JEE MAIN : CHAPTER WISE TEST PAPER-10

SUBJECT :- PHYSICS DATE...
CLASS :- 11th NAME...
CHAPTER :- SIMPLE HARMONIC MOTION SECTION...

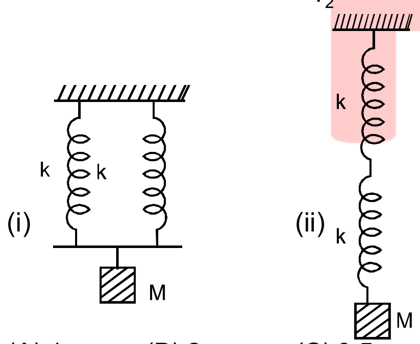
(SECTION-A)

1. The position vector of a particle from origin is given by $\vec{r} = A(\hat{i}\cos\omega t + \hat{j}\sin\omega t)$. The motion of the particle is
(A) simple harmonic
(B) on a straight line
(C) on a circle
(D) with constant acceleration

2. The distance moved by a particle in simple harmonic motion in one time period is
(A) A (B) 2A (C) 4A (D) zero

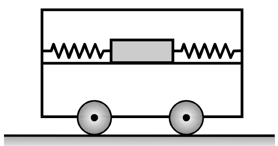
3. The average energy in one time period in simple harmonic motion is
(A) $\frac{1}{2}m\omega^2A^2$ (B) $\frac{1}{4}m\omega^2A^2$
(C) $m\omega^2A^2$ (D) zero

4. Two springs A and B having force constants k each are arranged (i) in parallel and (ii) in series. A mass M is attached to two arrangements separately. If time period in case (i) is T_1 and in case (ii) is T_2., then ratio $\frac{T_1}{T_2}$ is



(A) 1 (B) 2 (C) 0.5 (D) 0.25

5. Two springs, each of spring constant k, are attached to a block of mass m as shown in the figure. The block can slide smoothly along a horizontal platform clamped to the opposite walls of the trolley of mass M. If the block is displaced by x cm and released, the period of oscillation is :



(A) $T = 2\pi\sqrt{\frac{Mm}{2k}}$ (B) $T = 2\pi\sqrt{\frac{(M+m)}{kmM}}$
(C) $T = 2\pi\sqrt{\frac{mM}{2k(M+m)}}$ (D) $T = 2\pi\frac{(M+m)^2}{k}$

6. A simple pendulum has some time period T. What will be the percentage change in its time period if its amplitudes is decreased by 5%?
(A) 6 % (B) 3 % (C) 1.5 % (D) 0 %

7. A simple harmonic motion is given by $y = 5(\sin 3\pi t + \sqrt{3}\cos 3\pi t)$. What is the amplitude of motion if y is in m ?
(A) 100 cm (B) 5 m
(C) 200 cm (D) 1000 cm

8. In a simple harmonic motion
(A) the potential energy is always equal to the kinetic energy
(B) the potential energy is never equal to the kinetic energy
(C) the average potential energy in any time interval is equal to the average kinetic energy in that time interval
(D) the average potential energy in one time period is equal to the avrage kinetic energy in this period.

9. A particle executes simple harmonic motion under the restoring force provided by a spring. The time period is T. If the spring is divided in two equal parts and one part is used to continue the simple harmonic motion, the time period will
(A) remain T (B) become 2T
(C) become T/2 (D) become $T/\sqrt{2}$

10. A mass of 1 kg attached to the bottom of a spring has a certain frequency of vibration. The following mass has to be added to it in order to reduce the frequency by half :
(A) 1 kg (B) 2 kg (C) 3 kg (D) 4 kg

11. **STATEMENT-1 :** Kinetic energy of SHM at mean position is equal to potential energy at ends for a particle moving in SHM.
STATEMENT-2 : Total energy in SHM is conserved.
(A) Statement-1 is True, Statement-2 is True; Statement-2 is a correct explanation for Statement-1.
(B) Statement-1 is True, Statement-2 is True; Statement-2 is NOT a correct explanation for Statement-1
(C) Statement-1 is True, Statement-2 is False
(D) Statement-1 is False, Statement-2 is True

12. 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

13. 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 becomes 5T/3. Then the ratio of m/M is :

(A) 3/5 (B) 25/9 (C) 16/9 (D) 5/3

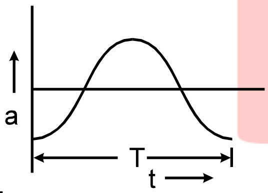
14. The total energy of a particle, executing simple harmonic motion is :

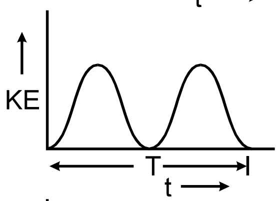
(A) $\propto x$ (B) $\propto x^2$

(C) independent of x (D) $\propto x^{1/2}$

Where x is the displacement from the mean position.

