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PHYSICS · JEE MAIN

Oscillations (SHM)

Previous Year Questions with answers

191 questions · **141** papers · **2002–2026** · newest paper first

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What is in this PDF: every Oscillations (SHM) question we hold from past JEE Main and AIEEE papers, with its options and answer. Where an answer comes from a source other than the official final key, it says so next to the answer.

Step-by-step solutions for every question are free in the EdLoop JEE app (Google Play) and on app.edloop.in. More chapters: pyq.edloop.in/free-pdfs/

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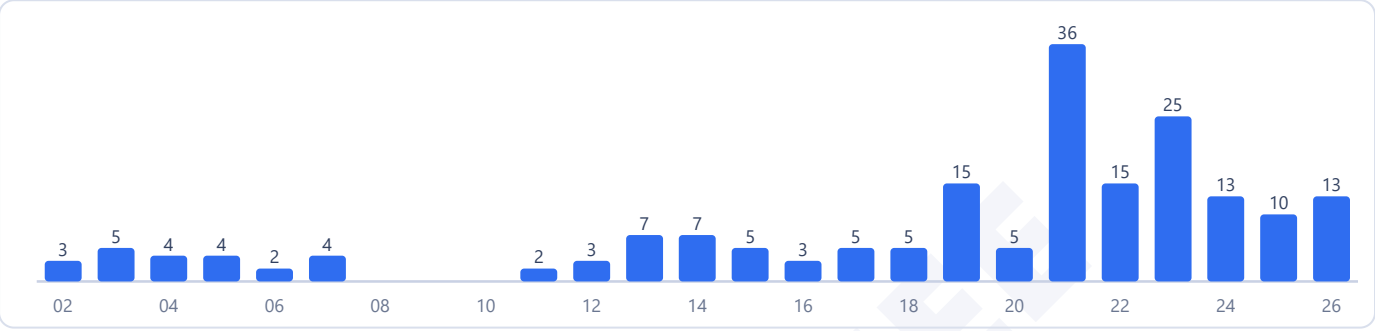
Chapter at a glance

2.9%	191	109 of 162	153 / 38
of Physics questions, 2019–2026	questions, 2002–2026	papers asked it, 2019–2026	MCQ / numerical, 2002–2026

Trend. Falling: 0.6 questions per paper in 2024–2026 against 0.9 in 2019–2023.

Questions per year



Counts are the questions we hold: 191 in 141 papers. 2 questions in this chapter came back in more than one paper.

Most-asked topics in this chapter (2002–2026)



How often it comes up

Oscillations (SHM) explores restorative forces and sinusoidal dynamics in Class 11 Physics, bridging kinematics with wave phenomena. Across the papers we hold from 2019 to 2026, the chapter delivered **132 questions in 162 papers**, which corresponds to **0.8 questions per paper**, and was present in 109 of those 162 papers. That ranks it **21st of 29 Physics chapters** by question count in that period, comprising 2.9% of all Physics questions.

Testing weight for harmonic motion has dropped noticeably when contrasted with earlier testing eras. Between 2002 and 2018, it represented 4.4% of the Physics section; in the recent 2024 to 2026 cycle, it declined to 2.3%, generating 36 questions in 58 papers. The most concentrated years in our archive were 2021 (24 questions across 26 papers) and 2022 (22 questions across 22 papers). The chapter has featured in every annual testing cycle since 2019, turning up in 109 of the 162 papers in our collection.

It forms the first half of Unit 10: Oscillations and Waves in NTA's Class 11 Physics syllabus, introducing differential equations of motion that re-emerge in alternating current circuits.

Most-asked topics

Between 2019 and 2026, questions separated into four distinct topics:

- **Oscillating Systems**: 65 questions. Spring-block combinations in series and parallel, simple pendulums, liquid columns in U-tubes, and floating hydrometers.
- **SHM Basics**: 39 questions. Harmonic displacement equations, phase constants, velocity-displacement ellipses, and linear acceleration relations.
- **Energy in SHM**: 24 questions. Kinetic and potential energy exchanges, time-averaged energies, and energy frequency doubling.

- **Damped & Forced Oscillations**: 4 questions. Exponential amplitude decay, quality factor, and driving frequency resonance peaks.

The first three topics were tested actively in 2026, while damped oscillations appeared occasionally in earlier years like 2021.

What the questions look like

Oscillating system problems typically require deriving the effective restoring force. A classic question cuts a uniform coil spring of stiffness 15 N/m into two pieces in a 1 : 3 length ratio and asks for the spring constant of the shorter segment. Because spring stiffness is inversely proportional to unstretched length, shorter segments become stiffer. Other questions evaluate the oscillation period of a cylinder floating upright in a liquid when gently depressed and released, requiring students to equate net restoring buoyant force to mass times acceleration.

Kinematic questions test the harmonic equations $x = A \sin(\omega t + \varphi)$. Students compute the earliest time when velocity reaches zero (at extreme displacement) or when acceleration vanishes (passing through the mean position). Phase difference problems determine whether two oscillators moving along parallel lines pass each other heading in identical or opposite directions.

Energy questions center on the quadratic dependence of energy on position. You will encounter questions noting that kinetic energy oscillates at an angular frequency of 176 rad/s, asking for the natural frequency of the physical oscillator itself. Because kinetic energy completes two full cycles for every single mechanical cycle of the mass, the oscillator frequency is half the kinetic energy frequency.

Numerical entry problems represent a noticeable portion: 38 of the 132 questions between 2019 and 2026 were numerical answer items.

How to practise it

Master the defining differential equation of simple harmonic motion: acceleration equals negative ω^2 times displacement. Whenever you encounter an unfamiliar physical setup, displace the system by a small distance x from its equilibrium position, write the net restoring force, and show that force is proportional to negative x. The ratio of the restoring constant to system inertia immediately gives ω^2.

Remember the energy frequency relation: while displacement, velocity, and acceleration complete one cycle in time period T, kinetic energy and potential energy complete two full cycles in the same duration. The frequency of energy oscillation is exactly twice the frequency of mechanical motion.

For spring combinations, treat springs like capacitors in electrical circuits: springs in parallel add their stiffnesses directly (k1 + k2), while springs in series combine reciprocally. For simple pendulums, verify that time period scales with the square root of length divided by effective acceleration, remembering to modify effective g inside accelerating elevators or vehicles.

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Q1 JEE Main 2026 · 8 Apr · Shift 2 MCQ

The frequency of oscillation of a mass m suspended by a spring is v_1. If the length of the spring is cut to half, the same mass oscillates with frequency v_2. The value of $\frac{v_2}{v_1}$ is _____.

(A) 1
(B) 2
(C) $\sqrt{2}$
(D) $\sqrt{3}$

Answer: (C) $\sqrt{2}$ · Official NTA final key

Q2 JEE Main 2026 · 6 Apr · Shift 1 MCQ

A particle is executing simple harmonic motion. Its amplitude is A and time period is 5 sec. The time required by it to move from $x = A$ to $x = \frac{A}{\sqrt{2}}$ is _____ sec.

(A) 1/4
(B) 5/4
(C) 5/8
(D) 3/8

Answer: (C) 5/8 · Official NTA final key

Q3 JEE Main 2026 · 6 Apr · Shift 2 MCQ

A spring stretches by 2 mm when it is loaded with a mass of 200 g. From equilibrium position the mass is further pulled down by 2 mm and released. The frequency associated with the system and maxmimum energy in the spring are _____ Hz and _____ J, respectively.
(Take g = 10 m/s^2)

(A) $\frac{5\sqrt{50}}{\pi}$ and 8×10^{-3}
(B) $\frac{5\sqrt{50}}{\pi}$ and 8
(C) $10\sqrt{50}$ and 2×10^{-3}
(D) $\frac{5\sqrt{50}}{\pi}$ and 16×10^{-3}

Answer: (A) $\frac{5\sqrt{50}}{\pi}$ and 8×10^{-3} · Official NTA final key

Q4 JEE Main 2026 · 5 Apr · Shift 2 MCQ

Match **List - I** with **List - II**.

List - I	List - II
A. $\sin^2 \omega t$	I. Periodic with time period $T = \frac{\pi}{\omega}$ but not simple harmonic motion (SHM)

B. $\sin^3(2\omega t)$ II. Periodic with time period $T = \frac{2\pi}{\omega}$ but Not SHM

C. $\sin(\omega t) + \cos(\pi\omega t)$ III. Periodic with time period $T = \frac{\pi}{\omega}$ and SHM

D. $\cos\omega t + \cos 2\omega t$ IV. Non-periodic

Choose the **correct** answer from the options given below :

(A) A-III, B-I, C-IV, D-II

(B) A-II, B-I, C-III, D-IV

(C) A-III, B-II, C-IV, D-I

(D) A-II, B-I, C-IV, D-III

Answer: (A) A-III, B-I, C-IV, D-II · Official NTA final key

Q5 JEE Main 2026 · 4 Apr · Shift 1 Numerical

The velocity of a particle executing simple harmonic motion along x-axis is described as $v^2 = 50 - x^2$, where x represents displacement. If the time period of motion is $\frac{x}{7}$ s, the value of x is _____.

Numerical value type: the answer is a number.

Answer: 44. · Official NTA final key

Q6 JEE Main 2026 · 4 Apr · Shift 2 MCQ

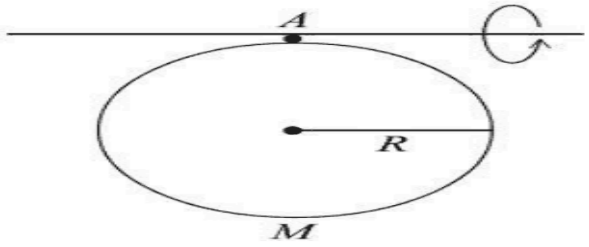
A uniform disc of radius R and mass M is free to oscillate about the axis A as shown in the figure. For small oscillations the time period is _____.

(g is acceleration due to gravity)

(see the figure above)

A uniform disc of radius R and mass M is free to oscillate about the axis A as shown in the figure. For small oscillations the time period is _____.

(g is acceleration due to gravity)



Options :

6952781397. $2\pi\sqrt{\frac{5R}{4g}}$

6952781398. $2\pi\sqrt{\frac{2R}{3g}}$

6952781399. $2\pi\sqrt{\frac{3R}{2g}}$

6952781400. $2\pi\sqrt{\frac{3R}{g}}$

(A) $2\pi\sqrt{\frac{5R}{4g}}$

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

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

(D) $2\pi\sqrt{\frac{3R}{g}}$

Answer: (A) $2\pi\sqrt{\frac{5R}{4g}}$ · Official NTA final key

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Q7 JEE Main 2026 · 2 Apr · Shift 2 MCQ

The equation of motion of a particle is given by $x = a\,\sin\left(50t + \frac{\pi}{3}\right)$ cm. The particle will come to rest at time t_1 and it will have zero acceleration at time t_2. The t_1 and t_2 respectively are _____.

(A) $\frac{\pi}{300}$ s, $\frac{\pi}{75}$ s

(B) $\frac{\pi}{75}$ s, $\frac{\pi}{300}$ s

(C) $\frac{\pi}{300}$ s, $\frac{\pi}{25}$ s

(D) $\frac{\pi}{50}$ s, $\frac{\pi}{100}$ s

Answer: (A) $\frac{\pi}{300}$ s, $\frac{\pi}{75}$ s · Official NTA final key

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Q8 JEE Main 2026 · 28 Jan · Shift 1 Numerical

The displacement of a particle, executing simple harmonic motion with time period T, is expressed as $x\,(t) = A\sin\omega t$, where A is the amplitude. The maximum value of potential energy of this oscillator is found at $t = T/2\beta$. The value of β is _____.

Numerical value type: the answer is a number.

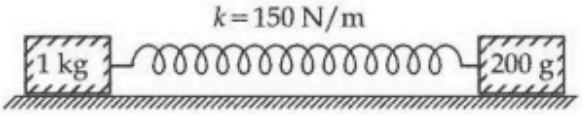
Answer: 2. · Official NTA final key

Q9 JEE Main 2026 · 28 Jan · Shift 2 MCQ

As shown in the figure, a spring is kept in a stretched position with some extension by holding the masses 1 kg and 0.2 kg with a separation more than spring natural length and are released. Assuming the horizontal surface to be frictionless, the angular frequency (in SI unit) of the system is :

(see the figure above)

Q.45 As shown in the figure, a spring is kept in a stretched position with some extension by holding the masses 1 kg and 0.2 kg with a separation more than spring natural length and are released. Assuming the horizontal surface to be frictionless, the angular frequency (in SI unit) of the system is :



Options

1. 27
2. 20
3. 5
4. 30

(A) 27
(B) 20
(C) 5
(D) 30

Answer: (D) 30 · Official NTA final key

Q10 JEE Main 2026 · 24 Jan · Shift 1 MCQ

A spring of force constant 15 N/m is cut into two pieces. If the ratio of their length is 1:3, then the force constant of smaller piece is _____ N/m.

(A) 60
(B) 45
(C) 20
(D) 15

Answer: (A) 60 · Official NTA final key

Q11 JEE Main 2026 · 24 Jan · Shift 1 MCQ

A cylindrical block of mass M and area of cross section A is floating in a liquid of density ρ and with its axis vertical. When depressed a little and released the block starts oscillating. The period of oscillation is _____.

(A) $2\pi\sqrt{\frac{\rho A}{Mg}}$
(B) $\pi\sqrt{\frac{\rho A}{Mg}}$
(C) $2\pi\sqrt{\frac{M}{\rho Ag}}$
(D) $\pi\sqrt{\frac{2M}{\rho Ag}}$

Answer: (C) $2\pi\sqrt{\frac{M}{\rho Ag}}$ · Official NTA final key

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Q12 JEE Main 2026 · 23 Jan · Shift 1 MCQ

A simple pendulum of string length 30 cm performs 20 oscillations in 10 s. The length of the string required for the pendulum to perform 40 oscillations in the same time duration is _____ cm. [Assume that the mass of the pendulum remains same.]

