

NEET : CHAPTER WISE TEST-10

SUBJECT :- PHYSICS

CLASS :- 11th

CHAPTER :- SIMPLE HARMONIC MOTION

DATE.....

NAME.....

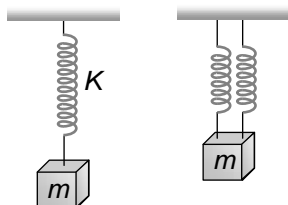
SECTION.....

(SECTION-A)

- 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) $\frac{-\pi}{3}$ (B) $\frac{\pi}{6}$ (C) $\frac{-\pi}{6}$ (D) $\frac{\pi}{3}$
- A particle executes S.H.M. with a period of 6 second and amplitude of 3 cm. Its maximum speed in cm/sec is
(A) $\pi/2$ (B) π (C) 2π (D) 3π
- If a simple pendulum oscillates with an amplitude of 50 mm and time period of 2 sec, then its maximum velocity is
(A) 0.10 m/s (B) 0.15 m/s
(C) 0.8 m/s (D) 0.26 m/s
- Two particles P and Q start from origin and execute Simple Harmonic Motion along X-axis with same amplitude but with periods 3 seconds and 6 seconds respectively. The ratio of the velocities of P and Q when they meet is
(A) 1 : 2 (B) 2 : 1 (C) 2 : 3 (D) 3 : 2
- Velocity at mean position of a particle executing 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) $\frac{\sqrt{3}}{4}v$
- A particle of mass 10 grams is executing simple harmonic motion with an amplitude of 0.5 m and periodic time of $(\pi/5)$ seconds. 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
- The displacement of an oscillating particle varies with time (in seconds) according to the equation y (cm) = $\sin \frac{\pi}{2}\left(\frac{t}{2} + \frac{1}{3}\right)$. The maximum acceleration of the particle is approximately
(A) 5.21 cm/s^2 (B) 3.62 cm/s^2
(C) 1.81 cm/s^2 (D) 0.62 cm/s^2
- A particle executes harmonic motion with an angular velocity and maximum acceleration of 3.5 rad/sec and 7.5 m/s² respectively. The amplitude of oscillation is
(A) 0.28 m (B) 0.36 m
(C) 0.53 m (D) 0.61 m
- 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
- The kinetic energy and potential energy of a particle executing simple harmonic motion will be equal, when displacement (amplitude = a) is
(A) $\frac{a}{2}$ (B) $a\sqrt{2}$
(C) $\frac{a}{\sqrt{2}}$ (D) $\frac{a\sqrt{2}}{3}$
- 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
- If $x = a \sin\left(\omega t + \frac{\pi}{6}\right)$ and $x' = a \cos \omega t$, then what is the phase difference between the two waves
(A) $\pi/3$ (B) $\pi/6$ (C) $\pi/2$ (D) π

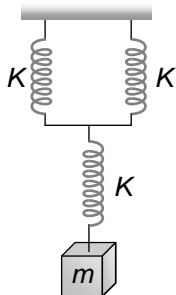
13. The potential energy of a simple harmonic oscillator when the particle is half way to its end point is (where E is the total energy)
- (A) $\frac{1}{8}E$ (B) $\frac{1}{4}E$
(C) $\frac{1}{2}E$ (D) $\frac{2}{3}E$
14. A particle of mass m is hanging vertically by an ideal spring of force constant K . If the mass is made to oscillate vertically, its total energy is
- (A) Maximum at extreme position
(B) Maximum at mean position
(C) Minimum at mean position
(D) Same at all position
15. 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
16. The instantaneous displacement of a simple pendulum oscillator is given by $x = A \cos\left(\omega t + \frac{\pi}{4}\right)$. Its speed will be maximum at time
- (A) $\frac{\pi}{4\omega}$ (B) $\frac{\pi}{2\omega}$
(C) $\frac{\pi}{\omega}$ (D) $\frac{2\pi}{\omega}$
17. A body executing simple harmonic motion has a maximum acceleration equal to 24 metres/sec^2 and maximum velocity equal to 16 metres/sec . The amplitude of the simple harmonic motion is
- (A) $\frac{32}{3} \text{ metres}$ (B) $\frac{3}{32} \text{ metres}$
(C) $\frac{1024}{9} \text{ metres}$ (D) $\frac{64}{9} \text{ metres}$
18. The length of a simple pendulum is increased by 1%. Its time period will]
- (A) Increase by 1%
(B) Increase by 0.5%
(C) Decrease by 0.5%
(D) Increase by 2%
19. A simple pendulum is executing simple harmonic motion with a time period T . If the length of the pendulum is increased by 21%, the percentage increase in the time period of the pendulum of increased length is
- (A) 10% (B) 21%
(C) 30% (D) 50%
20. 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) $\frac{k_1}{k_2}$ (B) $\sqrt{\frac{k_1}{k_2}}$
(C) $\frac{k_2}{k_1}$ (D) $\sqrt{\frac{k_2}{k_1}}$
21. 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) $\frac{1}{8}$
22. 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
23. 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) $20\pi \text{ sec}$ (B) $2\pi \text{ sec}$
(C) $2\pi/10 \text{ sec}$ (D) $200\pi \text{ sec}$
24. 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 $4m$ is suspended from the same spring
- (A) $n/4$ (B) $4n$ (C) $n/2$ (D) $2n$

25. 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) $\frac{T}{2}$

26. What will be the force constant of the spring system shown in the 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) $\left[\frac{2}{K_1} + \frac{1}{K_2}\right]^{-1}$

