Chapter 12 Simple Harmonic Motion

1. A person goes to bed at sharp 10.00 pm every day. Is it an example of periodic motion? If yes, what is the time period? If no, why?

Ans: It is not motion at first place.

2. A particle executing simple harmonic motion comes to rest at the extreme positions. Is the resultant force on the particle zero at these positions according to Newton's first law?

[Sol. No, force is maximum at extreme position.]

3. Can simple harmonic motion take place in a non-inertial frame? If yes, should the ratio of the force applied with the displacement be constant?

Ans. Yes, No

4. A particle executes simple harmonic motion. If you are told that its velocity at this instant is zero, can you say what its displacement is? If you are told that its velocity at this instant is maximum, can you say what its displacement is?

[Sol. No, to know the displacement we should know the initial position of the particle. If it is said that initial position is mean position then we can answer the above question.]

5. A small creature moves with constant speed in a vertical circle on a bright day. Does its shadow formed by the sun on a horizontal plane move in a simple harmonic motion?

Ans: Yes

6. A particle executes simple harmonic motion. Let P be a point near the mean position and *Q* be a point near an extreme. The speed of the particle at P is larger than the speed at *Q*. Still the particle crosses P and *Q* equal number of times in a given time interval. Does it make you unhappy?

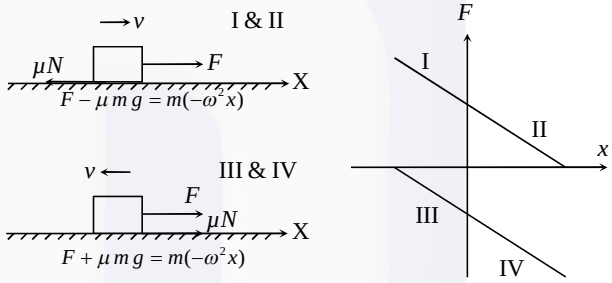
Ans: Not at all

7. In measuring time period of a pendulum, it is advised to measure the time between consecutive passages through the mean position in the same direction. This is said to result in better accuracy than measuring time between consecutive passages through an extreme position. Explain.

[Sol. Because mean position is fixed, while extreme position keeps on changing. So, when we use stop watch, we are very sure about the mean position.]

8. It is proposed to move a particle in simple harmonic motion on a rough horizontal surface by applying an external force along the line of motion. Sketch the graph of the applied force against the position of the particle. Note that the applied force has two values for a given position depending on whether the particle is moving in positive or negative direction.

Ans:



9. Can the potential energy in a simple harmonic motion be negative? Will it be so if we choose zero potential energy at some point other than the mean position?

Ans: Yes, Yes

10. The energy of a system in simple harmonic motion is given by $E = \frac{1}{2} m\omega^2 A^2$. Which of the following two statements is more appropriate?
    a. The energy is increased because the amplitude is increased.
    b. The amplitude is increased because the energy is increased.

Ans: A

11. A pendulum clock gives correct time at the equator. Will it gain time or loose time as it is taken to the poles?

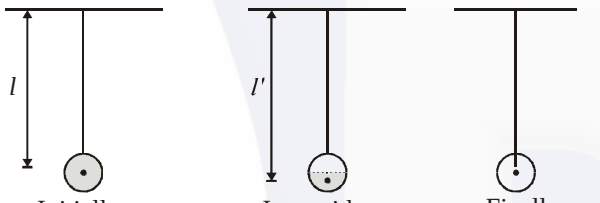
[Sol. $T = 2\pi\sqrt{\frac{l}{g}}$ at pole g is more so time period gets decreased hence check gains time]

12. Can a pendulum clock be used in an earth-satellite?

Ans: No as $g_{eff} = 0$

13. A hollow sphere filled with water is used as the bob of a pendulum. Assume that the equation for simple pendulum is valid with the distance between the point of suspension and centre of mass of the bob acting as the effective length of the pendulum. If water slowly leaks out of the bob, how will the time period vary?

Ans: first it will increase then it will decrease.



$T = 2\pi\sqrt{\frac{l}{g}}$ first l increases and then it decreases.]

14. A block of known mass is suspended from a fixed support through a light spring. Can you find the time period of vertical oscillation only by measuring the extension of the spring when the block is in equilibrium?

Ans: Yes. $T = 2\pi\sqrt{\frac{m}{k}} = 2\pi\sqrt{\frac{x_0}{g}}$ as $mg = kx_0$.

15. A platoon of soldiers marches on horizontal road in steps according to the sound of a marching band. The band is stopped and the soldiers are ordered to break the steps while crossing a bridge. Why?

Ans: forced oscillation may break the bridge.

16. The force acting on a particle moving along X-axis is $F = -k(x - v_0t)$ where k is a positive constant. An observer moving at a constant velocity v_o along the X-axis looks at the particle. What kind of motion does he find for the particle?

Ans: since he moves with constant velocity, he sees the same force. And this force is not that of SHM.