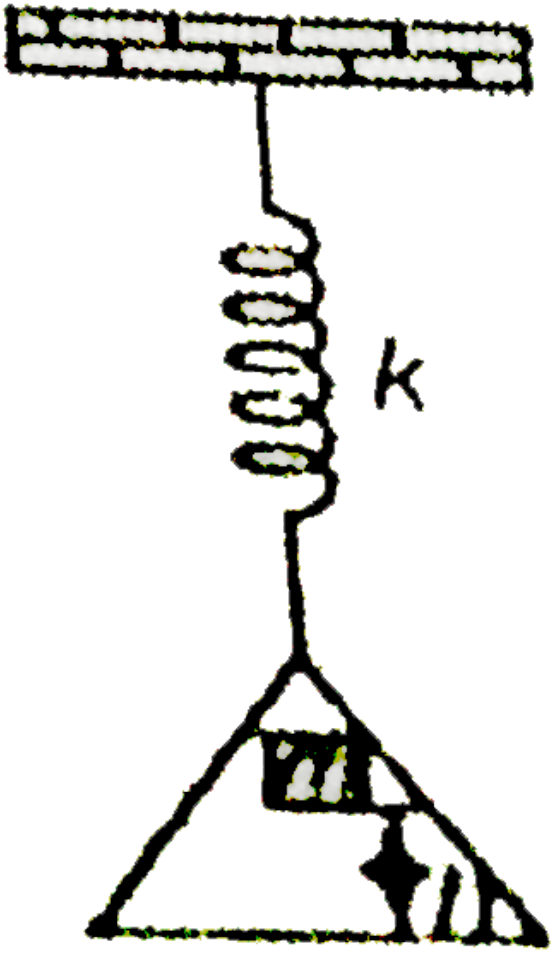
D. None of these

Answer: A

Watch Video Solution

20. A load of mass m falls from a height h on to the scale pan hung from a spring as shown in the adjoining figure. If the spring constant is k and

mass of the scale pan is zero and the mass m does not bounce relative to the pan, then the amplitude of vibration is



A. $\frac{mg}{k}$

B. $\frac{mg}{k}\sqrt{\left(\frac{1+2hk}{mg}\right)}$

C. $\frac{mg}{k}+\frac{mg}{k}\sqrt{\left(\frac{1+2hk}{mg}\right)}$

D. $\frac{mg}{k}\sqrt{\left(\frac{1+2hk}{mg}-\frac{mg}{k}\right)}$

Answer: B

View Text Solution

21. find the amplitude of vibration.

A. $\sqrt{\left(\frac{mv^2}{k}\right)}$

B. $\sqrt{\left(\frac{mv^2}{2k}\right)}$

C. $\sqrt{\left(\frac{mv^2}{4k}\right)}$

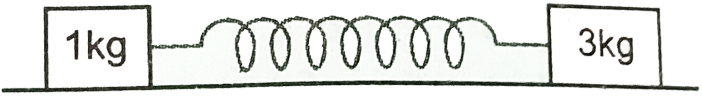
D. None of these

Answer: B

View Text Solution

22. Two point masses of $3.0kg$ and $1.0kg$ are attached to opposite ends of a horizontal spring whose spring constant is $3Nm^{-1}$ as shown in figure . The natural frequency of vibration so this

system is $n/\pi Hz$. Find the integral value of n.



A. 4 Hz

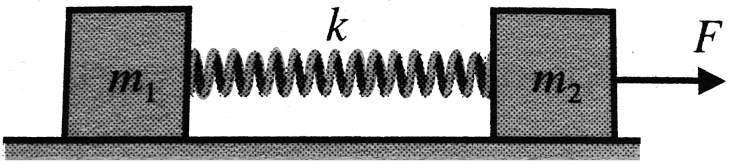
B. 3 Hz

C. 2 Hz

D. 1 Hz

Answer: B

Watch Video Solution



23.

Two blocks connected by a spring rest on a smooth horizontal plane as shown in Fig. A constant force F start acting on block m_2 as shown in the figure. Which of the following statements are not correct?

A. length of spring increases continuoulsy, if

$m_1 > m_2$

B. block start performing SHM about centre of mass of the system with increasing

amplitude.

