Oscillations

1. **Assertion (A):** A hole were drilled through the centre of earth and a ball is dropped into the hole at one end, it will not get out of other end of the hole.
Reason (R): Ball will execute simple harmonic motion inside the hole.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

2. **Assertion (A):** In SHM let x be the maximum speed, y the frequency of oscillation and z the maximum acceleration, then $\left(\frac{xy}{z}\right)$ is a constant quantity.
Reason (R): This is because $\left(\frac{xy}{z}\right)$ becomes a dimensionless quantity
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

3. A vertical spring block system is made to oscillate.
Assertion (A): Its time period on earth is more than that on the moon.
Reason (R): Its extension on moon (in equilibrium) is more than that on the earth .
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

4. **Assertion (A):** Total mechanical energy in SHM is conserved.
Reason (R): Kinetic energy of SHM at mean position is equal to potential energy at ends for a particle moving in SHM.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

5. **Assertion (A):** A SHM may be assumed as composition of many SHM's.
Reason (R): Superposition of many SHM's (along same line) of same frequency will be a SHM.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

6. **Assertion (A):** Displacement–time equation of a particle moving along x–axis is $x = 4 + 6\sin\omega t$. Under this situation, motion of particle is not simple harmonic.
Reason (R): $\frac{d^2x}{dt^2}$ for the given equation is not proportional to $-x$.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

7. **Assertion (A):** For a particle performing SHM, its speed decreases as it goes away from the mean position.
Reason (R): In SHM, the acceleration is always opposite to the velocity of the particle.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

8. **Assertion (A):** Motion of a ball bouncing elastically in vertical direction on a smooth horizontal floor is a periodic motion but not an SHM.
Reason (R): Motion is SHM when restoring force is proportional to displacement from mean position.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

9. **Assertion (A):** A particle, simultaneously subjected to two simple harmonic motions of same frequency and same amplitude, will perform SHM only if the two SHM's are in the same direction.
Reason (R): A particle, simultaneously subjected to two simple harmonic motions of same frequency and same amplitude, perpendicular to each other the particle can be in uniform circular motion.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

10. **Assertion (A):** $x = A \sin \omega t$
$y = B \cos \omega t$
In the above co-ordinates particle moves in elliptical path.
Reason (R): A periodic motion can always be expressed as a sum of infinite number of harmonic motions with appropriate amplitude
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

11. **Assertion (A):** Under forced oscillation external periodic force apply to sustain the motion.
Reason (R): Under forced oscillation phase of harmonic motion of the particle differs from the phase of the driving force.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

12. **Assertion (A):** For large angle in simple pendulum $T > 2\pi\sqrt{\frac{\ell}{g}}$
Reason (R): $\sin\theta < \theta$, if the restoring force. mg $\sin\theta$ is replaced by mgθ, this amounts to effective reduction in g for large angle, hence an increase in T.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

13. **Assertion (A):** We can assume damped oscillation to be approximately periodic motion for small damping
Reason (R): Small damping means $\frac{b}{\sqrt{km}} << 1$
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

14. **Assertion (A):** When a simple pendulum is made to oscillate on the surface of moon, its time period increases.
Reason (R): Gravity at moon is less than gravity at earth.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

15. **Assertion (A):** The spring constant of a spring is 'K'. When it is divided into "n" equal parts, then spring constant of one piece is 'K/n'.
Reason (R): The spring constant is independent of material used.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

16. **Assertion (A):** The amplitude of an oscillating pendulum in air decreases gradually with time.
Reason (R): The frequency of the pendulum decreases with time.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

17. **Assertion (A):** The time period of spring mass system is greater at equator then at poles.
Reason (R): Time period of spring mass system depends on gravity.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

18. **Assertion (A):** In simple pendulum performing SHM net acceleration is always between tangential and radial acceleration except its lowest point and extreme points.
Reason (R): At lowest point tangential acceleration is zero.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

19. **Assertion (A):** Mechanical energy of a particle executing SHM is E, maximum KE of particle may be greater than E.
Reason (R): Minimum 'PE' of a system may be negative.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

20. **Assertion (A):** In common practice undamped spring block system is an example of oscillation as well as and periodic motion.
Reason (R): Every oscillating motion is necessarily a periodic motion.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

21. **Assertion (A):** $x = \sin^2(\omega t)$ represents a SHM about mean position $x = \frac{1}{2}$.
Reason (R): $(a \propto -x)$ is the necessary condition for SHM.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

22. **Assertion (A):** If PE of a particle executing SHM is given by $U = x^2 - 10x + 27$, then it is executing SHM about $x = 5$.
Reason (R): At mean position, restoring force is zero.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

23. **Assertion (A):** In resonance amplitude is infinity, in presence of dissipative forces.
Reason (R): At resonance driving frequency is equal to natural frequency of the system.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

24. **Assertion (A):** In damped oscillation, the motion is periodic.
Reason (R): In damped oscillation, the amplitude decreases due to dissipative forces.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

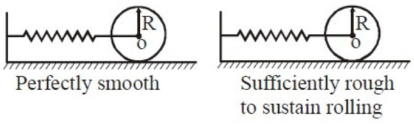
25. **Assertion (A):** The amplitude of damped oscillation depends on damping constants.
Reason (R): The angular frequency for a damped oscillation depends on damping constant only.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

26. **Assertion (A):** General vibrations of a polyatomic molecule about its equilibrium position is periodic but not SHM.
Reason (R): A periodic motion can always be expressed as a sum of infinite number of harmonic motion with appropriated amplitude.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

27. **Assertion (A):** In SHM acceleration leads displacement by phase π.
Reason (R): In SHM velocity leads displacement by phase $\pi/2$.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

28. **Assertion (A):** Amplitude of SHM $x = 4\sin^2\omega t + 2\cos^2\omega t + 2\sin\omega t \cos\omega t$ is $\sqrt{2}$
Reason (R): Angular frequency of given equation is 2ω.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

29. **Assertion (A):** For a physical pendulum period of oscillation is maximum about an axis passes through centre of mass.
Reason (R): A physical pendulum is in neutral equilibrium about centre of mass.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

30. 

