Physics Class 11 Important Question Chapter 13 Oscillations

Q. 1. What is a periodic motion? Which trigonometrical functions are suitable for expressing periodic motion?

Ans. A periodic motion is that motion which repeats itself again and again after a definite interval of time. Sine or cosine functions of time or their linear combinations are suitable for expressing periodic motion.

Q. 2. What is an oscillatory motion?

Ans. An oscillatory motion is that periodic motion in which the oscillating particle moves to and fro about an equilibrium position within well-defined limits.

Q. 3. Are all oscillatory motions simple harmonic? If yes, give an example but if not, why?

Ans. No, all oscillatory motions cannot be simple harmonic. In fact, only those oscillatory motions are simple harmonic for which force is proportional to displacement and directed towards the mean position.

Q. 4. What is the displacement of a particle executing simple harmonic motion?

Ans. For a particle executing mechanical simple harmonic motion, displacement is defined as the term which specifies its position as well as direction with respect to its mean position.

Q. 5. What is the significance of 'phase of a particle in an oscillatory motion?

Ans. In an oscillatory motion, the phase of a particle describes the state of motion of the particle at a given instant of time.

Q. 6. How is simple harmonic motion related to a uniform circular motion?

Ans. Simple harmonic motion may be considered as the projection of a uniform circular motion on a diameter of the circle.

Q. 7. Can an object executing SHM have acceleration without having velocity?

Ans. Yes, an object executing SHM can have maximum acceleration but zero velocity when situated at its extreme position.

Q. 8. A simple harmonic motion is expressed as the projection of uniform circular motion along one of its diameters. What is the displacement amplitude of SHM?

Ans. The displacement ampltiude of SHM is equal to the radius of the reference circle.

Q. 9. Two oscillators meet each other at their common mean position, while oscillating. What is the phase difference between them?

Ans. The phase difference is zero if both oscillators are moving in the same direction. However, the phase difference is it rad if the two oscillators are crossing the mean position simultaneously opposite directions.

Q. 10. What are the two basic characteristics of a simple harmonic motion?

Ans. The two basic characteristics of a SHM are:

(a) The force (or acceleration) is proportional to its displacement.

(b) The force (or acceleration) is directed towards the mean position of SHM.

Q. 11. Define force constant of a spring. Give its SI units and dimensional formula.

Ans. Force constant of a spring is defined as the restoring force set up in the spring per unit extension or compression in the spring. Its SI unit is N/m and dimensional formula is [MT-2].

Q. 12. When will the motion of a simple pendulum be simple harmonic?

Ans. Motion of a simple pendulum is simple harmonic when its amplitude (or angular amplitude θ) is small enough so that sinθ may have the same value as θ.

Q. 13. Can an ideal simple pendulum be constructed in practice? Give reason too.

Ans. We can never design an ideal simple pendulum because neither the pendulum bob can be an infinite, point mass nor the string be massless and inextensible.

Q. 14. Why does the amplitude of an oscillating pendulum go on decreasing with time?

Ans. The amplitude of an oscillating pendulum gradually goes on decreasing with time due to damping caused by viscous drag of air.

Q. 15. On which factors does the natural vibrational frequency of an oscillating body depend?

Ans. The natural vibrational frequency of an oscillating body depends on its elastic nature and its dimensions.

Q. 16. Define damping constant b. Give its dimensional formula too.

Ans. The damping constant b is defined as the damping force per unit velocity of the oscillator. Its dimensional formula is [MT-1].

Q. 17. What is resonance?

Ans. The phenomenon of increase in amplitude of oscillation of a driven oscillator when frequency of driving force is close to the natural frequency of oscillator.

Q. 18. When will the motion of a simple pendulum be simple harmonic? What will happen to its motion if the amplitude of oscillation is large?

Ans. The motion of a simple pendulum is simple harmonic motion only for small values of amplitude so that restoring force mg sinθ may be taken as mg θ.

If amplitude of oscillation is large, then sinθ ≠ θ and condition for SHM is not fulfilled. Therefore, now motion of pendulum is though oscillatory but not simple harmonic.

Q. 19. Is the motion of a simple pendulum a linear SHM or an angular SHM?

Ans. Truely speaking, the motion of a simple pendulum is angular SHM, provided that its angular amplitude θ is small enough.

Q. 20. For an oscillating simple pendulum, is the tension in the string constant throughout the oscillation? If not, when is it (a) minimum, and (b) maximum?

Ans. The tension in the string of an oscillating simple pendulum is different at different points of its oscillation. The tension in string is:

(a) minimum at the extreme positions during the oscillations, and

(b) maximum at the mean position.

Q. 21. Is the damping force constant for an oscillating system oscillating freely?

Ans. No, the damping force will not be constant. It is because the damping force is dependent on the velocity of oscillating system. For higher velocity, damping force is more but for smaller velocity, damping force is less.

Q. 22. In forced oscillations of an object, under what condition is the amplitude of oscillation maximum? Under what condition is energy of oscillator maximum?

Ans. In forced oscillations, the amplitude of oscillation as well as energy of oscillator will be maximum when frequency of external periodic force becomes exactly same as the natural frequency of the given oscillating object.

Q. 23. Sometimes, a bus begins to make a loud rattling sound at a certain speed on the road. Why?

Ans. The bus will start making a loud rattling sound when frequency of oscillations of the structure of the bus exactly matches the frequency of the engine of the bus.

Q. 24. What is the distance moved by a particle executing SHM of amplitude A in one complete cycle? What is the net displacement?

Ans. For a particle executing SHM, total distance covered in one complete cycle is 4A, where A = amplitude of SHM.

The net displacement of a particle executing SHM is zero in one complete cycle.

Q. 25. What will be the change in time period of a spring pendulum when taken to the Moon?

Ans. There will be no change in time period of a spring pendulum when taken to the Moon because the time period does not depend on the value of acceleration due to gravity.

Q. 26. What would happen to the motion of an oscillating particle if the sign of the force term in force law F = -ky is changed?

Ans. When the sign of force F is changed, the expression for force becomes F = ky. Now, this equation does not represent a harmonic oscillation. It is because now with increase in value of displacement y, value of force F and hence acceleration a goes on increasing. Thus, the motion will become a linearly accelerated motion along a given direction.

Q. 27. Why is a restoring force must for an object to execute simple harmonic motion?

Ans. Presence of a restoring force is a must for an object to execute simple harmonic motion. When the object is at the extreme position during its oscillation, its velocity is zero, i.e., the object is momentarily at rest. If there is no restoring force, then object will remain in its rest position there and will have no tendency to return to its mean position. Due to this reason, a restoring force is a must.