JEE

Prayas JEE (2025)

Physics

Oscillations

DPP: 7

Q1 The potential energy of a particle of mass m executing SHM is given by $U = A(1 - \cos 2x)$, where x is the instantaneous small displacement of the particle. The time period of oscillation is

(A) $\pi\sqrt{\frac{m}{A}}$

(B) $2\pi\sqrt{\frac{m}{A}}$

(C) $\pi\sqrt{\frac{m}{2A}}$

(D) $2\pi\sqrt{\frac{m}{2A}}$

Q2 A uniform rod of length l is suspended at $l/4$ from one end and made to undergo small oscillations. The time period of oscillation is:

(A) $2\pi\sqrt{\frac{7l}{12g}}$

(B) $2\pi\sqrt{\frac{3l}{7g}}$

(C) $2\pi\sqrt{\frac{7l}{3g}}$

(D) $2\pi\sqrt{\frac{4l}{5g}}$

Q3 The displacement of a particle executing simple harmonic motion is given by, $y = A_0 + A\sin\omega t + B\cos\omega t$. Then the amplitude of its oscillation is given by:

(A) $A + B$

(B) $A_0 + \sqrt{A^2 + B^2}$

(C) $\sqrt{A^2 + B^2}$

(D) $\sqrt{A_0^2 + (A + B)^2}$

Q4 When two displacements represented by $y_1 = a\sin(\omega t)$ and $y_2 = b\cos(\omega t)$ are superimposed, the motion is:

(A) not a simple harmonic.

(B) simple harmonic with amplitude $\frac{a}{b}$.

(C) simple harmonic with amplitude $\sqrt{a^2 + b^2}$

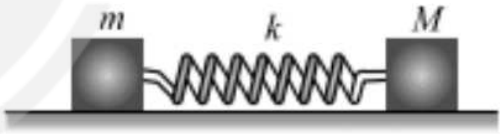
(D) simple harmonic with amplitude $\frac{(a+b)}{2}$.

Q5 Two particles are in SHM in a straight line. Amplitude A and time period T of both the particles are equal. At time $t = 0$, one particle is at displacement $Y_1 = +A$ and the other at $Y_2 = -\frac{A}{2}$, and they are approaching towards each other. After what time they cross each other?

(A) $T/3$ (B) $T/4$

(C) $5T/6$ (D) $T/6$

Q6 The spring as shown in figure is kept in a stretched position with extension x when the system is released. Assuming the horizontal surface to be frictionless, the frequency of oscillation is



(A) $\frac{1}{2\pi}\sqrt{\frac{k(M+m)}{Mm}}$

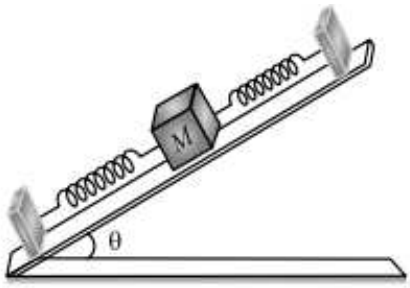
(B) $\frac{1}{2\pi}\sqrt{\frac{mM}{k(M+m)}}$

(C) $\frac{1}{2\pi}\sqrt{\left[\frac{kM}{(m+M)}\right]}$

(D) $\frac{1}{2\pi}\sqrt{\frac{km}{(M+m)}}$

Q7 On a smooth inclined plane, a body of mass M is attached between two springs. The other ends of the springs are fixed to firm supports. If each spring has force constant K, the period of

oscillation of the body (assuming the springs as massless) is



(A) $2\pi\left(\frac{M}{2K}\right)^{1/2}$

(B) $2\pi\left(\frac{2M}{K}\right)^{1/2}$

(C) $2\pi\frac{Mg\sin\theta}{2K}$

(D) $2\pi\left(\frac{2Mg}{K}\right)^{1/2}$

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Answer Key

Q1	(A)	Q5	(D)
Q2	(A)	Q6	(A)
Q3	(C)	Q7	(A)
Q4	(C)		

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