27. 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) $4K$

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

- (A) $\sqrt{k_1 k_2}$ (B) $(k_1 + k_2) / 2$
(C) $k_1 + k_2$ (D) $k_1 k_2 / (k_1 + k_2)$

29. To make the frequency double of a spring oscillator, we have to
(A) Reduce the mass to one fourth

- (B) Quadruple the mass
(C) Double of mass
(D) Half of the mass

30. Two springs with spring constants $K_1 = 1500 \text{ N/m}$ and $K_2 = 3000 \text{ N/m}$ 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

31. 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) $f_2 = \sqrt{2}f_1$

32. A spring executes SHM with mass of 10 kg attached to it. The force constant of spring is 10 N/m . If at any instant its velocity is 40 cm/sec , the displacement will be (where amplitude is 0.5 m)

- (A) 0.09 m (B) 0.3 m
(C) 0.03 m (D) 0.9 m

33. A linear harmonic oscillator of force constant $2 \times 10^6 \text{ N/m}$ times and amplitude 0.01 m has a total mechanical energy of 160 joules . Its

- (A) Maximum potential energy is 100 J
(B) Maximum K.E. is 100 J
(C) Maximum P.E. is 100 J
(D) Minimum P.E. is zero

34. Two simple pendulums of length 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.

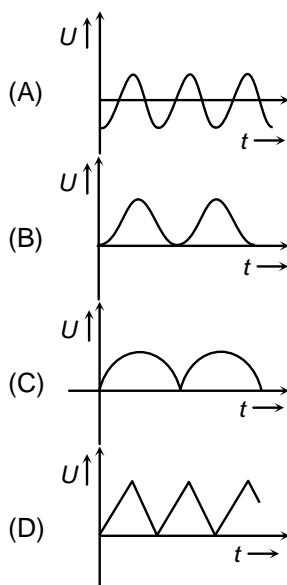
- (A) 5 (B) 1 (C) 2 (D) 3

35. A body executes simple harmonic motion. The potential energy (P.E.), the kinetic energy (K.E.) and total energy (T.E.) are

measured as a function of displacement x . Which of the following statements is true
(A) P.E. is maximum when $x = 0$
(B) K.E. is maximum when $x = 0$
(C) T.E. is zero when $x = 0$
(D) K.E. is maximum when x is maximum

(SECTION-B)

36. 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) $Mg/2K$
37. 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
38. 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) $\sin \omega t - \sin 2\omega t$
39. As a body performs S.H.M., its potential energy U varies with time as indicated in



40. **Assertion** : If the amplitude of a simple harmonic oscillator is doubled, its total energy becomes four times.
Reason : The total energy is directly proportional to the square of amplitude of vibration of the harmonic oscillator.
(A) If both assertion and reason are true and the reason is the correct explanation of the assertion.
(B) If both assertion and reason are true but reason is not the correct explanation of the assertion.
(C) If assertion is true but reason is false.
(D) If the assertion and reason both are false.
41. **Assertion** : In extreme position of a particle executing S.H.M., both velocity and acceleration are zero.
Reason : In S.H.M., acceleration always acts towards mean position.
(A) If both assertion and reason are true and the reason is the correct explanation of the assertion.
(B) If both assertion and reason are true but reason is not the correct explanation of the assertion.
(C) If assertion is true but reason is false.
(D) If assertion is false but reason is true.
42. A particle undergoing simple harmonic motion has time dependent displacement given by $x(t) = A \sin \frac{\pi t}{90}$. The ratio of kinetic to potential energy of this particle at $t = 210$ s will be:
(A) $1/9$ (B) 1 (C) $1/3$ (D) $1/2$
43. A pendulum is executing simple harmonic motion and its maximum kinetic energy is K_1 . If the length of the pendulum is doubled and it performs simple harmonic motion with the same amplitude as in the first case, its maximum kinetic energy is K_2 . Then:
(A) $K_2 = \frac{K_1}{2}$ (B) $K_2 = 2K_1$
(C) $K_2 = K_1$ (D) $K_2 = \frac{K_1}{4}$
44. A particle is executing simple harmonic motion (SHM) of amplitude A , along the x -

axis, about $x = 0$. When its potential Energy (PE) equals kinetic energy (KE), the position of the particle will be :

- (A) $\frac{A}{2\sqrt{2}}$ (B) $\frac{A}{2}$
(C) A (D) $\frac{A}{\sqrt{2}}$

45. 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 sec (B) 0.02 sec
(C) 0.1 sec (B) 0.2 sec

46. 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

47. If the length of simple pendulum is increased by 300%, then the time period will be increased by

- (A) 100% (B) 200%
(C) 300% (D) 400%

48. A mass M , attached to a horizontal spring, executes SHM with a 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) $\frac{M+m}{M}$
(C) $\left(\frac{M}{M+m}\right)^{1/2}$ (D) $\left(\frac{M+m}{M}\right)^{1/2}$

49. A pendulum is hung from the roof of a sufficiently high building and is moving freely to and fro like a simple harmonic

oscillator. The acceleration of the bob of the pendulum is 20 m/s^2 at a distance of 5 m from the mean position. The time period of oscillation is :

- (A) $2\pi \text{ s}$ (B) 1 s (C) 2 s (D) $\pi \text{ s}$

50. A spring of force constant k is cut into lengths of ratio 1 : 2 : 3. They are connected in series and the new force constant is k' . Then they are connected in parallel and force constant is k'' . Then $k' : k''$ is :

- (A) 1 : 6 (B) 1 : 9
(C) 1 : 11 (D) 1 : 14