(A) 7.5
(B) 120
(C) 0.75
(D) 15

Answer: (A) 7.5 · Official NTA final key

Q13 JEE Main 2026 · 21 Jan · Shift 2 MCQ

The kinetic energy of a simple harmonic oscillator is oscillating with angular frequency of 176 rad/s. The frequency of this simple harmonic oscillator is _____ Hz. [take $\pi = \frac{22}{7}$]

(A) 28
(B) 176
(C) 14
(D) 88

Answer: (C) 14 · Official NTA final key

Q14 JEE Main 2025 · 8 Apr · Shift 2 MCQ

A block of mass 2 kg is attached to one end of a massless spring whose other end is fixed at a wall. The spring-mass system moves on a frictionless horizontal table. The spring's natural length is 2 m and spring constant is 200 N/m. The block is pushed such that the length of the spring becomes 1 m and then released. At distance $x\,m$ $(x < 2)$ from the wall, the speed of the block will be

(A) $10\left[1-(2-x)^2\right]^{\frac{1}{2}}$ m/s
(B) $10\left[1-(2-x)\right]^{\frac{3}{2}}$ m/s
(C) $10\left[1-(2-x)^2\right]$ m/s
(D) $10\left[1-(2-x)^2\right]^2$ m/s

Answer: (A) $10\left[1-(2-x)^2\right]^{\frac{1}{2}}$ m/s · Key from source paper

Q15 JEE Main 2025 · 4 Apr · Shift 1 MCQ

Two simple pendulums having lengths l_1 and l_2 with negligible string mass undergo angular displacements θ_1 and θ_2, from their mean positions, respectively. If the angular accelerations of both pendulums are same, then which expression is correct?

(A) $\theta_1 l_2^2 = \theta_2 l_1^2$
(B) $\theta_1 l_1^2 = \theta_2 l_2^2$
(C) $\theta_1 l_1 = \theta_2 l_2$
(D) $\theta_1 l_2 = \theta_2 l_1$

Answer: (D) $\theta_1 l_2 = \theta_2 l_1$ · Key from source paper

Q16 JEE Main 2025 · 3 Apr · Shift 1 MCQ

Two blocks of masses m and $M, (M > m)$, are placed on a frictionless table as shown in figure. A massless spring with spring constant k is attached with the lower block. If the system is slightly displaced and released, then (μ = coefficient of friction between the two blocks)

(see the figure above)

A. The time period of small oscillation of the two blocks is $T = 2\pi\sqrt{\frac{(m+M)}{k}}$

B. The acceleration of the blocks is $a = -\frac{kx}{M+m}$ (x = displacement of the blocks from the mean position)

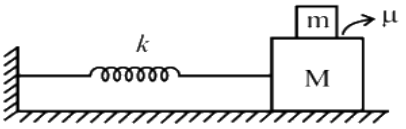
C. The magnitude of the frictional force on the upper block is $\frac{m\mu|x|}{M+m}$

D. The maximum amplitude of the upper block, if it does not slip, is $\frac{\mu(M+m)g}{k}$

E. Maximum frictional force can be $\mu(M+m)g$.

Choose the correct answer from the options given below:

1. Two blocks of masses m and $M, (M > m)$, are placed on a frictionless table as shown in figure. A massless spring with spring constant k is attached with the lower block. If the system is slightly displaced and released, then (μ = coefficient of friction between the two blocks)



A. The time period of small oscillation of the two blocks is $T = 2\pi\sqrt{\frac{(m+M)}{k}}$

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C. The magnitude of the frictional force on the upper block is $\frac{m\mu|x|}{M+m}$

D. The maximum amplitude of the upper block, if it does not slip, is $\frac{\mu(M+m)g}{k}$

E. Maximum frictional force can be $\mu(M+m)g$.

Choose the correct answer from the options given below:

(1) B, C, D Only (2) A, B, D Only (3) C, D, E Only (4) A, B, C Only

(A) B, C, D Only
(B) A, B, D Only
(C) C, D, E Only
(D) A, B, C Only

Answer: (B) A, B, D Only · Key from source paper

Q17 JEE Main 2025 · 2 Apr · Shift 1 MCQ

A particle is subjected to two simple harmonic motions as :

$x_1 = \sqrt{7}\sin 5t cm$ and $x_2 = 2\sqrt{7}\sin\left(5t + \frac{\pi}{3}\right) cm$

where x is displacement and t is time in seconds.

The maximum acceleration of the particle is $x \times 10^{-2} ms^{-2}$. The value of x is :

(A) $5\sqrt{7}$
(B) $25\sqrt{7}$
(C) 175
(D) 125

Answer: (C) 175 · Key from source paper

Q18 JEE Main 2025 · 29 Jan · Shift 1 MCQ

Given below are two statements : one is labelled as Assertion (A) and the other is labelled as Reason (R). Assertion (A) : Time period of a simple pendulum is longer at the top of a mountain than that at the base of the mountain. Reason (R): Time period of a simple pendulum decreases with increasing value of acceleration due to gravity and vice-versa. In the light of the above statements, choose the most appropriate answer from the options given below :

(A) Both (**A**) and (**R**) are true and (**R**) is the correct explanation of (**A**)
(B) (A) is true but (R) is false
(C) (A) is false but (R) is true
(D) Both (**A**) and (**R**) are true but (**R**) is not the correct explanation of (**A**)

Answer: (A) Both (A) and (R) are true and (R) is the correct explanation of (A) · Key from source paper

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Q19 JEE Main 2025 · 29 Jan · Shift 2 MCQ

Two bodies A and B of equal mass are suspended from two massless springs of spring constant k_1 and k_2, respectively. If the bodies oscillate vertically such that their amplitudes are equal, the ratio of the maximum velocity of A to the maximum velocity of B is

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(A) $\frac{k_1}{k_2}$
(B) $\sqrt{\frac{k_1}{k_2}}$
(C) $\sqrt{\frac{k_2}{k_1}}$
(D) $\frac{k_2}{k_1}$

Answer: (B) $\sqrt{\frac{k_1}{k_2}}$ · Key from source paper

Q20 JEE Main 2025 · 28 Jan · Shift 2 MCQ

Given below are two statements. One is labelled as Assertion (A) and the other is labelled as Reason (R). Assertion (A) : Knowing initial position x_0 and initial momentum p_0 is enough to determine the position and momentum at any time t for a simple harmonic motion with a given angular frequency ω . Reason (R): The amplitude and phase can be expressed in terms of x_0 and p_0. In the light of the above statements, choose the correct answer from the options given below :

(A) (A) is false but (R) is true
(B) (A) is true but (R) is false
(C) Both (A) and (R) are true but (R) is NOT the correct explanation of (A)
(D) Both (A) and (R) are true and (R) is the correct explanation of (A)

Answer: (D) Both (A) and (R) are true and (R) is the correct explanation of (A) · Key from source paper

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Q21 JEE Main 2025 · 24 Jan · Shift 1 MCQ

A particle is executing simple harmonic motion with time period 2 s and amplitude 1 cm . If D and d are the total distance and displacement covered by the particle in 12.5 s , then $\frac{D}{d}$ is

(A) $\frac{16}{5}$
(B) 10
(C) $\frac{15}{4}$
(D) 25

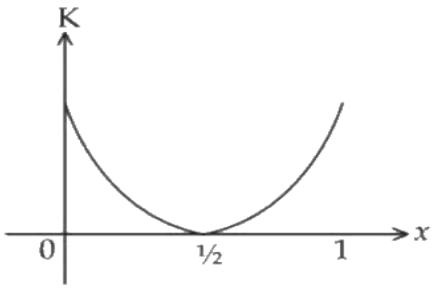
Answer: (D) 25 · Key from source paper

Q22 JEE Main 2025 · 24 Jan · Shift 2 MCQ

A particle oscillates along the x-axis according to the law, $x(t) = x_0 \sin^2\left(\frac{t}{2}\right)$ where $x_0 = 1$ m. The kinetic energy (K) of the particle as a function of x is correctly represented by the graph

Q36. A particle oscillates along the x-axis according to the law, $x(t) = x_0 \sin^2\left(\frac{t}{2}\right)$ where $x_0 = 1$ m. The kinetic energy (K) of the particle as a function of x is correctly represented by the graph

(1)



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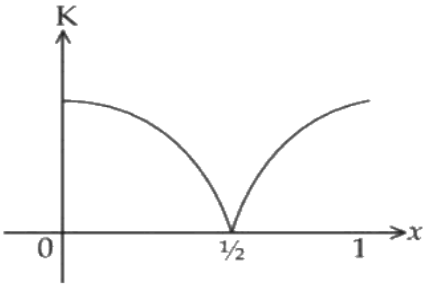

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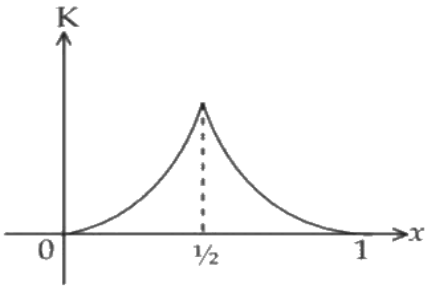

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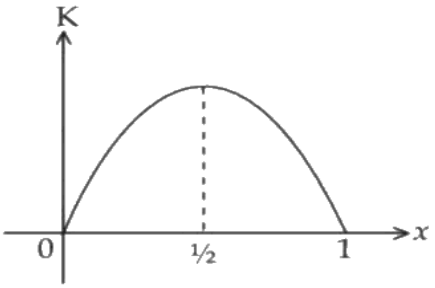


(A) *see figure*
(B) *see figure*
(C) *see figure*
(D) *see figure*

Answer: (D) · Key from source paper

Q23 JEE Main 2025 · 23 Jan · Shift 1 MCQ

A light hollow cube of side length 10 cm and mass 10 g , is floating in water. It is pushed down and released to execute simple harmonic oscillations. The time period of oscillations is $y\pi \times 10^{-2}$ s, where the value of y is (Acceleration due to gravity, $g = 10$ m/s^2, density of water $= 10^3$ kg/m^3)

(A) 6
(B) 2
(C) 4
(D) 1

Answer: (B) 2 · Key from source paper

Q24 JEE Main 2024 · 9 Apr · Shift 1 Numerical

The position, velocity and acceleration of a particle executing simple harmonic motion are found to have magnitudes of 4 m, 2 ms^{-1} and 16 ms^{-2} at a certain instant. The amplitude of the motion is $\sqrt{x}$, m where x is _____

Numerical value type: the answer is a number.

Answer: 17. · Key from source paper

Q25 JEE Main 2024 · 9 Apr · Shift 2 Numerical

A particle of mass 0.50 kg executes simple harmonic motion under force $F = -50\,(\mathrm{Nm}^{-1})\,x$. The time period of oscillation is $\frac{x}{35}$ s. The value of x is _____ (Given $\pi = \frac{22}{7}$)

Numerical value type: the answer is a number.

Answer: 22. · Key from source paper

Q26 JEE Main 2024 · 8 Apr · Shift 2 Numerical

An object of mass 0.2 kg executes simple harmonic motion along x axis with frequency of $\left(\frac{25}{\pi}\right)$Hz. At the position $x = 0.04$ m the object has kinetic energy 0.5 J and potential energy 0.4 J. The amplitude of oscillation is _____ cm.

Numerical value type: the answer is a number.

Answer: 6. · Key from source paper

Q27 JEE Main 2024 · 6 Apr · Shift 1 Numerical

A particle is doing simple harmonic motion of amplitude 0.06 m and time period 3.14 s. The maximum velocity of the particle is _____ cm/s.

Numerical value type: the answer is a number.

Answer: 12. · Key from source paper

Q28 JEE Main 2024 · 5 Apr · Shift 1 MCQ

A simple pendulum doing small oscillations at a place R height above earth surface has time period of T_1 = 4 s. T_2 would be it's time period if it is brought to a point which is at a height 2R from earth surface. Choose the correct relation [R = radius of earth] :

(A) $2\ \mathrm{T}_1 = \mathrm{T}_2$
(B) $2\ \mathrm{T}_1 = 3\ \mathrm{T}_2$
(C) $\mathrm{T}_1 = \mathrm{T}_2$
(D) $3\ \mathrm{T}_1 = 2\ \mathrm{T}_2$

Answer: (D) $3\ \mathrm{T}_1 = 2\ \mathrm{T}_2$ · Key from source paper

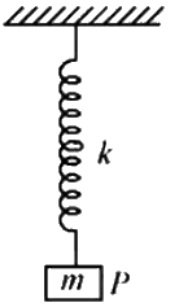
Q29 JEE Main 2024 · 4 Apr · Shift 2 MCQ

In simple harmonic motion, the total mechanical energy of given system is E. If mass of oscillating particle P

(see the figure above)

is doubled then the new energy of the system for same amplitude is:

Q10. In simple harmonic motion, the total mechanical energy of given system is E. If mass of oscillating particle P



is doubled then the new energy of the system for same amplitude is:

(1) E (2) $E/\sqrt{2}$

(3) $2E$ (4) $E\sqrt{2}$

(A) E

(B) $E/\sqrt{2}$

(C) $2E$

(D) $E\sqrt{2}$

Answer: (A) E · Key from source paper

Q30 JEE Main 2024 · 4 Apr · Shift 2 Numerical

The displacement of a particle executing SHM is given by $x = 10\sin\left(wt + \frac{\pi}{3}\right) m$. The time period of motion is 3.14 s. The velocity of the particle at $t = 0$ is _____ m/s.

Numerical value type: the answer is a number.

Answer: 10. · Key from source paper

Q31 JEE Main 2024 · 1 Feb · Shift 2 Numerical

A mass m is suspended from a spring of negligible mass and the system oscillates with a frequency f_1. The frequency of oscillations if a mass $9m$ is suspended from the same spring is f_2. The value of $\frac{f_1}{f_2}$ is _____.

Numerical value type: the answer is a number.

Answer: 3. · Key from source paper

Q32 JEE Main 2024 · 31 Jan · Shift 1 Numerical

A particle performs simple harmonic motion with amplitude A. Its speed is increased to three times at an instant when its displacement is $\frac{2A}{3}$. The new amplitude of motion is $\frac{nA}{3}$. The value of n is _____.

Numerical value type: the answer is a number.

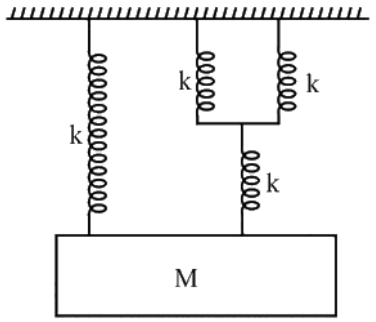
Answer: 7. · Key from source paper

Q33 JEE Main 2024 · 31 Jan · Shift 2 Numerical

The time period of simple harmonic motion of mass M in the given figure is $\pi\sqrt{\frac{\alpha M}{5K}}$, where the value of α is _____.

(see the figure above)

Q24. The time period of simple harmonic motion of mass M in the given figure is $\pi\sqrt{\frac{\alpha M}{5K}}$, where the value of α is _____.



Numerical value type: the answer is a number.