C. blocks start performing SHM about centre of mass of the system which moves rectilinearly with constant acceleration

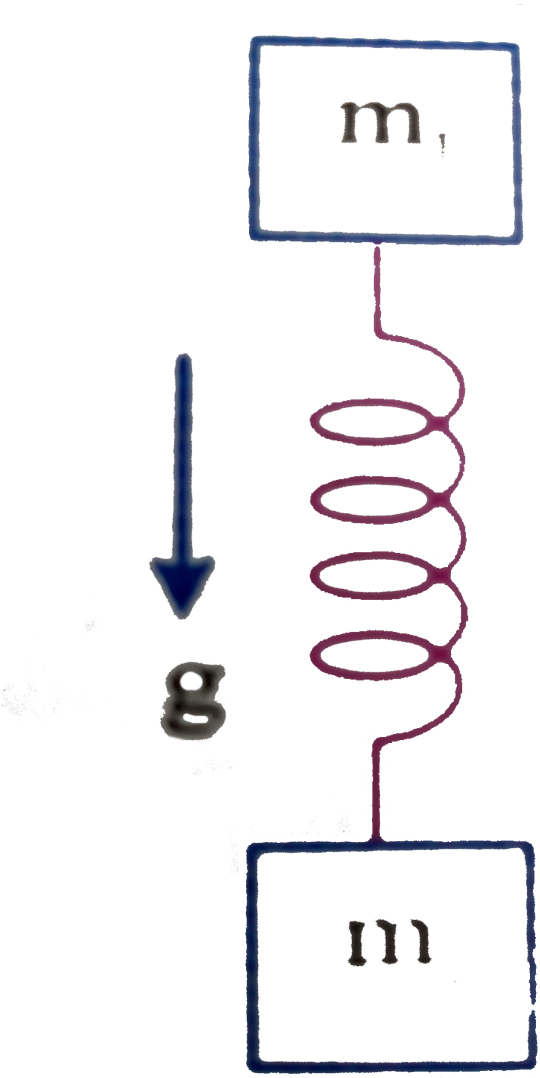
D. acceleration of m_2 is maximum at initial moment of time only

Answer: C

Watch Video Solution

24. There is a spring with netural length L_0. Two masses m_1 and m_2 are connected to both of its ends as shown in figure. The whole system is held at rest. At any time $t = 0, m_2$ is released and system starts free fall. Initial stretched length of spring before fall is L. what is the displacement

of centre of mass as function of time?



A. gt^2

B. $\frac{1}{2}gt^2$

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

D. $\frac{m_1+m_2}{m_1m_2}\times t$

Answer: B

Watch Video Solution

25. The time period of a second's pendulum is 2 sec. The spherical bob which is empty from inside has a mass of 50 gm. This is now replaced by another solid bob of same radius but having

different mass of 100 gm. The new time period will be

A. 4 s

B. 1 s

C. 2 s

D. 8 s

Answer: C

Watch Video Solution

26. A clock pendulum is adjusted for giving corrent time in Patna. This clock pendulum also givens correct time in

A. Delhi

B. Kota

C. Hyderabad

D. None of these

Answer: D

Watch Video Solution

27. A simple pendulum of length L and mass (bob) M is oscillating in a plane about a vertical line between angular limit $-\phi$ and $+\phi$. For an angular displacement $\theta(|\theta| < \phi)$, the tension in the string and the velocity of the bob are T and V respectively. The following relations hold good under the above conditions:

A. T =Mg cos θ

B. T cos θ=Mg

C. $T - \mathrm{Mg}\cos\theta = \frac{Mv^2}{L}$

D. None of these

Answer: C

Watch Video Solution

28. From the ceiling of a train, a pendulum of length 'l' is suspended. The train is moving with an acceleration a_0 on horizontal surface. What must be the period of oscillation of pendulum?

A. $T = 2\pi\sqrt{\left(\frac{l}{g}\right)}$

B. $T = 2\pi\sqrt{\left(\frac{l}{a_0^2 - g^2}\right)}$

C. $T = \pi\sqrt{\left(\frac{l}{a_0^2 + g^2}\right)}$

D. $T = 2\pi\sqrt{\left(\frac{l}{a_0^2 - g^2}\right)}$

Answer: B

Watch Video Solution

29. A clock with an iron pendulum keeps correct time at $20^\circ C$. How much time will it lose or gain in a day if the temperature changes to $40^\circ C$. Thermal coefficient of liner expansion $\alpha = 0.000012 per^\circ C$.

A. 10.3s/day

B. 19s/day

C. 5.5s/day

D. 6.8s/day

Answer: A

Watch Video Solution

30. There are two pendulums of length l_1 and l_2 start vibrating. At some instant, the two are in mean position in the same phase. Calculate after how many vibrations of shorter pendulum, the

two wll be in phase in the mean position?

$[(l_1 > l_2), l_1 = 121cm, l_2 = 100cm]$

A. 11

B. 10

C. 9

D. 8

Answer: A

View Text Solution

31. A clock is performing SHM along a vertical line with amplitude of 40 cm on a horizontal plank. The block just lose the contact with plank when plank is momentarily at rest. Then, (Take, $g = 10m/s^2$)

A. the period of its oscillation is $\frac{2\pi}{5}s$

B. the period of is oscillation is $\frac{2\pi}{6}s$

C. the period of its oscillation is $\frac{\pi}{5}s$

D. None of the above

Answer: A

Watch Video Solution

32. There is a ring or mass m and radius R is pivoted at a point O on its periphery. It is free to rotate about an axis perpendicular to its plane. What is the period of ring?

