CHAPTER 13 Oscillations

Periodic Motion, Superposition of Waves, Displacement, Velocity, Phase, Acceleration in SHM

1. The phase difference between displacement and acceleration of a particle in a simple harmonic motion is: *(2020)*

a. $\frac{3\pi}{2}$ rad b. $\frac{\pi}{2}$ rad

c. Zero d. π rad

2. Identify the function which represents a periodic motion. *(2020-Covid)*

a. $\log_e(\omega t)$ b. $\sin\omega t + \cos\omega t$

c. $e^{-\omega t}$ d. $e^{\omega t}$

3. The displacement of a particle executing simple harmonic motion is given by $y = A_0 + A\sin\omega t + B\cos\omega t$

Then the amplitude of its oscillation is given by: *(2019)*

a. $A_0 + \sqrt{A^2 + B^2}$ b. $\sqrt{A^2 + B^2}$

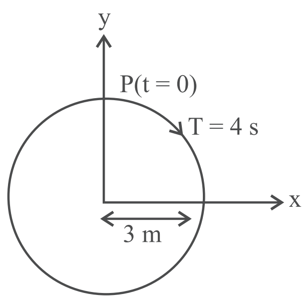
c. $\sqrt{A_0^2 + (A+B)^2}$ d. $A + B$

4. Average velocity of a particle executing SHM in one complete vibration is: *(2019)*

a. $\frac{A\omega}{2}$ b. $A\omega$

c. $\frac{A\omega^2}{2}$ d. Zero

5. The radius of circle, the period of revolution, initial position and sense of revolution are indicated in the



y - projection of the radius vector of rotating particle P is: *(2019)*

a. $y(t) = -3\cos 2\pi t$, where y in m

b. $y(t) = 4\sin\left(\frac{\pi t}{2}\right)$, where y in m

c. $y(t) = 3\cos\left(\frac{3\pi t}{2}\right)$, where y in m

d. $y(t) = 3\cos\left(\frac{\pi t}{2}\right)$, where y in m

6. A particle executes linear simple harmonic motion with an amplitude of 3 cm. When the particle is at 2 cm from the mean position, the magnitude of its velocity is equal to that of its acceleration. Then its time period in seconds is: *(2017-Delhi)*

a. $\frac{\sqrt{5}}{2\pi}$ b. $\frac{4\pi}{\sqrt{5}}$

c. $\frac{2\pi}{\sqrt{3}}$ d. $\frac{\sqrt{5}}{\pi}$

7. When two displacements represented by $y_1 = a\sin(\omega t)$ and $y_2 = b\cos(\omega t)$ are superimposed, the motion is: *(2015)*

a. Simple harmonic with amplitude $\frac{a}{b}$

b. Simple harmonic with amplitude $\sqrt{a^2 + b^2}$

c. Simple harmonic with amplitude $\frac{(a+b)}{2}$

d. Not a simple harmonic

8. A particle is executing S.H.M. along a straight line. Its velocities at distances x_1 and x_2 from the mean position are v_1 and v_2 respectively. Its time period is: *(2015)*

a. $2\pi\sqrt{\frac{x_2^2 - x_1^2}{v_1^2 - v_2^2}}$ b. $2\pi\sqrt{\frac{v_1^2 - v_2^2}{x_1^2 + x_2^2}}$

c. $2\pi\sqrt{\frac{v_1^2 - v_2^2}{x_1^2 - x_2^2}}$ d. $2\pi\sqrt{\frac{x_1^2 + x_2^2}{v_1^2 + v_2^2}}$

9. A particle is executing a simple harmonic motion. Its maximum acceleration is α and maximum velocity is β. Then, its time period of vibration will be: *(2015 Re)*

a. $\frac{2\pi\beta}{\alpha}$ b. $\frac{\beta^2}{\alpha^2}$

c. $\frac{\alpha}{\beta}$ d. $\frac{\beta^2}{\alpha}$

10. The oscillation of a body on a smooth horizontal surface is represented by the equation,

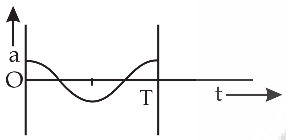
$X = A\cos(\omega t)$

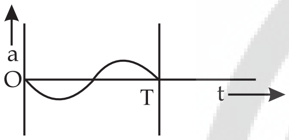
Where,

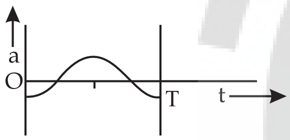
X = displacement at time t

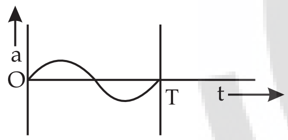
ω = frequency of oscillation

Which one of the following graphs shows correctly the variation a with t? *(2014)*

a. 

b. 

c. 

d. 

Here a = acceleration at time t

T = time period

Energy in SHM (P.E., K.E. and T.E.)

11. A body is executing simple harmonic motion with frequency 'n', the frequency of its potential energy is: *(2021)*

a. 2n b. 3n

c. 4n d. n

Simple Pendulum and Loaded Springs

12. Two pendulums of length 121 cm and 100 cm start vibrating in phase. At some instant, the two are at their means position in the same phase. The minimum number of vibrations of the shorter pendulum after which the two are again in phase at the means position is: *(2022)*

a. 8 b. 11

c. 9 d. 10

13. A spring is stretched by 5 cm by a force 10 N. The time period of the oscillations when a mass of 2 kg is suspended by it is: *(2021)*

a. 6.28 s b. 3.14 s

c. 0.628 s d. 0.0628 s

14. 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: *(2018)*

a. 2s b. π s

c. 2π s d. 1 s

15. 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: *(2017-Delhi)*

a. 1 : 9 b. 1 : 11

c. 1 : 14 d. 1 : 6

16. A body of mass m is attached to the lower end of a spring whose upper end is fixed. The spring has negligible mass. When the mass m is slightly pulled down and released, it oscillates with a time period of 3 s. When the mass m is increased by 1 kg, the time period of oscillations becomes 5 s. The value of m in kg is: *(2016 - II)*

a. $\frac{16}{9}$ b. $\frac{9}{16}$

c. $\frac{3}{4}$ d. $\frac{4}{3}$

Answer Key

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
d	b	b	d	d	b	b	a	a	c	a	b	c	b	b	b