Answer: 12. · Key from source paper

Q34 JEE Main 2024 · 29 Jan · Shift 1 Numerical

When the displacement of a simple harmonic oscillator is one third of its amplitude, the ratio of total energy to the kinetic energy is $\frac{x}{8}$, where $x =$ _____.

Numerical value type: the answer is a number.

Answer: 9. · Key from source paper

Q35 JEE Main 2024 · 29 Jan · Shift 2 Numerical

A simple harmonic oscillator has an amplitude A and time period 6π second. Assuming the oscillation starts from its mean position, the time required by it to travel from $x = A$ to $x = \frac{\sqrt{3}}{2}A$ will be $\frac{\pi}{x}$ s, where $x =$ _____.

Numerical value type: the answer is a number.

Answer: 2. · Key from source paper

Q36 JEE Main 2024 · 27 Jan · Shift 1 Numerical

A particle executes simple harmonic motion with an amplitude of 4 cm. At the mean position, velocity of the particle is 10 cm s^{-1}. The distance of the particle from the mean position when its speed becomes 5 cm s^{-1} is $\sqrt{\alpha}$ cm, where $\alpha =$ _____.

Numerical value type: the answer is a number.

Answer: 12. · Key from source paper

Q37 JEE Main 2023 · 15 Apr · Shift 1 MCQ

In a linear Simple Harmonic Motion (SHM)
(A) Restoring force is directly proportional to the displacement.
(B) The acceleration and displacement are opposite in direction.
(C) The velocity is maximum at mean position.
(D) The acceleration is minimum at extreme points.
Choose the correct answer from the options given below:

(A) (C) and (D) only
(B) (A), (C) and (D) only
(C) (A), (B) and (C) only
(D) (A), (B) and (D) only

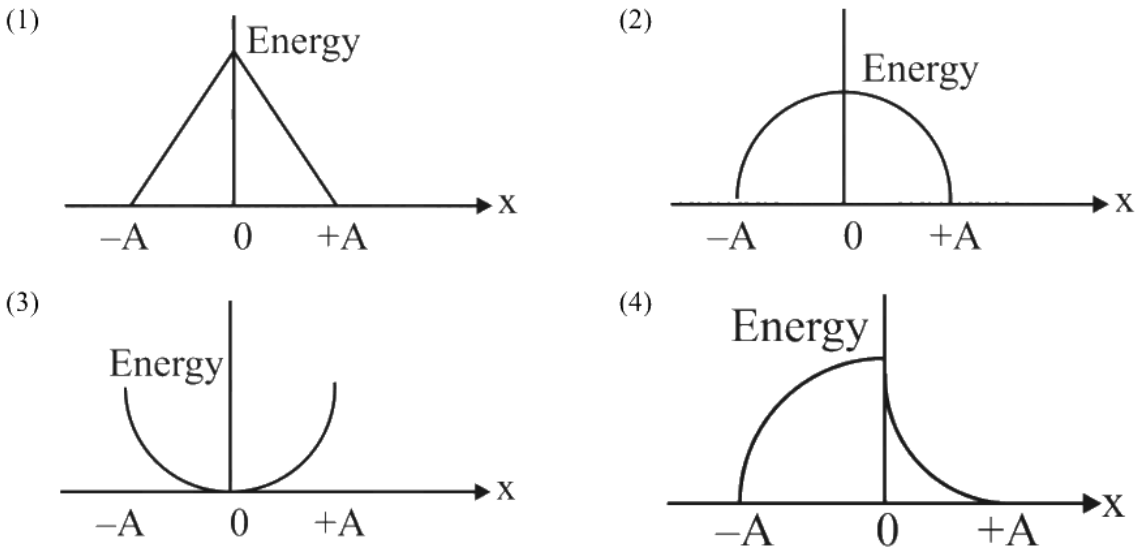
Answer: (C) (A), (B) and (C) only · Key from source paper

Q38 JEE Main 2023 · 13 Apr · Shift 1 MCQ

Which graph represents the difference between total energy and potential energy of a particle executing SHM vs its distance from mean position?

(see the figure above)

Q13. Which graph represents the difference between total energy and potential energy of a particle executing SHM vs its distance from mean position?



(A) (graph drawn, see figure)
(B) (graph drawn, see figure)
(C) (graph drawn, see figure)
(D) (graph drawn, see figure)

Answer: (B) (graph drawn, see figure) · Key from source paper

Q39 JEE Main 2023 · 13 Apr · Shift 1 Numerical

At a given point of time the value of displacement of a simple harmonic oscillator is given as $y = A\cos(30^\circ)$. If amplitude is 40 cm and kinetic energy at that time is 200 J, the value of force constant 1.0×10^x N m^{-1}. The value of x is _____.

Numerical value type: the answer is a number.

Answer: 4. · Key from source paper

Q40 JEE Main 2023 · 13 Apr · Shift 2 MCQ

A particle executes SHM of amplitude A. The distance from the mean position when its kinetic energy becomes equal to its potential energy is:

(A) $\frac{1}{\sqrt{2}}A$
(B) $2A$
(C) $\sqrt{2A}$
(D) $\frac{1}{2}A$

Answer: (A) $\frac{1}{\sqrt{2}}A$ · Key from source paper

Q41 JEE Main 2023 · 12 Apr · Shift 1 MCQ

A particle is executing simple harmonic motion (SHM). The ratio of potential energy and kinetic energy of the particle when its displacement is half of its amplitude will be

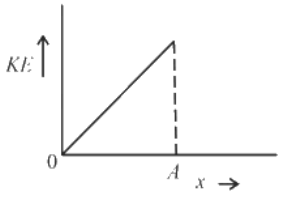
(A) $1:1$
(B) $1:3$
(C) $2:1$
(D) $1:4$

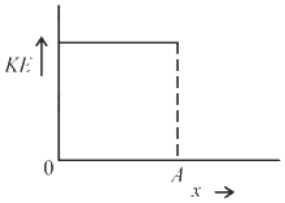
Answer: (B) $1:3$ · Key from source paper

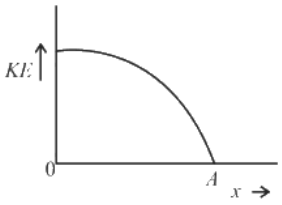
Q42 JEE Main 2023 · 11 Apr · Shift 1 MCQ

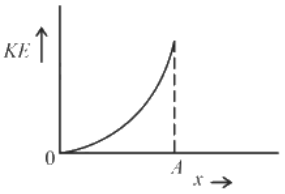
The variation of kinetic energy (KE) of a particle executing simple harmonic motion with the displacement (x) starting from mean position to extreme position (A) is given by

Q9. The variation of kinetic energy (KE) of a particle executing simple harmonic motion with the displacement (x) starting from mean position to extreme position (A) is given by

(1)


(2)


(3)


(4)


(A) *see figure*
(B) *see figure*
(C) *see figure*
(D) *see figure*

Answer: (C) · Key from source paper

Q43 JEE Main 2023 · 10 Apr · Shift 1 MCQ

A particle executes S.H.M. of amplitude A along x-axis. At $t = 0$, the position of the particle is $x = \frac{A}{2}$ and it moves along positive x-axis. The displacement of particle in time t is $x = A\ \sin\omega t + \delta$, then the value δ will be

(A) $\frac{\pi}{2}$
(B) $\frac{\pi}{6}$
(C) $\frac{\pi}{3}$
(D) $\frac{\pi}{4}$

Answer: (B) $\frac{\pi}{6}$ · Key from source paper

Q44 JEE Main 2023 · 10 Apr · Shift 2 MCQ

For a periodic motion represented by the equation $y = \sin\omega t + \cos\omega t$ the amplitude of the motion is

(A) 1
(B) 0.5
(C) 2
(D) $\sqrt{2}$

Answer: (D) $\sqrt{2}$ · Key from source paper

Q45 JEE Main 2023 · 10 Apr · Shift 2 Numerical

A rectangular block of mass 5 kg attached to a horizontal spiral spring executes simple harmonic motion of amplitude 1 m and time period 3.14 s. The maximum force exerted by spring on block is

_____ N.

Numerical value type: the answer is a number.

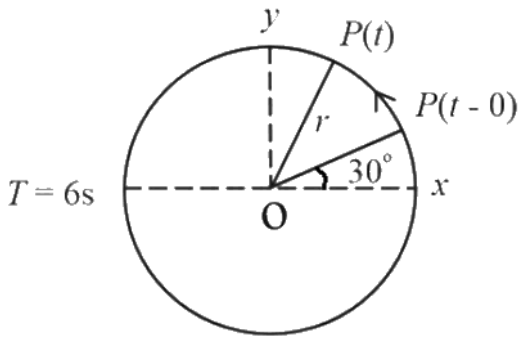
Answer: 20. · Key from source paper

Q46 JEE Main 2023 · 8 Apr · Shift 2 MCQ

For particle P revolving round the centre O with radius of circular path r and regular velocity ω, as shown in below figure, the projection of OP on the x-axis at time t is

(see the figure above)

Q13. For particle P revolving round the centre O with radius of circular path r and regular velocity ω, as shown in below figure, the projection of OP on the x-axis at time t is



(1) $x(t) = r\ \cos\left(\omega t - \frac{\pi}{6}\right)$
(2) $x(t) = r\ \cos\left(\omega t + \frac{\pi}{6}\right)$
(3) $x(t) = r\ \sin\left(\omega t + \frac{\pi}{6}\right)$
(4) $x(t) = r\ \cos(\omega t)$

(A) $x(t) = r\cos\left(\omega t - \frac{\pi}{6}\right)$
(B) $x(t) = r\cos\left(\omega t + \frac{\pi}{6}\right)$
(C) $x(t) = r\sin\left(\omega t + \frac{\pi}{6}\right)$
(D) $x(t) = r\cos(\omega t)$

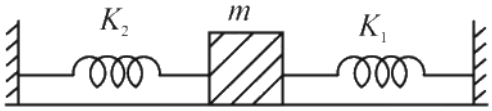
Answer: (B) $x(t) = r\cos\left(\omega t + \frac{\pi}{6}\right)$ · Key from source paper

Q47 JEE Main 2023 · 6 Apr · Shift 1 MCQ

A mass m is attached to two springs as shown in figure. The spring constants of two springs are K_1 and K_2. For the frictionless surface, the time period of oscillation of mass m is

(see the figure above)

Q4. A mass m is attached to two springs as shown in figure. The spring constants of two springs are K_1 and K_2. For the frictionless surface, the time period of oscillation of mass m is



(1) $2\pi\sqrt{\frac{m}{K_1+K_2}}$

(2) $\frac{1}{2\pi}\sqrt{\frac{K_1-K_2}{m}}$

(3) $2\pi\sqrt{\frac{m}{K_1-K_2}}$

(4) $\frac{1}{2\pi}\sqrt{\frac{K_1+K_2}{m}}$

(A) $2\pi\sqrt{\frac{m}{K_1+K_2}}$

(B) $\frac{1}{2\pi}\sqrt{\frac{K_1-K_2}{m}}$

(C) $2\pi\sqrt{\frac{m}{K_1-K_2}}$

(D) $\frac{1}{2\pi}\sqrt{\frac{K_1+K_2}{m}}$

Answer: (A) $2\pi\sqrt{\frac{m}{K_1+K_2}}$ · Key from source paper

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Q48 JEE Main 2023 · 6 Apr · Shift 2 Numerical

A simple pendulum with length $100\ \text{cm}$ and bob of mass $250\ \text{g}$ is executing S.H.M of amplitude $10\ \text{cm}$. The maximum tension in the string is found to be $\frac{x}{40}$ N. The value of x is _____ .

Numerical value type: the answer is a number.

Accepted answers: 99 or 101. · Key from source paper

Q49 JEE Main 2023 · 1 Feb · Shift 1 Numerical

The amplitude of a particle executing SHM is 3 cm. The displacement at which its kinetic energy will be 25% more than the potential energy is: _____ cm.

Numerical value type: the answer is a number.

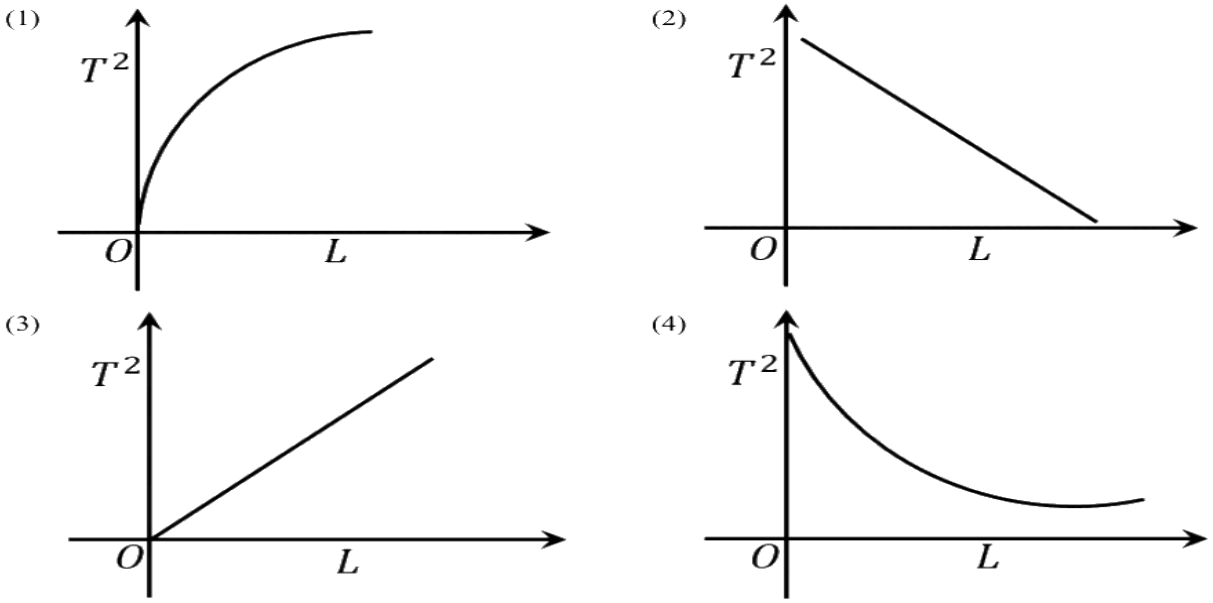
Answer: 2. · Key from source paper

Q50 JEE Main 2023 · 1 Feb · Shift 2 MCQ

Choose the correct length (L) versus square of time period (T^2) graph for a simple pendulum executing simple harmonic motion.