A. $T = 2\pi\left(\left(\frac{R}{g}\right)\right)$

B. $T = 2\pi\sqrt{\left(\frac{2R}{g}\right)}$

C. $T = \pi\sqrt{\left(\frac{2R}{g}\right)}$

D. $T = 2\pi\sqrt{\left(\frac{3R}{g}\right)}$

Answer: B

View Text Solution

33. There is a rod of length l and mass m. It is hinged at one end to the ceiling. The period of small oscillation is

A. $T = 2\pi\sqrt{\left(\frac{2l}{3g}\right)}$

B. $T = \pi\sqrt{\left(\frac{l}{3g}\right)}$

C. $T = 2\pi\sqrt{\left(\frac{l}{3g}\right)}$

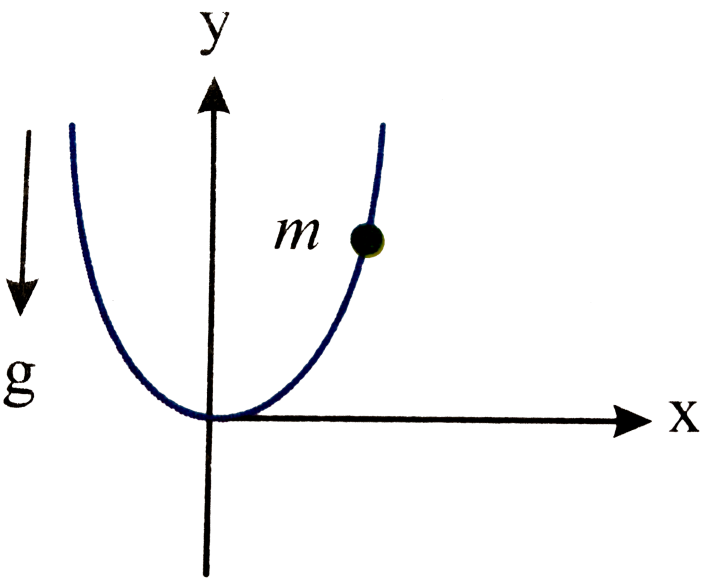
D. $T = 2\pi\sqrt{\left(\frac{l}{g}\right)}$

Answer: A

Watch Video Solution

34. A particle of mass m is allowed to oscillate near the minimum of a vertical parabolic path having the equaiton $x^2 = 4ay$. The angular

frequency of small oscillation is given by



A. $\sqrt{gh}$

B. $\sqrt{2gh}$

C. $\sqrt{\left(\frac{g}{2a}\right)}$

D. $\sqrt{\left(\frac{g}{a}\right)}$

Answer: C

Watch Video Solution

35. A highly rigid cubical block A of small mass M and side L is fixed rigidly on the other cubical block of same dimensions and of 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 faces of A. After

the force is withdrawn , block A exceutes small oscillations , the time period of which is given by

A. $\sqrt{\eta m L}$

B. $2\pi\sqrt{m\frac{\eta}{L}}$

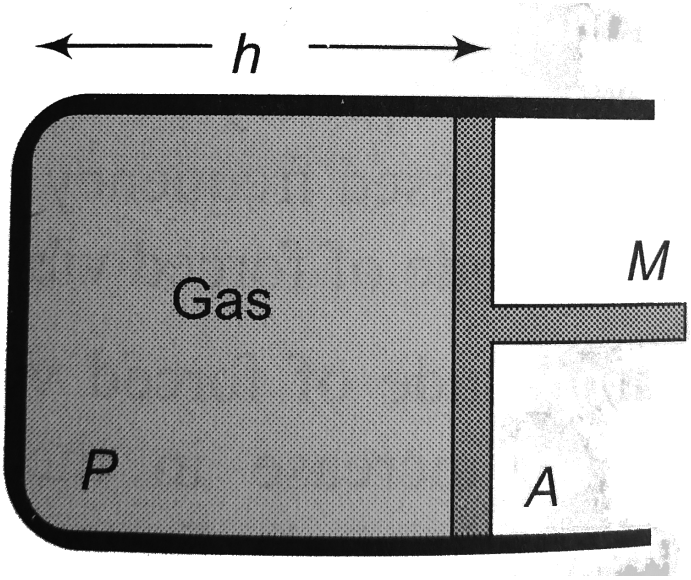
C. $2\pi\sqrt{\left(\frac{mL}{\eta}\right)}$

D. $2\pi\sqrt{\left(\frac{m}{\eta L}\right)}$

Answer: D

Watch Video Solution

36. A cylinder piston of mass M sides smoothlly inside a long cylinder closed at and enclesing a cartin mass of gas The cylinder is kept with its axis horizantal if the pistan is distanced from its equations positions it oscillation simple harmoniically .THe period of oscillation will be



