Oscillations

CHAPTER 14

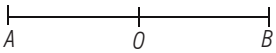
TRY YOURSELF ANSWERS

1. A motion can be periodic and not oscillatory. For example, uniform circular motion is periodic but not oscillatory.

2. A periodic motion repeats after a definite time interval T.
So, $y(t) = y(t + T) = y(t + 2T)$ etc.

3. It is the position of the body where the force acting on it is zero.

4. Distance travelled by oscillator is one time period,
$x = AO + OB + BO + OA = 4AO$
Amplitude of motion $= AO$



$\therefore$ Required ratio, $\frac{4AO}{AO} = \frac{4}{1} = 4:1$

5. $\omega = 2\pi n$, where n is frequency and ω is angular frequency.

We know that, $n = \frac{1}{T}$

$\therefore \quad \omega = \frac{2\pi}{T}$

6. π or 180°.

7. Velocity : $v(t) = \frac{d}{dt}x(t) = -\omega A \sin(\omega t + \phi)$

8. At the extreme positions.

9. $\frac{\text{Kinetic energy}}{\text{Total energy}} = \frac{\frac{1}{2}m\omega^2[A^2 - A^2/4]}{\frac{1}{2}m\omega^2 A^2} = \frac{3}{4}$

10. No, the total mechanical energy of a harmonic position, is independent of time.

11. (i) Minimum at extreme position (ii) maximum at mean position.

12. The time period of a simple pendulum is

$$T = 2\pi\sqrt{\frac{l}{g}} \quad \text{or} \quad l = \frac{gT^2}{4\pi^2}$$

The time period of a simple pendulum, which ticks seconds, is 2 s.

$\therefore \quad l = \frac{(9.8\ \text{m s}^{-2})(2\ \text{s})^2}{4\pi^2} = 1\ \text{m}$

13. The component of weight ($mg \sin\theta$) keeps the pendulum in motion.

14. (i) Gravity (ii) Weight of different column.

15. $T = 2\pi\sqrt{\frac{l}{g}}$

If initial length l is 100 cm then after 64% increment, the new length l' is 169 cm.

$\therefore \quad T = 2\pi\sqrt{\frac{100}{g}} = T' = 2\pi\sqrt{\frac{169}{g}}$

Now, $\frac{T}{T'} = \frac{10}{13}$

change in time period $= \frac{T' - T}{T} \times 100$

$= \frac{13 - 10}{10} \times 100 = 30\%$

16. The time period remains same in both the cases.

17. Time period of oscillation of loaded spring, $T = 2\pi\sqrt{\frac{m}{k}}$, where m is the mass of the load attached and k is the spring constant.

18. The force constant of a spring is the change in the force it exerts divided by the change in deflection of spring.

19. When a spring of force constant k is cut into n equal parts, the force constant of each part would be nk.
Here, $n = 3$, $\therefore$ The force constant of each part would be $3k$.

20. In first case, $T_1 = 1.5$ s, $m = m$ Kg

As $T = 2\pi\sqrt{\frac{m}{K}} \quad \Rightarrow \quad 1.5 = 2\pi\sqrt{\frac{m}{K}}$ ...(i)

In second case
$T_2 = 1.5 + 1 = 2.5$, mass $= (m + 3)$ Kg

Then, $2.5 = 2\pi\sqrt{\frac{m+3}{K}}$ ...(ii)

Dividing (ii) by (i), we get

$\frac{2.5}{1.5} = \frac{m+3}{\sqrt{m}}$ or $\frac{5^2}{3^2} = \frac{m+3}{m} \Rightarrow m = 1.69$ kg.

BEST SELLING BOOKS FOR CLASS 11

Visit www.mtg.in for complete information