Assertion (A): Period of oscillation of rolling body is more than sliding body.
Reason (R): Frictional force always opposes the spring force in given case.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

31. **Assertion (A):** Two particles are in SHM with same time period, same amplitude, same position and same speed are in the same phase.
Reason (R): Phase of particle depends on position and speed of particle.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

32. **Assertion (A):** In damped oscillation both amplitude and frequency change with time.
Reason (R): Both amplitude and frequency vary exponentially.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

33. **Assertion (A):** Time period of partially immersed spring block system is less than full immersed spring block system.
Reason (R): Time period of spring system is independent of changing values of g.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

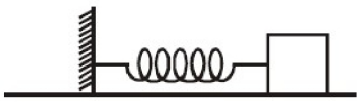
34. **Assertion (A):** In forced oscillations, the steady state motion of the particle (after natural oscillations die out) is SHM whose frequency is the frequency of the driving frequency ω_d, not the natural frequency w of the particle.
Reason (R): In forced oscillation ω_d should be greater than natural frequency ω of the particle.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

35. **Assertion (A):** For a physical pendulum if distance of point of suspension from centre of mass increases time period first decreases then increases.
Reason (R): For a physical pendulum there is some distance from centre of mass at which frequency of oscillation is maximum.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

36. **Assertion (A):** A spring block watch gives the correct time in orbiting satellite.
Reason (R): Time period of a spring block watch is independent of g and depends only on spring factor and mass of the block.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

37. **Assertion (A):** If a pendulum clock is taken to a mountain top, its time period decreases.
Reason (R): Value of acceleration due to gravity is more at heights.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

38. **Assertion (A):** In simple harmonic motion total mechanical energy can be negative also.
Reason (R): Potential energy is always negative and if it is greater than kinetic energy total mechanical energy will be negative.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

39. 

Assertion (A): In an ideal spring mass system, block was given some charge & placed in uniform electric field which is along the spring, it's time period & frequency of oscillation does not change.

Reason (R): In an ideal oscillating spring mass system constant force does not change its time period & frequency and it only changes the mean position & amplitude.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

(3) (A) is true but (R) is false

(4) Both (A) and (R) are false

40. **Assertion (A):** The graph between velocity and displacement for a harmonic oscillator is a parabola.

Reason (R): Velocity does change uniformly with displacement in harmonic motion.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

(3) (A) is true but (R) is false

(4) Both (A) and (R) are false

41. **Assertion (A):** A small body suspended by a light spring performing SHM. When the entire system is immersed in a nonviscous liquid period of oscillation does not change.

Reason (R): The angular frequency of oscillation of the particle does not change.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

(3) (A) is true but (R) is false

(4) Both (A) and (R) are false

42. **Assertion (A):** The graph of potential energy and kinetic energy of a particle in SHM with respect to position is a parabola.

Reason (R): The potential energy and kinetic energy of a particle in SHM, do not vary linearly with position.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

(3) (A) is true but (R) is false

(4) Both (A) and (R) are false

43. **Assertion (A):** A simple pendulum is attached on a roof of a elevator. Time period of SHM is T when elevator is at rest. Time period of SHM must be greater than T if elevator start moving upward.

Reason (R): Time period of simple pendulum does not depend on acceleration due to gravity.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

(3) (A) is true but (R) is false

(4) Both (A) and (R) are false

44. **Assertion (A):** Maximum potential energy in simple harmonic motion is equal to net mechanical energy.

Reason (R): Maximum kinetic energy in simple harmonic motion is equal to net mechanical energy.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

(3) (A) is true but (R) is false

(4) Both (A) and (R) are false

45. **Assertion (A):** Sine and cosine functions are periodic functions.
Reason (R): Sinusoidal functions repeat its values after a definite interval of time.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

46. **Assertion (A):** In SHM the velocity is maximum when the acceleration is minimum.
Reason (R): Displacement and velocity in SHM differ in phase by $\frac{\pi}{2}$.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

47. **Assertion (A):** The periodic time of a hard spring is less as compared to that of a soft spring.
Reason (R): The spring constant is large for hard spring.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

48. **Assertion (A):** Vibration of polyatomic molecules is not simple harmonic motion.
Reason (R): The vibrations are superposition of SHMs of different frequency.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

49. **Assertion (A):** If the amplitude of a simple harmonic oscillator is doubled, its total energy also becomes doubled.
Reason (R): In harmonic oscillation, the total energy is directly proportional to the amplitude of vibration.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

50. **Assertion (A):** For a system executing SHM, the mechanical energy remains constant.
Reason (R): In SHM, kinetic energy and potential energy vary periodically with double the frequency of SHM.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

ANSWER KEY

Que.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Ans.	1	2	4	3	1	4	3	1	4	2	2	1	1	1	4	3	4	2	1	3
Que.	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
Ans.	1	1	4	4	3	2	2	2	1	2	4	4	2	3	2	1	4	3	1	4
Que.	41	42	43	44	45	46	47	48	49	50										
Ans.	2	2	4	3	1	2	1	1	4	2										