15. Acceleration a versus time t graph of a body in SHM is given by a curve shown below. T is the time peirod. Then corresponding graph between kinetic energy KE and time t is correctly represented by



(A)


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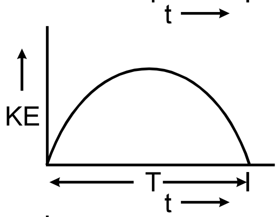
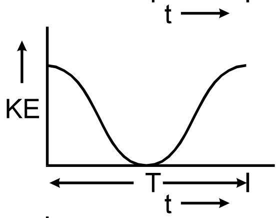
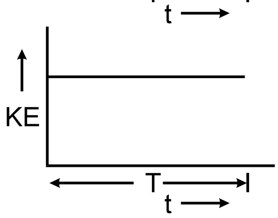


(C)


(D)


16. A coin is placed on a horizontal platform which undergoes vertical simple harmonic motion of angular frequency ω. The amplitude of oscillation is gradually increased. The coin will leave contact with the platform for the first time :

(A) at the highest position of the platform

(B) at the mean position of the platform

(C) for an amplitude of $\frac{g}{\omega^2}$

(D) for an amplitude of $\frac{g^2}{\omega^2}$

17. 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 motion is :

(A) $\frac{\pi}{2}$ (B) $\frac{\pi}{3}$ (C) $\frac{\pi}{4}$ (D) $\frac{\pi}{6}$

18. A particle performs simple harmonic motion with amplitude A. Its speed is trebled at the instant that it is at distance $\frac{2A}{3}$ from equilibrium position. The new amplitude of the motion is.

(A) 3A (B) $A\sqrt{3}$

(C) $\frac{7A}{3}$ (D) $\frac{A}{3}\sqrt{41}$

19. Two masses 8 kg and 4 kg are suspended together by a massless spring of spring constant 1000 N/m. When the masses are in equilibrium 8 kg is removed without disturbing the system. The amplitude of oscillation is

(A) 0.5 m (B) 0.08 m

(C) 0.4 m (D) 0.04 m

20. A bob is attached to a long, light string. The string is deflected by 3° initially with respect to vertical. The length of the string is 1 m . The value of θ at any time t after the bob released can be approximately written as (Use $g = \pi^2$)

(A) $3° \cos \pi t$ (B) $3° \sin \pi t$

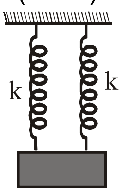
(C) $3° \sin (\pi t + \frac{\pi}{6})$ (D) $3° \cos (\pi t + \frac{\pi}{6})$

(SECTION-B)

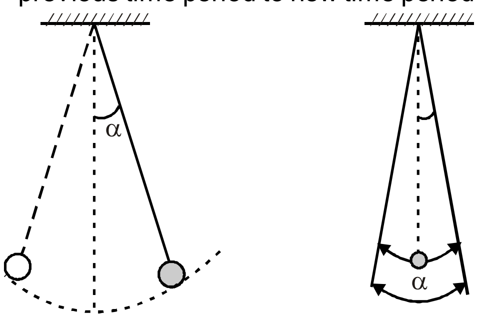
21. A particle starts from point A, moves along a straight line path with an acceleration given by a = 2 (4 – x) where x is distance from point A. The particle stops at point B for a moment. Find the distance AB (in m). (All values are in S.I. units)

22. Two particles P_1 and P_2 are performing SHM along the same line about the same mean position. Initially they are at their positive extreme position. If the time period of each particle is 12 sec and the difference of their amplitudes is 12 cm then find the minimum time (in sec) after which the separation between the particle become 6 cm.

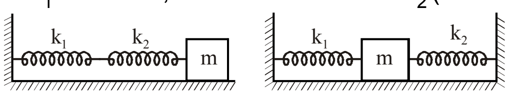
23. A small block of mass $m = \frac{1}{2}\text{kg}$ is attached to two springs each of force constant k = 10 N/m as shown in figure. The block is executing SHM with amplitude $A = \frac{1}{2}\text{m}$. When the block is at equilibrium position one of the spring breaks without changing momentum of block. What is new amplitude (in cm) of oscillation.



24. A simple pendulum swings with an initial angular amplitude α. If two elastic walls making an angle α are introduced in the system in a symmetrical way as shown in the figure. Then find ratio of previous time period to new time period.



25. In the figure shown, a block executes SHM under the influence of two springs on a smooth surface as shown. It is found that the time period of oscillation in case (a) is double that in case (b). If k_1 is 10N/m, what is the value of k_2 (in N/m)?



(a) (b)

26. A block is placed on a horizontal platform vibrating up and down, simple harmonically. It is observed that the block loses its contact with the platform when its angular frequency is 5 rad/s. The amplitude of vibration can not be less than __________ cm.

27. A body of mass $\sqrt{2}$ kg is suspended on a spring constant 200 N/m, we shift the body from position of equilibrium vertically downward to distance x_0 and released. Determine distance traversed by the body (in cm) during the time interval from $t_1 = \frac{T}{4}$ to $t_2 = \frac{3T}{8}$. Here x_0 is the stretch of the spring in equilibrium position and T is time period of its oscillation.

28. A block of mass 2 kg is kept in touch with a spring of constant 100 N/m on a smooth inclined plane of inclination 30º. We compress the block and release. What can be the maximum compression (in cm) so that the block does not lose contact with the spring at any time during the motion?

29. We start two pendulum-clocks at the same time. Of the two only one is accurate, and only at its100 swing the two clocks swing together again. By what percentage do we have to change the length of the inaccurate pendulum to make it accurate?

30. The drawing shows a top view of a frictionless horizontal surface, where there are two springs with particles of mass m_1 and m_2 attached to them. Each spring has a spring constant of 1200 N/m. The particles are pulled to the right and then released from the positions shown in the drawing. How much time passes before the particles are side by side for the first time at x = 0m if m_1 = 3 kg and m_2 = 27 kg. If time is $\frac{n\pi}{80}$ sec, fill n in OMR sheet.