(see the figure above)

Q14. Choose the correct length (L) versus square of time period (T_2)) graph for a simple pendulum executing simple harmonic motion.



(A) (graph 1, see figure)
(B) (graph 2, see figure)
(C) (graph 3, see figure)
(D) (graph 4, see figure)

Answer: (C) (graph 3, see figure) · Key from source paper

Q51 JEE Main 2023 · 31 Jan · Shift 1 MCQ

The maximum potential energy of a block executing simple harmonic motion is 25 J. A is amplitude of oscillation. At $\frac{A}{2}$, the kinetic energy of the block is

(A) 37.5 J
(B) 9.75 J
(C) 18.75 J
(D) 12.5 J

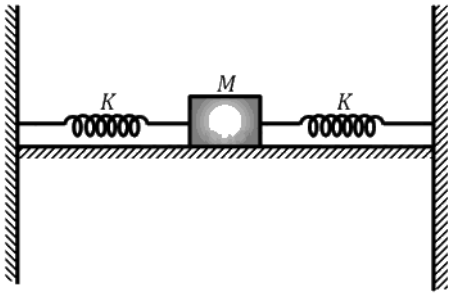
Answer: (C) 18.75 J · Key from source paper

Q52 JEE Main 2023 · 31 Jan · Shift 1 Numerical

In the figure given below. a block of mass M = 490 g placed on a frictionless table is connected with two springs having same spring constant (K = 2 N m^{-1}). If the block is horizontally displaced through X m then the number of complete oscillations it will make in 14π seconds will be _____.

(see the figure above)

Q25. In the figure given below. a block of mass $M = 490$ g placed on a frictionless table is connected with two springs having same spring constant ($K = 2$ N m^{-1}). If the block is horizontally displaced through X m then the number of complete oscillations it will make in 14π seconds will be _____.



Numerical value type: the answer is a number.

Answer: 20. · Key from source paper

Q53 JEE Main 2023 · 30 Jan · Shift 1 Numerical

The general displacement of a simple harmonic oscillator is $x = A \sin \omega t$. Let T be its time period. The slope of its potential energy (U) – time (t) curve will be maximum when $t = \frac{T}{\beta}$. The value of β is _____.

Numerical value type: the answer is a number.

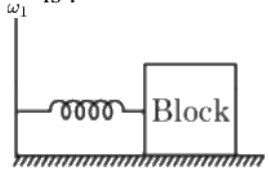
Answer: 8. · Key from source paper

Q54 JEE Main 2023 · 30 Jan · Shift 2 MCQ

For a simple harmonic motion in a mass spring system shown, the surface is frictionless. When the mass of the block is 1 kg, the angular frequency is ω_1. When the mass block is 2 kg the angular frequency is ω_2. The ratio $\frac{\omega_2}{\omega_1}$ is :

(see the figure above)

Q13. For a simple harmonic motion in a mass spring system shown, the surface is frictionless. When the mass of the block is 1 kg, the angular frequency is ω_1. When the mass block is 2 kg the angular frequency is ω_2. The ratio $\frac{\omega_2}{\omega_1}$ is :



(1) $\sqrt{2}$
(2) $\frac{1}{\sqrt{2}}$
(3) 2
(4) $\frac{1}{2}$

(A) $\sqrt{2}$
(B) $\frac{1}{\sqrt{2}}$
(C) 2
(D) $\frac{1}{2}$

Answer: (B) $\frac{1}{\sqrt{2}}$ · Key from source paper

Q55 JEE Main 2023 · 30 Jan · Shift 2 Numerical

The velocity of a particle executing SHM varies with displacement (x) as $4v^2 = 50 - x^2$. The time period of oscillations is $\frac{\pi}{7}$ s. The value of x is _____.
[Take $\pi = \frac{22}{7}$]

Numerical value type: the answer is a number.

Answer: 88. · Key from source paper

Q56 JEE Main 2023 · 29 Jan · Shift 2 Numerical

A particle of mass 250 g executes a simple harmonic motion under a periodic force $F = (-25x)$ N. The particle attains a maximum speed of $4\ \mathrm{m\,s^{-1}}$ during its oscillation. The amplitude of the motion is _____ cm.

Numerical value type: the answer is a number.

Answer: 40. · Key from source paper

Q57 JEE Main 2023 · 25 Jan · Shift 1 MCQ

T is the time period of simple pendulum on the earth's surface. Its time period becomes xT when taken to a height R (equal to earth's radius) above the earth's surface. Then, the value of x will be:

(A) 4
(B) 2
(C) $\frac{1}{2}$
(D) $\frac{1}{4}$

Answer: (B) 2 · Key from source paper

Q58 JEE Main 2023 · 25 Jan · Shift 2 MCQ

A particle executes simple harmonic motion between $x = -A$ and $x = +A$. If time taken by particle to go from $x = 0$ to $\frac{A}{2}$ is 2 s; then time taken by particle in going from $x = \frac{A}{2}$ to A is:

(A) 3 s
(B) 2 s
(C) 1.5 s
(D) 4 s

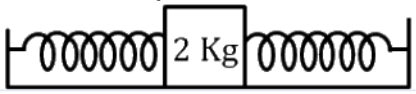
Answer: (D) 4 s · Key from source paper

Q59 JEE Main 2023 · 24 Jan · Shift 1 Numerical

A block of mass 2 kg is attached with two identical springs of spring constant $20\ \mathrm{N\,m^{-1}}$ each. The block is placed on a frictionless surface and the ends of the springs are attached to rigid supports (see figure). When the mass is displaced from its equilibrium position, it executes a simple harmonic motion. The time period of oscillation is $\frac{\pi}{\sqrt{X}}$ in SI unit. The value of X is _____.

(see the figure above)

Q25. A block of mass 2 kg is attached with two identical springs of spring constant 20 N m^{-1} each. The block is placed on a frictionless surface and the ends of the springs are attached to rigid supports (see figure). When the mass is displaced from its equilibrium position, it executes a simple harmonic motion. The time period of oscillation is $\frac{\pi}{\sqrt{X}}$ in SI unit. The value of X is_____.



Numerical value type: the answer is a number.

Answer: 5. · Key from source paper

Q60 JEE Main 2023 · 24 Jan · Shift 2 MCQ

Given below are two statements: one is labelled as **Assertion A** and the other is labelled as **Reason R**

Assertion A: A pendulum clock when taken to Mount Everest becomes fast.

Reason R: The value of g (acceleration due to gravity) is less at Mount Everest than its value on the surface of earth.

In the light of the above statements, choose the most appropriate answer from the options given below

(A) Both A and R are correct and R is the correct explanation of A
(B) Both A and R are correct but R is not the correct explanation of A
(C) A is correct but R is not correct
(D) A is not correct but R is correct

Answer: (D) A is not correct but R is correct · Key from source paper

Q61 JEE Main 2023 · 24 Jan · Shift 2 Numerical

A mass m attached to free end of a spring executes SHM with a period of 1 s. If the mass is increased by 3 kg the period of oscillation increases by one second, the value of mass m is _____ kg.

Numerical value type: the answer is a number.

Answer: 1. · Key from source paper

Q62 JEE Main 2022 · 29 Jul · Shift 1 MCQ

The time period of oscillation of a simple pendulum of length L suspended from the roof of a vehicle which moves without friction down an inclined plane of inclination α, is given by :

(A) $2\pi\sqrt{\frac{L}{g\cos\alpha}}$

(B) $2\pi\sqrt{\frac{L}{g\sin\alpha}}$

(C) $2\pi\sqrt{\frac{L}{g}}$

(D) $2\pi\sqrt{\frac{L}{g\tan\alpha}}$

Answer: (A) $2\pi\sqrt{\frac{L}{g\cos\alpha}}$ · Key from source paper

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Q63 JEE Main 2022 · 29 Jul · Shift 2 Numerical

The metallic bob of simple pendulum has the relative density 5. The time period of this pendulum is 10 s. If the metallic bob is immersed in water, then the new time period becomes $5\sqrt{x}$ s. The value of x will be _____.

Numerical value type: the answer is a number.

Answer: 5. · Key from source paper

Q64 JEE Main 2022 · 28 Jul · Shift 2 Numerical

The potential energy of a particle of mass $4\ \text{kg}$ in motion along the x-axis is given by $U = 4(1 - \cos 4x)$ J. The time period of the particle for small oscillation $(\sin\theta \simeq \theta)$ $\left(\frac{\pi}{K}\right)$ s. The value of K is _____.

Numerical value type: the answer is a number.

Answer: 2. · Key from source paper

Q65 JEE Main 2022 · 27 Jul · Shift 1 Numerical

A mass 0.9 kg, attached to a horizontal spring, executes SHM with an amplitude A_1. When this mass passes through its mean position, then a smaller mass of 124 g is placed over it and both masses move together with amplitude A_2. If the ratio $\frac{A_1}{A_2}$ is $\frac{\alpha}{\alpha-1}$, then the value of α will be _____ .

Numerical value type: the answer is a number.

Answer: 16. · Key from source paper

Q66 JEE Main 2022 · 26 Jul · Shift 1 MCQ

When a particle executes simple Harmonic motion, the nature of graph of velocity as function of displacement will be

(A) Circular
(B) Ellipitical
(C) Sinusoidal
(D) Straight line

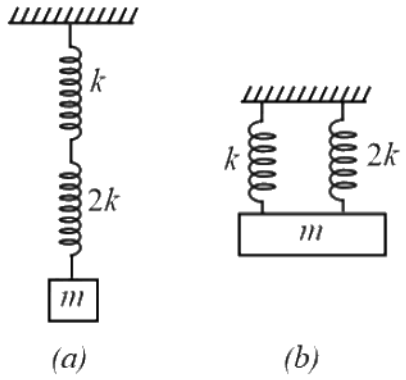
Answer: (B) Ellipitical · Key from source paper

Q67 JEE Main 2022 · 26 Jul · Shift 2 Numerical

As per given figures, two springs of spring constants K and $2\ \mathrm{K}$ are connected to mass m. If the period of oscillation in figure (a) is 3 s, then the period of oscillation in figure (b) will be $\sqrt{x}$ s. The value of x is _____ .

(see the figure above)

Q24. As per given figures, two springs of spring constants K and $2\ \mathrm{K}$ are connected to mass m. If the period of oscillation in figure (a) is 3 s, then the period of oscillation in figure (b) will be $\sqrt{x}$ s. The value of x is _____ .



Numerical value type: the answer is a number.

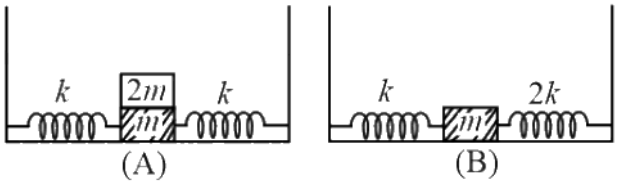
Answer: 2. · Key from source paper

Q68 JEE Main 2022 · 25 Jul · Shift 1 MCQ

In figure (A), mass $2m$ is fixed on mass m which is attached to two springs of spring constant k. In figure (B), mass m is attached to two spring of spring constant k and $2k$. If mass m in (A) and (B) are displaced by distance x horizontally and then released, then time period T_1 and T_2 corresponding to (A) and (B) respectively follow the relation.

(see the figure above)

Q9. In figure (A), mass $2m$ is fixed on mass m which is attached to two springs of spring constant k. In figure (B), mass m is attached to two spring of spring constant k and $2k$. If mass m in (A) and (B) are displaced by distance x horizontally and then released, then time period T_1 and T_2 corresponding to (A) and (B) respectively follow the relation.



(1) $\frac{T_1}{T_2} = \frac{3}{\sqrt{2}}$

(2) $\frac{T_1}{T_2} = \sqrt{\frac{3}{2}}$

(3) $\frac{T_1}{T_2} = \sqrt{\frac{2}{3}}$

(4) $\frac{T_1}{T_2} = \frac{\sqrt{2}}{3}$

(A) $\frac{T_1}{T_2} = \frac{3}{\sqrt{2}}$

(B) $\frac{T_1}{T_2} = \sqrt{\frac{3}{2}}$

(C) $\frac{T_1}{T_2} = \sqrt{\frac{2}{3}}$

(D) $\frac{T_1}{T_2} = \frac{\sqrt{2}}{3}$

Answer: (A) $\frac{T_1}{T_2} = \frac{3}{\sqrt{2}}$ · Key from source paper

Q69 JEE Main 2022 · 29 Jun · Shift 1 Numerical

A body is performing simple harmonic with an amplitude of $10\ \text{cm}$. The velocity of the body was tripled by air Jet when it is at $5\ \text{cm}$ from its mean position. The new amplitude of vibration is $\sqrt{x}\ \text{cm}$. The value of x is _____.

Numerical value type: the answer is a number.

Answer: 700. · Key from source paper

Q70 JEE Main 2022 · 29 Jun · Shift 2 MCQ

The motion of a simple pendulum executing S.H.M. is represented by the following equation $y = A\sin(\pi t + \phi)$, where time is measured in second. The length of pendulum is

(A) $97.23\ \text{cm}$

(B) $25.3\ \text{cm}$

(C) $99.4\ \text{cm}$

(D) $406.1\ \text{cm}$

Answer: (C) $99.4\ \text{cm}$ · Key from source paper

Q71 JEE Main 2022 · 28 Jun · Shift 1 MCQ

Motion of a particle in $x - y$ plane is described by a set of following equations $x = 4\sin\left(\frac{\pi}{2} - \omega t\right)\ \text{m}$ and $y = 4\sin(\omega t)\ \text{m}$. The path of the particle will be

(A) circular
(B) helical
(C) parabolic
(D) eliptical

Answer: (A) circular · Key from source paper

Q72 JEE Main 2022 · 27 Jun · Shift 1 MCQ

The displacement of simple harmonic oscillator after 3 seconds starting from its mean position is equal to half of its amplitude. The time period of harmonic motion is

(A) 12 s
(B) 8 s
(C) 36 s
(D) 6 s

Answer: (C) 36 s · Key from source paper

Q73 JEE Main 2022 · 27 Jun · Shift 2 MCQ

The equation of a particle executing simple harmonic motion is given by $x = \sin \pi \left(t + \frac{1}{3}\right)$ m. At $t = 1$ s, the speed of particle will be (Given: $\pi = 3.14$)

(A) 157 cm s^{-1}
(B) 0 cm s^{-1}
(C) 272 cm s^{-1}
(D) 314 cm s^{-1}

Answer: (A) 157 cm s^{-1} · Key from source paper

Q74 JEE Main 2022 · 27 Jun · Shift 2 Numerical

A particle executes simple harmonic motion. Its amplitude is 8 cm and time period is 6 s. The time it will take to travel from its position of maximum displacement to the point corresponding to half of its amplitude, is _____ s

Numerical value type: the answer is a number.