A. $T = 2\pi\sqrt{\left(\frac{MA}{pA}\right)}$

B. $T = 2\pi\sqrt{\left(\frac{MA}{ph}\right)}$

C. $T = 2\pi\sqrt{\left(\frac{M}{peh}\right)}$

D. $T = 2\pi\sqrt{MphA}$

Answer: A

Watch Video Solution

Bitsat Archives

1. A particle of mass m= 5g is executing simple harmonic motion with an amplitude 0.3m and time period $\pi/5$ second. The maximum value of force acting on the particle is

A. 5 N

B. 4 N

C. 0.5 N

D. 0.15N

Answer: D

Watch Video Solution

2. Pulse rate of a noumal person is 75 per minute.

The time period of heart is

A. $0.8s$

B. $0.75s$

C. $1.25s$

D. $1.75s$

Answer: A

Watch Video Solution

3. A simple wave motion represented by $y = 5\left(\sin 4\pi t + \sqrt{3}\cos 4\pi t\right)$. Its amplitude is

A. 5

B. $5\sqrt{3}$

C. $10\sqrt{3}$

D. 10

Answer: D

Watch Video Solution

4. If the displacement of simple pendulum at any time is 0.02 m and acceleration is $2m/s^2$, then in this time angular velocity will be

A. 100 rad/s

B. 10 rad/s

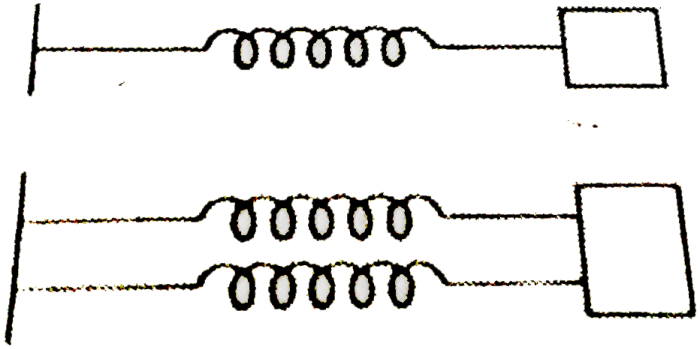
C. 1 rad/s

D. 0.1 rad/s

Answer: B

View Text Solution

5. If k_s and k_p respectively are effective spring constant in series and parallel combination of springs as shown in figure, find $\frac{k_s}{k_p}$.



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

B. $\frac{3}{7}$

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

D. $\frac{7}{3}$

Answer: C

Watch Video Solution

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

A. $\frac{\pi}{2} cm / s^2$

B. $\frac{\pi^2}{2} cm / s^2$

C. $\frac{\pi}{4} cm / s^2$

D. $\frac{\pi}{4} cm / s^2$

Answer: B

Watch Video Solution

7. The equation

$$\frac{d^2y}{dt^2} + b\frac{dy}{dt} + \omega^2 y = 0$$

represents the equation of motion for a

A. free vibration

B. damped vibration

C. forced vibration

D. resonant vibration

Answer: B

Watch Video Solution

8. A pole is floating in a liquid with 80 cm of its length immersed. It is pushed doun a certain distance and then released. Time period of vertical oscillation is

A. $\frac{4\pi}{7}$ s

B. $\frac{3\pi}{7}$ s

C. $\frac{2\pi}{7}s$

D. $\frac{\pi}{7}s$

Answer: A

Watch Video Solution

9. A pendulum has a ball of mass m attached to the stringa and is suspended from the roof of a trolley. If the trolley rolls upwards with acceleration a, then what is the angle made by the string with the inclined plane? (Given that, $a = 5m/s^2, g = 10m/s^2$ and the angle of inclination of the plane is 30°)

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

B. $\cot^{-1}\left(\frac{2}{\sqrt{3}}\right)$

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

D. $\tan^{-1}\left(\frac{2}{\sqrt{3}}\right)$

Answer: B

Watch Video Solution

10. A particle is executing simple harmonic motion with an amplitude A and time period T.

The displacement of the particles after 2T period from its initial position is

A. A

B. 4A

C. 8A

D. zero

Answer: D

Watch Video Solution

11. In a seconds pendulum, mass of bob is 30 gm . If it is replaced by 90 gm mass. Then its time period will

A. 1 s

B. 2 s

C. 4 s

D. 3 s

Answer: A

Watch Video Solution

12. A simple pendulum hanging from the ceiling of a stationary lift has a time period T 1 . When the lift moves downward with constant velocity, the time period is T2, then

A. t_2 is infinity

B. $t_2 > t_1$

C. $t_2 < t_1$

D. $t_2 = t_1$

Answer: D

Watch Video Solution