Practice Set 1 (Oscilations)

Q1. Two simple pendulums of length $0.5 \mathrm{~m}$ and $2.0 \mathrm{~m}$ respectively are given small linear displacement in one direction at die same time. They will again be in the same phase when the pendulum of shorter length has completed oscillations

(a) 5 (b) 1 (c) 2 (d) 3

Q2. A mass m is vertically suspended from a spring of negligible mass; the system oscillates with a frequency n. What will be the frequency of the system, if a mass $4 \mathrm{~m}$ is suspended from the same spring?

(a) $\frac{n}{4}$ (b) $4n$ (c) $\frac{n}{2}$ (d) $2\mathrm{n}$

Q3. A particle, with restoring force proportional to displacement and resisting force proportional to velocity is subjected to a force F sin ωt. If the amplitude of the particle is maximum for $\omega=\omega_1$ and the energy of the particle maximum for $\omega=\omega_2$, then

(a) $\omega=\omega_0$ and $\omega_2 \neq \omega_0$

(b) $\omega_1=\omega_0$ and $\omega_2=\omega_0$

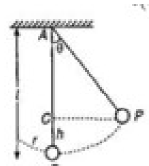
(c) $\omega_1 \neq \omega_0$ and $\omega_2=\omega_0$

(d) $\omega_1 \neq \omega_0$ and $\omega_2 \neq \omega_0$ where $\omega_0 \rightarrow$ natural angular frequency of oscillations of particle.

Q4. The time period of a simple pendulum is $2 \mathrm{~s}$. If its length is increased by 4 times, then its period becomes:

(a) $16 \mathrm{~s}$ (b) $12 \mathrm{~s}$ (c) $8 \mathrm{~s}$ (d) $4 \mathrm{~s}$

Q5. A pendulum is displaced to an angle θ from its equilibrium position; then it will pass through its mean position with a velocity v equal to:



(a) $\sqrt{2gl}$ (b) $\sqrt{2gl\sin\theta}$

(c) $\sqrt{2gl\cos\theta}$ (d) $\sqrt{2gl(1-\cos\theta)}$

Q6. Two simple harmonic motions given by $x=A\sin(\omega t+\delta)$ and $y=A\sin\left(\omega t+\delta+\frac{\pi}{2}\right)$ act on a particle simultaneously; then the motion of particle will be:

(a) circular anti-clockwise (b) circular clockwise

(c) elliptical anti-clockwise (d) elliptical clockwise

Q7. When a damped harmonic oscillator completes 100 oscillations, its amplitude is reduced to $\frac{1}{3}$ of its initial value. What will be its amplitude 'when it completes 200 oscillations?

(a) $\frac{1}{5}$ (b) $\frac{2}{3}$ (c) $\frac{1}{6}$ (d) $\frac{1}{9}$

Q8. The displacement of particle between maximum potential energy position and maximum kinetic energy position in simple harmonic motion is

(a) $\pm\frac{a}{2}$ (b) $\pm a$ (c) $\pm 2al$ (d) ± 1

Q9. The time period of a mass suspended from a spring is T. If the spring is cut into four equal parts and the same mass is suspended from one of the parts, then the new time period will be:

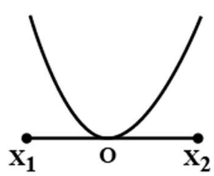
(a) $\frac{T}{2}$ (b) $2\ \mathrm{T}$ (c) $\frac{T}{4}$ (d) T

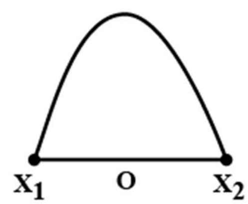
Q10. In case of a forced vibration, the resonance wave becomes very sharp when the:

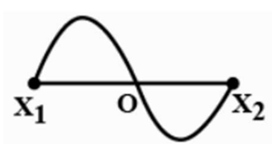
(a) applied periodic force is small (b) quality factor is small

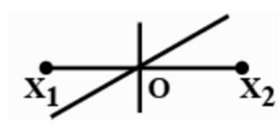
(c) damping force is small (d) restoring force is small

Q11. A particle of mass m oscillates with simple harmonic motion between points x_1 and x_2, the equilibrium position being O. Its potential energy is plotted. It will be as given below in the graph:

(a) 

(b) 

(c) 

(d) 

Q12. Two springs of spring constants k_1 | and k_2 | are joined in series. The effective spring constant of the combination is given by:

(a) $\sqrt{k_1 k_2}$ (b) $(k_1 + k_2)/2$ (c) $k_1 + k_2$ (d) $k_1 k_2/(k_1 + k_2)$

Q13. Particle executing simple harmonic motion of amplitude $5\ \mathrm{cm}$ has maximum speed of $31.4\ \mathrm{cm/s}$. The frequency of its oscillation is:

(a) $3\ \mathrm{Hz}$ (b) $2\ \mathrm{Hz}$ (c) $4\ \mathrm{Hz}$ (d) $1\ \mathrm{Hz}$

Q14. A rectangular block of mass m and area of cross-section A floats in a liquid of density ρ given a small vertical displacement from equilibrium it undergoes oscillation with a time period T. Then:

(a) $T \propto \sqrt{\rho}$ (b) $T \propto \frac{1}{\sqrt{A}}$ (c) $T \propto \frac{1}{\rho}$ (d) $T \propto \frac{1}{\sqrt{m}}$ |

Q15. The phase difference between the instantaneous velocity and acceleration of a particle executing simple harmonic motion is:

(a) 0.5π (d) π (c) 0.707π (d) zero

Practice Set (Solution)

Ans. 1: (c)	Ans. 2: (c)	Ans. 3: (c)	Ans. 4: (d)	Ans. 5: (d)	Ans. 6: (b)	Ans. 7: (d)
Ans. 8: (b)	Ans. 9: (a)	Ans. 10: (c)	Ans. 11: (c)	Ans. 12: (d)	Ans. 13: (d)	Ans. 14: (b)
Ans. 15: (b)						