Answer: 1. · Key from source paper

Q75 JEE Main 2022 · 26 Jun · Shift 1 MCQ

Time period of a simple pendulum in a stationary lift is T. If the lift accelerates with $\frac{g}{6}$ vertically upwards then the time period will be
(Where g = acceleration due to gravity)

(A) $\sqrt{\frac{6}{5}}T$

(B) $\sqrt{\frac{5}{6}}T$

(C) $\sqrt{\frac{6}{7}}T$

(D) $\sqrt{\frac{7}{6}}T$

Answer: (C) $\sqrt{\frac{6}{7}}T$ · Key from source paper

Q76 JEE Main 2022 · 24 Jun · Shift 2 MCQ

Two massless springs with spring constants $2k$ and $9k$, carry 50 g and 100 g masses at their free ends. These two masses oscillate vertically such that their maximum velocities are equal. Then, the ratio of their respective amplitudes will be :

(A) $3:2$

(B) $1:2$

(C) $3:1$

(D) $2:3$

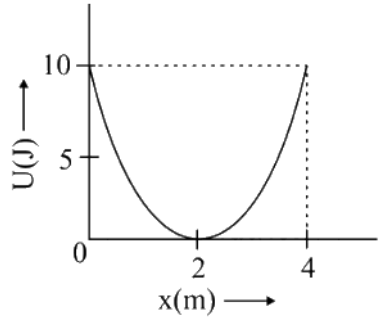
Answer: (A) $3:2$ · Key from source paper

Q77 JEE Main 2021 · 1 Sep · Shift 2 MCQ

A mass of 5 kg is connected to a spring. The potential energy curve of the simple harmonic motion executed by the system is shown in the figure. A simple pendulum of length 4 m has the same period of oscillation as the spring system. What is the value of acceleration due to gravity on the planet where these experiments are performed ?

(see the figure above)

Q10. A mass of 5 kg is connected to a spring. The potential energy curve of the simple harmonic motion executed by the system is shown in the figure. A simple pendulum of length 4 m has the same period of oscillation as the spring system. What is the value of acceleration due to gravity on the planet where these experiments are performed ?



(1) 4 m s^{-2}

(2) 8 m s^{-2}

(3) 5 m s^{-2}

(4) 10 m s^{-2}

(A) 4 m s^{-2}
(B) 8 m s^{-2}
(C) 5 m s^{-2}
(D) 10 m s^{-2}

Answer: (A) 4 m s^{-2} · Key from source paper

Q78 JEE Main 2021 · 31 Aug · Shift 1 Numerical

A particle of mass 1 kg is hanging from a spring of force constant 100 N m^{-1}. The mass is pulled slightly downward and released so that it executes free simple harmonic motion with time period T. The time when the kinetic energy and potential energy of the system will become equal, is $\frac{T}{n}$. The value of n is _____.

Numerical value type: the answer is a number.

Answer: 8. · Key from source paper

Q79 JEE Main 2021 · 31 Aug · Shift 2 MCQ

A bob of mass m suspended by a thread of length ℓ undergoes simple harmonic oscillations with time period T. If the bob is immersed in a liquid that has density $\frac{1}{4}$ times that of the bob and the length of the thread is increased by $\frac{1}{3}^{rd}$ of the original length, then the time period of the simple harmonic oscillations will be:

(A) $\frac{3}{4}T$
(B) $\frac{4}{3}T$
(C) T
(D) $\frac{3}{2}T$

Answer: (B) $\frac{4}{3}T$ · Key from source paper

Q80 JEE Main 2021 · 31 Aug · Shift 2 MCQ

For a body executing S.H.M. :
(a) Potential energy is always equal to its $K.E$.
(b) Average potential and kinetic energy over any given time interval are always equal.
(c) Sum of the kinetic and potential energy at any point of time is constant.
(d) Average $K.E$. in one time period is equal to average potential energy in one time period.
Choose the most appropriate option from the options given below :

(A) (c) and (d)
(B) only (c)
(C) only (b)
(D) (b) and (c)

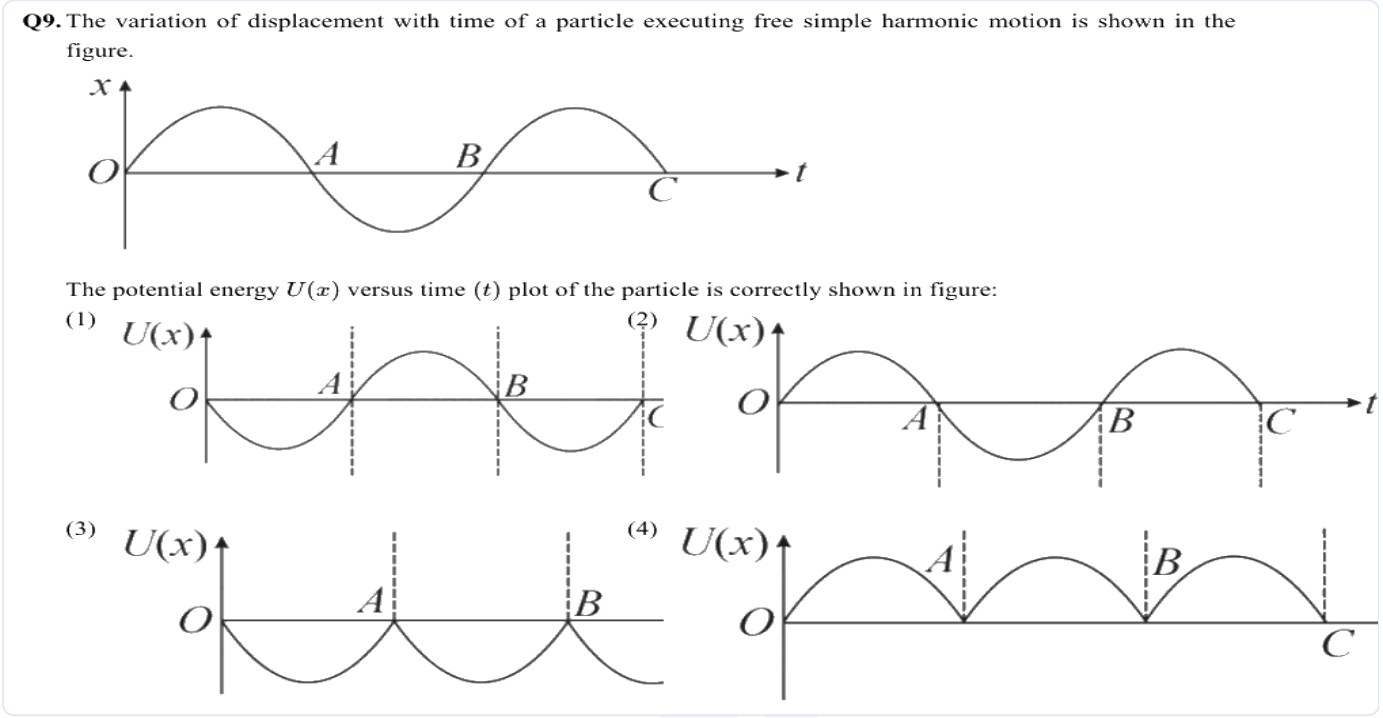
Answer: (A) (c) and (d) · Key from source paper

Q81 JEE Main 2021 · 27 Aug · Shift 1 MCQ

The variation of displacement with time of a particle executing free simple harmonic motion is shown in the figure.

(see the figure above)

The potential energy $U(x)$ versus time (t) plot of the particle is correctly shown in figure:



(A) *see figure*

(B) *see figure*

(C) *see figure*

(D) *see figure*

Answer: (D) · Key from source paper

Q82 JEE Main 2021 · 27 Aug · Shift 2 Numerical

Two simple harmonic motion, are represented by the equations

$y_1 = 10\sin\left(3\pi t + \frac{\pi}{3}\right)$; $y_2 = 5\left(\sin 3\pi t + \sqrt{3}\cos 3\pi t\right)$

Ratio of amplitude of y_1 to $y_2 = x : 1$. The value of x is

Numerical value type: the answer is a number.

Answer: 1. · Key from source paper

Q83 JEE Main 2021 · 26 Aug · Shift 2 MCQ

If the length of the pendulum in pendulum clock increases by 0.1%, then the error in time per day is:

(A) $43.2\ \text{s}$
(B) $8.64\ \text{s}$
(C) $86.4\ \text{s}$
(D) $4.32\ \text{s}$

Answer: (A) $43.2\ \text{s}$ · Key from source paper

Q84 JEE Main 2021 · 26 Aug · Shift 2 Numerical

Two simple harmonic motions are represented by the equations $x_1 = 5\sin\left(2\pi t + \frac{\pi}{4}\right)$ and $x_2 = 5\sqrt{2}\,(\sin 2\pi t + \cos 2\pi t)$. The amplitude of the second motion is _____ times the amplitude in the first motion.

Numerical value type: the answer is a number.

Answer: 2. · Key from source paper

Q85 JEE Main 2021 · 27 Jul · Shift 1 MCQ

A particle starts executing simple harmonic motion (SHM) of amplitude a and total energy E. At any instant, its kinetic energy is $\frac{3E}{4}$, then its displacement y is given by:

(A) $y = a$
(B) $y = \frac{a}{\sqrt{2}}$
(C) $y = \frac{a\sqrt{3}}{2}$
(D) $y = \frac{a}{2}$

Answer: (D) $y = \frac{a}{2}$ · Key from source paper

Q86 JEE Main 2021 · 27 Jul · Shift 2 MCQ

An object of mass $0.5\ \text{kg}$ is executing simple harmonic motion. It amplitude is $5\ \text{cm}$ and time period (T) is $0.2\ \text{s}$. What will be the potential energy of the object at an instant $\text{t} = \frac{T}{4}\ \text{s}$ starting from mean position. Assume that the initial phase of the oscillation is zero.

(A) $0.62\ \text{J}$
(B) $6.2 \times 10^{-3}\ \text{J}$
(C) $1.2 \times 10^{3}\ \text{J}$
(D) $6.2 \times 10^{3}\ \text{J}$

Answer: (A) $0.62\ \text{J}$ · Key from source paper

Q87 JEE Main 2021 · 27 Jul · Shift 2 Numerical

A particle executes simple harmonic motion represented by displacement function as $x(t) = A\sin(\omega t + \phi)$. If the position and velocity of the particle at $t = 0\ \text{s}$ are $2\ \text{cm}$ and $2\omega\ \text{cm s}^{-1}$ respectively, then its amplitude is $x\sqrt{2}\ \text{cm}$ where the value of x is

Numerical value type: the answer is a number.

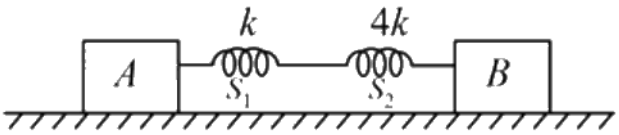
Answer: 2. · Key from source paper

Q88 JEE Main 2021 · 25 Jul · Shift 1 Numerical

In the reported figure, two bodies A and B of masses $200\ \text{g}$ and $800\ \text{g}$ are attached with the system of springs. Springs are kept in a stretched position with some extension when the system is released. The horizontal surface is assumed to be frictionless. The angular frequency will be _____ rad s^{-1} when $k = 20\ \text{N m}^{-1}$.

(see the figure above)

Q23. In the reported figure, two bodies A and B of masses 200 g and 800 g are attached with the system of springs. Springs are kept in a stretched position with some extension when the system is released. The horizontal surface is assumed to be frictionless. The angular frequency will be _____ rad s^{-1} when $k = 20$ N m^{-1}.



Numerical value type: the answer is a number.

Answer: 10. · Key from source paper

Q89 JEE Main 2021 · 25 Jul · Shift 2 MCQ

In a simple harmonic oscillation, what fraction of total mechanical energy is in the form of kinetic energy, when the particle is midway between mean and extreme position.

(A) $\frac{1}{2}$
(B) $\frac{3}{4}$
(C) $\frac{1}{3}$
(D) $\frac{1}{4}$

Answer: (B) $\frac{3}{4}$ · Key from source paper

Q90 JEE Main 2021 · 22 Jul · Shift 1 MCQ

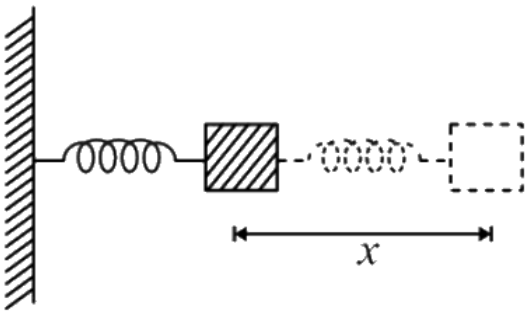
The motion of a mass on a spring, with spring constant K is as shown in figure.

(see the figure above)

The equation of motion is given by, $x(t) = A\sin\omega t + B\cos\omega t$ with $\omega = \sqrt{\frac{K}{m}}$.

Suppose that at time $t = 0$, the position of mass is $x(0)$ and velocity $v(0)$, then its displacement can also be represented as $x(t) = C\cos(\omega t - \phi)$, where C and ϕ are

Q3. The motion of a mass on a spring, with spring constant K is as shown in figure.



The equation of motion is given by, $x(t) = A\sin\omega t + B\cos\omega t$ with $\omega = \sqrt{\frac{K}{m}}$.

Suppose that at time $t = 0$, the position of mass is $x(0)$ and velocity $v(0)$, then its displacement can also be represented as $x(t) = C\cos(\omega t - \phi)$, where C and ϕ are

(1) $C = \sqrt{\frac{2v(0)^2}{\omega^2} + x(0)^2}$, $\phi = \tan^{-1}\left(\frac{v(0)}{x(0)\omega}\right)$

(2) $C = \sqrt{\frac{2v(0)^2}{\omega^2} + x(0)^2}$, $\phi = \tan^{-1}\left(\frac{x(0)\omega}{2v(0)}\right)$

(3) $C = \sqrt{\frac{v(0)^2}{\omega^2} + x(0)^2}$, $\phi = \tan^{-1}\left(\frac{x(0)\omega}{v(0)}\right)$

(4) $C = \sqrt{\frac{v(0)^2}{\omega^2} + x(0)^2}$, $\phi = \tan^{-1}\left(\frac{v(0)}{x(0)\omega}\right)$

(A) $C = \sqrt{\frac{2v(0)^2}{\omega^2} + x(0)^2}$, $\phi = \tan^{-1}\left(\frac{v(0)}{x(0)\omega}\right)$

(B) $C = \sqrt{\frac{2v(0)^2}{\omega^2} + x(0)^2}$, $\phi = \tan^{-1}\left(\frac{x(0)\omega}{2v(0)}\right)$

(C) $C = \sqrt{\frac{v(0)^2}{\omega^2} + x(0)^2}$, $\phi = \tan^{-1}\left(\frac{x(0)\omega}{v(0)}\right)$

(D) $C = \sqrt{\frac{v(0)^2}{\omega^2} + x(0)^2}$, $\phi = \tan^{-1}\left(\frac{v(0)}{x(0)\omega}\right)$

Answer: (D) $C = \sqrt{\frac{v(0)^2}{\omega^2} + x(0)^2}$, $\phi = \tan^{-1}\left(\frac{v(0)}{x(0)\omega}\right)$ · Key from source paper

Q91 JEE Main 2021 · 22 Jul · Shift 1 MCQ

T_0 is the time period of a simple pendulum at a place. If the length of the pendulum is reduced to $\frac{1}{16}$ times of its initial value, the modified time period is

(A) T_0

(B) $8\pi T_0$

(C) $4T_0$

(D) $\frac{1}{4}T_0$

Answer: (D) $\frac{1}{4}T_0$ · Key from source paper

Q92 JEE Main 2021 · 20 Jul · Shift 2 MCQ

A particle is making simple harmonic motion along the X-axis. If at a distances x_1 and x_2 from the mean position the velocities of the particle are v_1 and v_2, respectively. The time period of its oscillation is given as:

(A) $T = 2\pi\sqrt{\frac{x_2^2+x_1^2}{v_1^2-v_2^2}}$

(B) $T = 2\pi\sqrt{\frac{x_2^2+x_1^2}{v_1^2+v_2^2}}$

(C) $T = 2\pi\sqrt{\frac{x_2^2-x_1^2}{v_1^2+v_2^2}}$

(D) $T = 2\pi\sqrt{\frac{x_2^2-x_1^2}{v_1^2-v_2^2}}$

Answer: (D) $T = 2\pi\sqrt{\frac{x_2^2-x_1^2}{v_1^2-v_2^2}}$ · Key from source paper

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Q93 JEE Main 2021 · 18 Mar · Shift 1 · Numerical

A particle performs simple harmonic motion with a period of 2 second. The time taken by the particle to cover a displacement equal to half of its amplitude from the mean position is $\frac{1}{a}$ s. The value of a to the nearest integer is

Numerical value type: the answer is a number.

Answer: 6. · Key from source paper

Q94 JEE Main 2021 · 18 Mar · Shift 2 · MCQ

The function of time representing a simple harmonic motion with a period of $\frac{\pi}{\omega}$ is :

(A) $\sin(\omega t) + \cos(\omega t)$

(B) $\cos(\omega t) + \cos(2\omega t) + \cos(3\omega t)$

(C) $\sin^2(\omega t)$

(D) $3\cos\left(\frac{\pi}{4} - 2\omega t\right)$

Options (4) or (3) were accepted. More than one answer was accepted. · Key from source paper

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Q95 JEE Main 2021 · 17 Mar · Shift 1 · MCQ

For what value of displacement the kinetic energy and potential energy of a simple harmonic oscillation become equal?

(A) $x = 0$

(B) $x = \pm A$

(C) $x = \pm\frac{A}{\sqrt{2}}$

(D) $x = \frac{A}{2}$

Answer: (C) $x = \pm\frac{A}{\sqrt{2}}$ · Key from source paper

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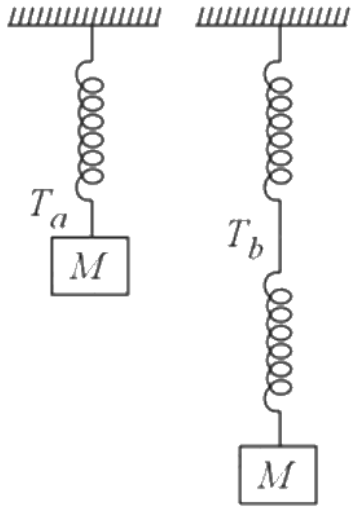
Q96 JEE Main 2021 · 17 Mar · Shift 1 · Numerical

Consider two identical springs each of spring constant k and negligible mass compared to the mass M as shown. Fig. 1 shows one of them and Fig. 2 shows their series combination. The ratios of time period of oscillation of the two SHM is $\frac{T_b}{T_a} = \sqrt{x}$, where value of x is _____. (Round off to the Nearest Integer)

(see the figure above)

Q25. Consider two identical springs each of spring constant k and negligible mass compared to the mass M as shown. Fig. 1 shows one of them and Fig. 2 shows their series combination. The ratios of time period of oscillation of the two SHM is $\frac{T_b}{T_a} = \sqrt{x}$, where value of x is _____.

(Round off to the Nearest Integer)



Numerical value type: the answer is a number.

Answer: 2. · Key from source paper

Q97 JEE Main 2021 · 17 Mar · Shift 2 MCQ

A block of mass $1\ \text{kg}$ attached to a spring is made to oscillate with an initial amplitude of $12\ \text{cm}$. After 2 minutes the amplitude decreases to $6\ \text{cm}$. Determine the value of the damping constant for this motion. (take $\ln 2 = 0.693$)

(A) $1.16 \times 10^{-2}\ \text{kg s}^{-1}$

(B) $3.3 \times 10^{2}\ \text{kg s}^{-1}$

(C) $1.16 \times 10^{2}\ \text{kg s}^{-1}$

(D) $5.7 \times 10^{-3}\ \text{kg s}^{-1}$

Answer: (A) $1.16 \times 10^{-2}\ \text{kg s}^{-1}$ · Key from source paper

Q98 JEE Main 2021 · 17 Mar · Shift 2 MCQ

Two particles A and B of equal masses are suspended from two massless springs of spring constants K_1 and K_2 respectively.If the maximum velocities during oscillations are equal, the ratio of the amplitude of A and B is

(A) $\frac{K_2}{K_1}$

(B) $\frac{K_1}{K_2}$

(C) $\sqrt{\frac{K_1}{K_2}}$

(D) $\sqrt{\frac{K_2}{K_1}}$

Answer: (D) $\sqrt{\frac{K_2}{K_1}}$ · Key from source paper

Q99 JEE Main 2021 · 16 Mar · Shift 1 MCQ

Time period of a simple pendulum is T inside a lift when the lift is stationary. If the lift moves upwards with an acceleration $\frac{g}{2}$, the time period of pendulum will be :

(A) $\sqrt{3}T$
(B) $\frac{T}{\sqrt{3}}$
(C) $\sqrt{\frac{3}{2}}T$
(D) $\sqrt{\frac{2}{3}}T$

Answer: (D) $\sqrt{\frac{2}{3}}T$ · Key from source paper

Q100 JEE Main 2021 · 16 Mar · Shift 2 MCQ

The amplitude of a mass-spring system, which is executing simple harmonic motion decreases with time. If mass $= 500$ g, Decay constant $= 20\ \text{g s}^{-1}$ then how much time is required for the amplitude of the system to drop to half of its initial value? $(\ln 2 = 0.693)$

(A) 34.65 s
(B) 17.32 s
(C) 0.034 s
(D) 15.1 s

Answer: (A) 34.65 s · Key from source paper

Q101 JEE Main 2021 · 26 Feb · Shift 1 MCQ

If two similar springs each of spring constant K_1 are joined in series, the new spring constant and time period would be changed by a factor:

(A) $\frac{1}{2},\ 2\sqrt{2}$
(B) $\frac{1}{4},\ \sqrt{2}$
(C) $\frac{1}{4},\ 2\sqrt{2}$
(D) $\frac{1}{2},\ \sqrt{2}$

Answer: (D) $\frac{1}{2},\ \sqrt{2}$ · Key from source paper

Q102 JEE Main 2021 · 26 Feb · Shift 2 MCQ

Given below are two statements:
Statement I: A second's pendulum has a time period of 1 second.
Statement II: It takes precisely one second to move between the two extreme positions. In the light of the above statements, choose the correct answer from the options given below

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(A) Statement I is false but Statement II is true
(B) Both Statement I and Statement II are true
(C) Both Statement I and Statement II are False
(D) Statement I is true but Statement II is false

Answer: (A) Statement I is false but Statement II is true · Key from source paper

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Q103 JEE Main 2021 · 26 Feb · Shift 2 MCQ

A particle executes S.H.M., the graph of velocity as a function of displacement is :

(A) a circle
(B) a helix
(C) a parabola
(D) an ellipse

Answer: (D) an ellipse · Key from source paper

Q104 JEE Main 2021 · 26 Feb · Shift 2 Numerical

A particle executes S.H.M. with amplitude A and time period T. The displacement of the particle when its speed is half of maximum speed is $\frac{\sqrt{x}A}{2}$. The value of x is

Numerical value type: the answer is a number.

Answer: 3. · Key from source paper

Q105 JEE Main 2021 · 26 Feb · Shift 2 Numerical

Time period of a simple pendulum is T. The time taken to complete $\frac{5}{8}$ oscillations starting from mean position is $\frac{\alpha}{12}T$. The value of α is _____.

Numerical value type: the answer is a number.

Answer: 7. · Key from source paper

Q106 JEE Main 2021 · 25 Feb · Shift 1 MCQ

If the time period of a two meter long simple pendulum is $2\ \mathrm{s}$, the acceleration due to gravity at the place where pendulum is executing S.H.M. is:

(A) $2\pi^2\ \mathrm{m\ s^{-2}}$
(B) $16\ \mathrm{m\ s^{-2}}$
(C) $\pi^2\ \mathrm{m\ s^{-2}}$
(D) $9.8\ \mathrm{m\ s^{-2}}$

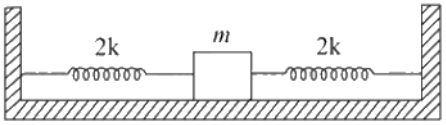
Answer: (A) $2\pi^2\ \mathrm{m\ s^{-2}}$ · Key from source paper

Q107 JEE Main 2021 · 25 Feb · Shift 2 MCQ

Two identical springs of spring constant $2k$ are attached to a block of mass m and to fixed support (see figure). When the mass is displaced from equilibrium position on either side, it executes simple harmonic motion. The time period of oscillations of this system is :

(see the figure above)

Q6. Two identical springs of spring constant $2k$ are attached to a block of mass m and to fixed support (see figure). When the mass is displaced from equilibrium position on either side, it executes simple harmonic motion. The time period of oscillations of this system is :



(1) $\pi\sqrt{\frac{m}{k}}$
(2) $2\pi\sqrt{\frac{m}{2k}}$
(3) $\pi\sqrt{\frac{m}{2k}}$
(4) $2\pi\sqrt{\frac{m}{k}}$

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

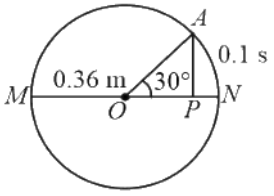
Answer: (A) $\pi\sqrt{\frac{m}{k}}$ · Key from source paper

Q108 JEE Main 2021 · 25 Feb · Shift 2 MCQ

The point A moves with a uniform speed along the circumference of a circle of radius 0.36 m and covers 30° in 0.1 s. The perpendicular projection P from A on the diameter MN represents the simple harmonic motion of P. The restoration force per unit mass when P touches M will be :

(see the figure above)

Q7. The point A moves with a uniform speed along the circumference of a circle of radius 0.36 m and covers 30° in 0.1 s. The perpendicular projection P from A on the diameter MN represents the simple harmonic motion of P. The restoration force per unit mass when P touches M will be :



(1) 0.49 N
(2) 9.87 N
(3) 50 N
(4) 100 N

(A) 0.49 N
(B) 9.87 N
(C) 50 N
(D) 100 N

Answer: (B) 9.87 N · Key from source paper

Q109 JEE Main 2021 · 25 Feb · Shift 2 MCQ

$Y = A\sin(\omega t + \phi_0)$ is the time-displacement equation of a SHM. At $t = 0$ the displacement of the particle is $Y = \frac{A}{2}$ and it is moving along negative x-direction. Then the initial phase angle ϕ_0 will be:

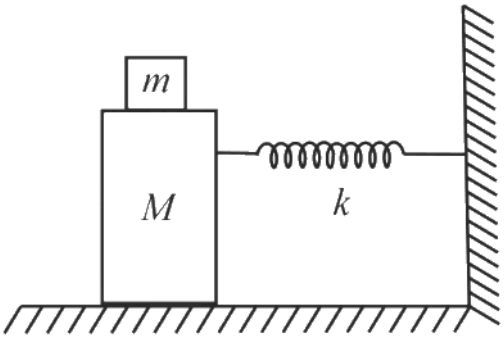
(A) $\frac{2\pi}{3}$
(B) $\frac{\pi}{6}$
(C) $\frac{5\pi}{6}$
(D) $\frac{\pi}{3}$

Answer: (C) $\frac{5\pi}{6}$ · Key from source paper

Q110 JEE Main 2021 · 24 Feb · Shift 1 MCQ

In the given figure, a mass M is attached to a horizontal spring which is fixed on one side to a rigid support. The spring constant of the spring is k. The mass oscillates on a frictionless surface with time period T and amplitude A. When the mass is in equilibrium position, as shown in the figure, another mass m is gently fixed upon it. The new amplitude of oscillation will be:
(see the figure above)

Q11. In the given figure, a mass M is attached to a horizontal spring which is fixed on one side to a rigid support. The spring constant of the spring is k. The mass oscillates on a frictionless surface with time period T and amplitude A. When the mass is in equilibrium position, as shown in the figure, another mass m is gently fixed upon it. The new amplitude of oscillation will be:



(1) $A\sqrt{\frac{M+m}{M}}$
(2) $A\sqrt{\frac{M}{M-m}}$
(3) $A\sqrt{\frac{M-m}{M}}$
(4) $A\sqrt{\frac{M}{M+m}}$

(A) $A\sqrt{\frac{M+m}{M}}$

(B) $A\sqrt{\frac{M}{M-m}}$

(C) $A\sqrt{\frac{M-m}{M}}$

(D) $A\sqrt{\frac{M}{M+m}}$

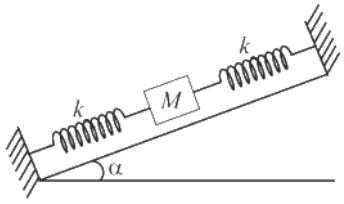
Answer: (D) $A\sqrt{\frac{M}{M+m}}$ · Key from source paper

Q111 JEE Main 2021 · 24 Feb · Shift 2 MCQ

In the given figure, a body of mass M is held between two massless springs, on a smooth inclined plane. The free ends of the springs are attached to firm supports. If each spring has spring constant k, the frequency of oscillation of given body is:

(see the figure above)

Q7. In the given figure, a body of mass M is held between two massless springs, on a smooth inclined plane. The free ends of the springs are attached to firm supports. If each spring has spring constant k, the frequency of oscillation of given body is:



(1) $\frac{1}{2\pi}\sqrt{\frac{2k}{Mg\sin\alpha}}$

(2) $\frac{1}{2\pi}\sqrt{\frac{k}{Mg}\sin\alpha}$

(3) $\frac{1}{2\pi}\sqrt{\frac{k}{2M}}$

(4) $\frac{1}{2\pi}\sqrt{\frac{2k}{M}}$

(A) $\frac{1}{2\pi}\sqrt{\frac{2k}{Mg\sin\alpha}}$

(B) $\frac{1}{2\pi}\sqrt{\frac{k}{Mg}}\sin\alpha$

(C) $\frac{1}{2\pi}\sqrt{\frac{k}{2M}}$

(D) $\frac{1}{2\pi}\sqrt{\frac{2k}{M}}$

Answer: (D) $\frac{1}{2\pi}\sqrt{\frac{2k}{M}}$ · Key from source paper

Q112 JEE Main 2021 · 24 Feb · Shift 2 MCQ

When a particle executes SHM, the nature of graphical representation of velocity as a function of displacement is:

(A) straight line
(B) elliptical
(C) circular
(D) parabolic

Answer: (B) elliptical · Key from source paper

Q113 JEE Main 2020 · 6 Sep · Shift 1 MCQ

An object of mass m is suspended at the end of a massless wire of length L and area of cross-section, A. Young modulus of the material of the wire is Y. If the mass is pulled down slightly its frequency of oscillation along the vertical direction is :

(A) $f = \frac{1}{2\pi}\sqrt{\frac{mL}{YA}}$
(B) $f = \frac{1}{2\pi}\sqrt{\frac{YA}{mL}}$
(C) $f = \frac{1}{2\pi}\sqrt{\frac{mA}{VL}}$
(D) $f = \frac{1}{2\pi}\sqrt{\frac{YL}{mA}}$

Answer: (B) $f = \frac{1}{2\pi}\sqrt{\frac{YA}{mL}}$ · Key from source paper

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Q114 JEE Main 2020 · 6 Sep · Shift 2 MCQ

When a particle of mass m is attached to a vertical spring of spring constant k and released, its motion, is described by $y(t) = y_0 \sin^2 \omega t$, where 'y' is measured from the lower end of upstretched spring. Then ω is :

(A) $\frac{1}{2}\sqrt{\frac{g}{y_0}}$
(B) $\sqrt{\frac{g}{y_0}}$
(C) $\sqrt{\frac{g}{2y_0}}$
(D) $\sqrt{\frac{2g}{y_0}}$

Answer: (C) $\sqrt{\frac{g}{2y_0}}$ · Key from source paper

Q115 JEE Main 2020 · 5 Sep · Shift 2 MCQ

A ring is hung on a nail. It can oscillate, without slipping or sliding (i) in its plane with a time period T_1 and (ii) back and forth in a direction perpendicular to its plane, with a period T_2. The ratio $\frac{T_1}{T_2}$ will be :

(A) $\frac{2}{\sqrt{3}}$
(B) $\frac{2}{3}$
(C) $\frac{3}{\sqrt{2}}$
(D) $\frac{\sqrt{2}}{3}$

Answer: (A) $\frac{2}{\sqrt{3}}$ · Key from source paper

Q116 JEE Main 2020 · 3 Sep · Shift 2 MCQ

A block of mass m attached to a massless spring is performing oscillatory motion of amplitude 'A' on a frictionless horizontal plane. If half of the mass of the block breaks off when it is passing through its equilibrium point, the amplitude of oscillation for the remaining system become fA. The value of f is:

(A) $\frac{1}{\sqrt{2}}$
(B) 1
(C) $\frac{1}{2}$
(D) $\sqrt{2}$

Answer: (A) $\frac{1}{\sqrt{2}}$ · Checked by our team

Q117 JEE Main 2020 · 2 Sep · Shift 2 MCQ

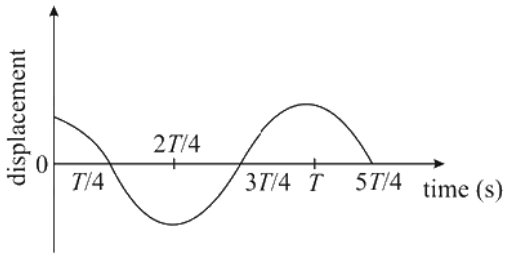
The displacement time graph of a particle executing SHM is given in figure: (sketch is schematic and not to scale)

(see the figure above)

Which of the following statements is/are true for this motion?

(A) The force is zero at $t = \frac{3T}{4}$
(B) The magnitude of acceleration is maximum at $t = T$
(C) The speed is maximum at $t = \frac{T}{4}$
(D) The $P.E.$ is equal to $K.E.$ of the oscillation at $t = \frac{T}{2}$

Q8. The displacement time graph of a particle executing SHM is given in figure: (sketch is schematic and not to scale)



Which of the following statements is/are true for this motion?

(A) The force is zero at $t = \frac{3T}{4}$
(B) The magnitude of acceleration is maximum at $t = T$
(C) The speed is maximum at $t = \frac{T}{4}$
(D) The $P.E.$ is equal to $K.E.$ of the oscillation at $t = \frac{T}{2}$

(1) (A), (B) and (C)
(2) (B), (C) and (D)
(3) (A), (B) and (D)
(4) (A) and (D)

(A) (A), (B) and (C)
(B) (B), (C) and (D)
(C) (A), (B) and (D)
(D) (A) and (D)

Answer: (A) (A), (B) and (C) · Key from source paper

Q118 JEE Main 2019 · 12 Apr · Shift 2 MCQ

A spring whose unstrentches length is l has a force constant k. The spring is cut into two pieces of unstretches lengths l_1 and l_2 where, $l_1 = nl_2$ and n is an integer. The ratio k_1/k_2 of the corresponding force constants, k_1 and k_2 will be:

(A) $\frac{1}{n^2}$
(B) n^2
(C) n
(D) $\frac{1}{n}$

Answer: (D) $\frac{1}{n}$ · Key from source paper

Q119 JEE Main 2019 · 10 Apr · Shift 1 MCQ

The displacement of a damped harmonic oscillator is given by $x(t) = e^{-0.1t}\ \cos(10\pi t + \varphi)$. Here t is in seconds. The time taken for its amplitude of vibration to drop to half of its initial value is close to:

(A) $27\ \text{s}$
(B) $4\ \text{s}$
(C) $13\ \text{s}$
(D) $7\ \text{s}$

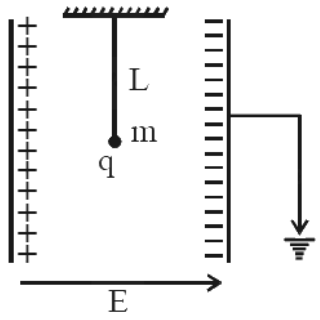
Answer: (D) $7\ \text{s}$ · Key from source paper

Q120 JEE Main 2019 · 10 Apr · Shift 2 MCQ

A simple pendulum of length L is placed between the plates of a parallel plate capacitor having electric field E , as shown in figure. Its bob has mass m and charge q. The time period of the pendulum is given by:

(see the figure above)

Q18. A simple pendulum of length L is placed between the plates of a parallel plate capacitor having electric field E , as shown in figure. Its bob has mass m and charge q . The time period of the pendulum is given by:



(1) $2\pi\sqrt{\frac{L}{\sqrt{g^2+\frac{qE^2}{m}}}}$

(2) $2\pi\sqrt{\frac{L}{g+\frac{qE}{m}}}$

(3) $2\pi\sqrt{\frac{L}{g-\frac{qE}{m}}}$

(4) $2\pi\sqrt{\frac{L}{\sqrt{g^2-\frac{q^2E^2}{m^2}}}}$

(A) $2\pi\sqrt{\frac{L}{\sqrt{g^2+\left(\frac{qE}{m}\right)^2}}}$

(B) $2\pi\sqrt{\frac{L}{g+\frac{qE}{m}}}$

(C) $2\pi\sqrt{\frac{L}{g-\frac{qE}{m}}}$

(D) $2\pi\sqrt{\frac{L}{\sqrt{g^2-\frac{q^2E^2}{m^2}}}}$

Answer: (A) $2\pi\sqrt{\frac{L}{\sqrt{g^2+\left(\frac{qE}{m}\right)^2}}}$ · Key from source paper

Q121 JEE Main 2019 · 9 Apr · Shift 1 MCQ

A simple pendulum oscillating in air has period T . The bob of the pendulum is completely immersed in a non-viscous liquid. The density of the liquid is $\frac{1}{16}$th of the material of the bob. If the bob is inside liquid all the time, its period of oscillation in this liquid is:

(A) $2T\sqrt{\frac{1}{10}}$

(B) $2T\sqrt{\frac{1}{14}}$

(C) $4T\sqrt{\frac{1}{15}}$

(D) $4T\sqrt{\frac{1}{14}}$

Answer: (C) $4T\sqrt{\frac{1}{15}}$ · Key from source paper

Q122 JEE Main 2019 · 8 Apr · Shift 2 MCQ

A damped harmonic oscillator has a frequency of 5 oscillations per second. The amplitude drops to half its value for every 10 oscillations. The time it will take to drop to $\frac{1}{1000}$ of the original amplitude is close to:

(A) 50 s

(B) 100 s

(C) 20 s

(D) 10 s

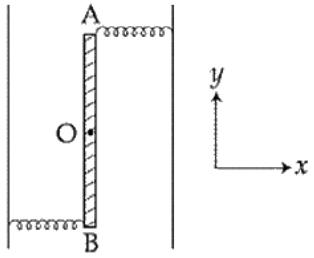
Answer: (C) 20 s · Key from source paper

Q123 JEE Main 2019 · 12 Jan · Shift 1 MCQ

Two light identical springs of spring constant k are attached horizontally at the two ends of a uniform horizontal rod AB of length l and mass m. The rod is pivoted at its center 'O' and can rotate freely in horizontal plane. The other ends of the two springs are fixed to rigid supports as shown in figure. The rod is gently pushed through a small angle and released. The frequency of resulting oscillation is:

(see the figure above)

Q11. Two light identical springs of spring constant k are attached horizontally at the two ends of a uniform horizontal rod AB of length l and mass m. The rod is pivoted at its center 'O' and can rotate freely in horizontal plane. The other ends of the two springs are fixed to rigid supports as shown in figure. The rod is gently pushed through a small angle and released. The frequency of resulting oscillation is:



(1) $\frac{1}{2\pi}\sqrt{\frac{3k}{m}}$

(2) $\frac{1}{2\pi}\sqrt{\frac{k}{m}}$

(3) $\frac{1}{2\pi}\sqrt{\frac{6k}{m}}$

(4) $\frac{1}{2\pi}\sqrt{\frac{2k}{m}}$

(A) $\frac{1}{2\pi}\sqrt{\frac{3k}{m}}$
(B) $\frac{1}{2\pi}\sqrt{\frac{k}{m}}$
(C) $\frac{1}{2\pi}\sqrt{\frac{6k}{m}}$
(D) $\frac{1}{2\pi}\sqrt{\frac{2k}{m}}$

Answer: (C) $\frac{1}{2\pi}\sqrt{\frac{6k}{m}}$ · Key from source paper

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Q124 JEE Main 2019 · 12 Jan · Shift 2 MCQ

A simple harmonic motion is represented by:
$y = 5\left(\sin 3\pi t + \sqrt{3}\cos 3\pi t\right)$ cm
The amplitude and time period of the motion are:

(A) 5 cm, $\frac{2}{3}$ s
(B) 10 cm, $\frac{2}{3}$ s
(C) 5 cm, $\frac{3}{2}$ s
(D) 10 cm, $\frac{3}{2}$ s

Answer: (B) 10 cm, $\frac{2}{3}$ s · Key from source paper

Q125 JEE Main 2019 · 11 Jan · Shift 1 MCQ

A particle undergoing simple harmonic motion has time dependent displacement given by $x(t)$ = A sin $\frac{\pi t}{90}$. The ratio of kinetic to potential energy of this particle at t = 210 s will be

(A) $\frac{1}{9}$
(B) 1
(C) 2
(D) $\frac{1}{3}$

Answer: (D) $\frac{1}{3}$ · Key from source paper

Q126 JEE Main 2019 · 11 Jan · Shift 2 MCQ

A pendulum is executing simple harmonic motion and its maximum kinetic energy is K_1. If the length of the pendulum is doubled and it performs simple harmonic motion with the same amplitude as in the first case, its maximum kinetic energy is K_2

(A) $K_2 = 2K_1$
(B) $K_2 = \frac{K_1}{2}$
(C) $K_2 = \frac{K_1}{4}$
(D) $K_2 = K$

Options (1) or (2) were accepted. More than one answer was accepted. · Key from source paper

Q127 JEE Main 2019 · 11 Jan · Shift 2 MCQ

A simple pendulum of length 1 m is oscillating with an angular frequency 10rad/s. The support of the pendulum starts oscillating up and down with a small angular frequency of 1rad/s and an amplitude of 10^{-2} m . The relative change in the angular frequency of the pendulum is best given by :

(A) 10^{-3}rad/s
(B) 1rad/s
(C) 10^{-1}rad/s
(D) 10^{-5}rad/s

Answer: (A) 10^{-3}rad/s · Key from source paper

Q128 JEE Main 2019 · 10 Jan · Shift 2 MCQ

A particle executes simple harmonic motion with an amplitude of $5\ cm$. When the particle is at $4\ cm$ from the mean position, the magnitude of its velocity in SI units is equal to that of its acceleration. Then, its periodic time in seconds is:

(A) $\frac{8\pi}{3}$
(B) $\frac{3}{8}\pi$
(C) $\frac{4\pi}{3}$
(D) $\frac{7}{3}\pi$

Answer: (A) $\frac{8\pi}{3}$ · Key from source paper

Q129 JEE Main 2019 · 10 Jan · Shift 2 MCQ

A cylindrical plastic bottle of negligible mass is filled with $310\ ml$ of water and left floating in a pond with still water. If pressed downward slightly and released, it starts performing simple harmonic motion at angular frequency ω. If the radius of the bottle is $2.5\ cm$ then ω is close to: (density of water $= 10^3 kg/m^3$)

(A) $5.00\ \text{rad sec}^{-1}$
(B) $2.50\ \text{rad sec}^{-1}$
(C) $7.9\ \text{rad sec}^{-1}$
(D) $3.75\ \text{rad sec}^{-1}$

Answer: (C) $7.9\ \text{rad sec}^{-1}$ · Key from source paper

Q130 JEE Main 2019 · 9 Jan · Shift 1 MCQ

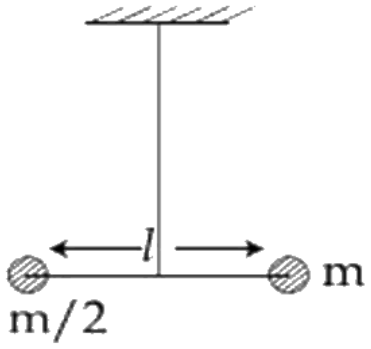
Two masses m and $\frac{m}{2}$ are connected at the two ends of a massless rigid rod of length l. The rod is suspended by a thin wire of torsional constant k at the centre of mass of the rod-mass system (see figure). Because of torsional constant k, the restoring torque is $\tau = k\theta$ for angular displacement θ. If

the rod is rotated by θ_0 and released, the tension in it when it passes through its mean position will be:

(see the figure above)

Q6. Two masses m and $\frac{m}{2}$ are connected at the two ends of a massless rigid rod of length l. The rod is suspended by a thin wire of torsional constant k at the centre of mass of the rod-mass system (see figure). Because of torsional constant k, the restoring torque is $\tau = k\theta$ for angular displacement θ. If the rod is rotated by θ_0 and released,

the tension in it when it passes through its mean position will be:



(1) $k\theta_0^2$

(2) $\frac{3k{\theta_0}^2}{l}$

(3) $\frac{2k{\theta_0}^2}{l}$

(4) $\frac{k{\theta_0}^2}{l}$

(A) $k\theta_0^2$

(B) $\frac{3k\theta_0^2}{l}$

(C) $\frac{2k\theta_0^2}{l}$

(D) $\frac{k\theta_0^2}{l}$

Answer: (D) $\frac{k\theta_0^2}{l}$ · Key from source paper

Q131 JEE Main 2019 · 9 Jan · Shift 2 MCQ

A particle is executing simple harmonic motion (SHM) of amplitude A, along the x -axis, about $x = 0$. When its potential Energy (PE) equal kinetic energy (KE), the position of the particle will be:

(A) A

(B) $\frac{A}{2}$

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

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

Answer: (D) $\frac{A}{\sqrt{2}}$ · Key from source paper

Q132 JEE Main 2019 · 9 Jan · Shift 2 MCQ

A rod of mass M and length $2L$ is suspended at its middle by a wire. It exhibits torsional oscillations. If two masses, each of mass m, are attached at a distance $L/2$ from its centre on both sides, it reduces the oscillation frequency by 20%. The value of ratio m/M is close to

(A) 0.17
(B) 0.77
(C) 0.57
(D) 0.37

Answer: (D) 0.37 · Key from source paper

Q133 JEE Main 2018 · 16 Apr · Online MCQ

An oscillator of mass M is at rest in its equilibrium position in a potential, $V = \frac{1}{2}k(x-X)^2$. A particle of mass m comes from the right with speed u and collides completely inelastic with M and sticks to it. This process repeats every time the oscillator crosses its equilibrium position. The amplitude of oscillations after 13 collisions is: ($M = 10$, $m = 5$, $u = 1$, $k = 1$)

(A) $\frac{2}{3}$
(B) $\frac{1}{\sqrt{3}}$
(C) $\sqrt{\frac{3}{5}}$
(D) $\frac{1}{2}$

Answer: (B) $\frac{1}{\sqrt{3}}$ · Key from source paper

Q134 JEE Main 2018 · 16 Apr · Online MCQ

A particle executes simple harmonic motion and it is located at $x = a$, b and c at time t_0, $2t_0$ and $3t_0$ respectively. The frequency of the oscillation is:

(A) $\frac{1}{2\pi t_0}\cos^{-1}\left(\frac{a+c}{2b}\right)$
(B) $\frac{1}{2\pi t_0}\cos^{-1}\left(\frac{a+2b}{3c}\right)$
(C) $\frac{1}{2\pi t_0}\cos^{-1}\left(\frac{a+b}{2c}\right)$
(D) $\frac{1}{2\pi t_0}\cos^{-1}\left(\frac{2a+3c}{b}\right)$

Answer: (A) $\frac{1}{2\pi t_0}\cos^{-1}\left(\frac{a+c}{2b}\right)$ · Key from source paper

Q135 JEE Main 2018 · 15 Apr · Shift 1 MCQ

A body of mass M and charge q is connected to a spring of spring constant k. It is oscillating along x-direction about its equilibrium position, taken to be at $x = 0$, with an amplitude A. An electric field E is applied along the x-direction. Which of the following statements is correct?

(A) The total energy of the system is $\frac{1}{2}m\omega^2A^2+\frac{1}{2}\frac{q^2E^2}{k}$

(B) The new equilibrium position is at a distance: $\frac{2qE}{k}$ from $x=0$

(C) The new equilibrium position is at a distance: $\frac{qE}{2k}$ from $x=0$

(D) The total energy of the system is $\frac{1}{2}m\omega^2A^2-\frac{1}{2}\frac{q^2E^2}{k}$

Answer: (A) The total energy of the system is $\frac{1}{2}m\omega^2A^2+\frac{1}{2}\frac{q^2E^2}{k}$ · Key from source paper

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Q136 JEE Main 2018 · 15 Apr · Shift 2 MCQ

Two simple harmonic motions, as shown, are at right angles. They are combined to form Lissajous figures. $x(t)=A\sin(at+\delta)$ $y(t)=B\sin(bt)$ Identify the correct match below

(A) Parameters: $\mathrm{A}=\mathrm{B}$, $\mathrm{a}=2\,\mathrm{b}$; $\delta=\frac{\pi}{2}$; Curve: Circle

(B) Parameters: $\mathrm{A}=\mathrm{B}$, $\mathrm{a}=\mathrm{b}$; $\delta=\frac{\pi}{2}$; Curve: Line

(C) Parameters: $\mathrm{A}\neq\mathrm{B}$, $\mathrm{a}=\mathrm{b}$; $\delta=\frac{\pi}{2}$; Curve: Ellipse

(D) Parameters: $\mathrm{A}\neq\mathrm{B}$, $\mathrm{a}=\mathrm{b}$; $\delta=0$; Curve: Parabola

Answer: (C) Parameters: $\mathrm{A}\neq\mathrm{B}$, $\mathrm{a}=\mathrm{b}$; $\delta=\frac{\pi}{2}$; **Curve: Ellipse** · Key from source paper

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Q137 JEE Main 2018 · 8 Apr · Offline MCQ

A silver atom in a solid oscillates in simple harmonic motion in some direction with a frequency of $10^{12}\ \mathrm{s}^{-1}$. What is the force constant of the bonds connecting one atom with the other? (Mole wt. of silver, $=108\ \mathrm{g\ mol}^{-1}$ and Avogadro number $=6.02\times10^{23}$)

(A) $5.5\ \mathrm{N\,m}^{-1}$

(B) $6.4\ \mathrm{N\,m}^{-1}$

(C) $7.1\ \mathrm{N\,m}^{-1}$

(D) $2.2\ \mathrm{N\,m}^{-1}$

Answer: (C) $7.1\ \mathrm{N\,m}^{-1}$ · Key from source paper

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Q138 JEE Main 2017 · 9 Apr · Online MCQ

A block of mass 0.1 kg is connected to an elastic spring of spring constant $640\ \mathrm{N\,m}^{-1}$ and oscillates in a damping medium of damping constant $10^{-2}\ \mathrm{kg\,s}^{-1}$. The system dissipates its energy gradually. The time taken for its mechanical energy of vibration to drop to half of its initial value, is closest to-

(A) 2 s

(B) 5 s

(C) 3 s

(D) 7 s

Answer: (D) 7 s · Key from source paper

Q139 JEE Main 2017 · 9 Apr · Online MCQ

In an experiment to determine the period of a simple pendulum of length 1 m, it is attached to different spherical bobs of radii r_1 and r_2. The two spherical bobs have uniform mass distribution. If the relative difference in the periods, is found to be 5×10^{-4} s, the difference in radii, $|r_1 - r_2|$ is best-given by

(A) 0.01 cm
(B) 0.05 cm
(C) 0.5 cm
(D) 1 cm

Answer: (B) 0.05 cm · Key from source paper

Q140 JEE Main 2017 · 8 Apr · Online MCQ

The ratio of maximum acceleration to maximum velocity in a simple harmonic motion is $10\ \mathrm{s}^{-1}$. At, $t = 0$ the displacement is 5 m. What is the maximum acceleration? The initial phase is $\frac{\pi}{4}$.

(A) $500\ \mathrm{m\ s}^{-2}$
(B) $750\sqrt{2}\ \mathrm{m\ s}^{-2}$
(C) $750\ \mathrm{m\ s}^{-2}$
(D) $500\sqrt{2}\ \mathrm{m\ s}^{-2}$

Answer: (D) $500\sqrt{2}\ \mathrm{m\ s}^{-2}$ · Key from source paper

Q141 JEE Main 2017 · 8 Apr · Online MCQ

A 1 kg block attached to a spring vibrates with a frequency of 1 Hz on a frictionless horizontal table. Two springs identical to the original spring are attached in parallel to a 8 kg block placed on the same table. So, the frequency of vibration of the 8 kg block is

(A) $2\ \mathrm{Hz}$
(B) $\frac{1}{4}\ \mathrm{Hz}$
(C) $\frac{1}{2\sqrt{2}}\ \mathrm{Hz}$
(D) $\frac{1}{2}\ \mathrm{Hz}$

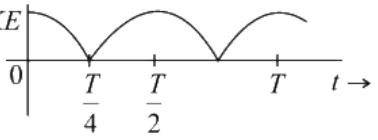
Answer: (D) $\frac{1}{2}\ \mathrm{Hz}$ · Key from source paper

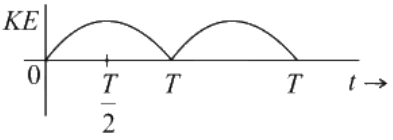
Q142 JEE Main 2017 · 2 Apr · Offline MCQ

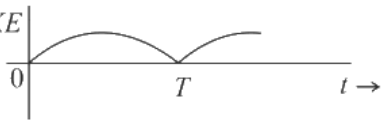
A particle is executing simple harmonic motion with a time period T. At time $t = 0$, it is at its position of equilibrium. The kinetic energy - time graph of the particle will look like:

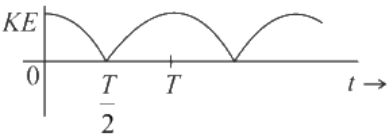
EdLoop JEE

Q13. A particle is executing simple harmonic motion with a time period T. At time $t = 0$, it is at its position of equilibrium. The kinetic energy - time graph of the particle will look like:

(1) 

(2) 

(3) 

(4) 

(A) *see figure*
(B) *see figure*
(C) *see figure*
(D) *see figure*

Answer: (A) · Key from source paper

Q143 JEE Main 2016 · 10 Apr · Online MCQ

In an engine the piston undergoes vertical simple harmonic motion with amplitude 7cm. A washer rests on top of the piston and moves with it. The motor speed is slowly increased. The frequency of the piston at which the washer no longer stays in contact with the piston, is close to :

(A) $0.7\ \text{Hz}$
(B) $1.9\ \text{Hz}$
(C) $1.2\ \text{Hz}$
(D) $0.1\ \text{Hz}$

Answer: (B) $1.9\ \text{Hz}$ · Key from source paper

Q144 JEE Main 2016 · 9 Apr · Online MCQ

Two particles are performing simple harmonic motion in a straight line about the same equilibrium point. The amplitude and time period for both particles are same and equal to A and T, respectively. At time $\text{t} = 0$ one particle has displacement A while the other one has displacement $-\frac{A}{2}$ and they are moving towards each other. If they cross each other at time t, then t is:

(A) $\frac{5T}{6}$
(B) $\frac{T}{3}$
(C) $\frac{T}{4}$
(D) $\frac{T}{6}$

Answer: (D) $\frac{T}{6}$ · Key from source paper

Q145 JEE Main 2016 · 3 Apr · Offline MCQ

A particle performs simple harmonic motion with amplitude A. Its speed is tripled at the instant that it is at a distance $\frac{2A}{3}$ from equilibrium position. The new amplitude of the motion is:

(A) $A\sqrt{3}$
(B) $\frac{7A}{3}$
(C) $\frac{A}{3}\sqrt{41}$
(D) $3A$

Answer: (B) $\frac{7A}{3}$ · Key from source paper

Q146 JEE Main 2015 · 11 Apr · Online MCQ

A pendulum with the time period of 1 s is losing energy due to damping. At a certain time, its energy is 45 J. If after completing 15 oscillations its energy has become 15 J, then its damping constant (in s^{-1}) will be

(A) $\frac{1}{2}$
(B) $\frac{1}{15}\ln 3$
(C) $\frac{1}{30}\ln 3$
(D) 2

Answer: (C) $\frac{1}{30}\ln 3$ · Key from source paper

Q147 JEE Main 2015 · 11 Apr · Online MCQ

A cylindrical block of wood (density $= 650$ kg m^{-3}), of base area 30 cm^2 and height 54 cm, floats in a liquid of density 900 kg m^{-3}. The block is depressed slightly and then released. The time period of the resulting oscillations of the block would be equal to that of a simple pendulum of length (nearly) :

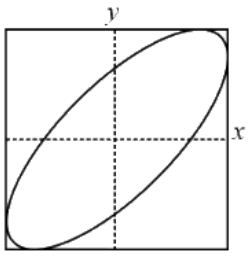
(A) 52 cm
(B) 26 cm
(C) 39 cm
(D) 65 cm

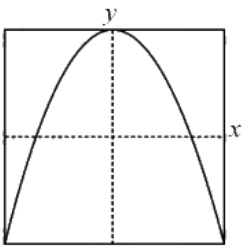
Answer: (C) 39 cm · Key from source paper

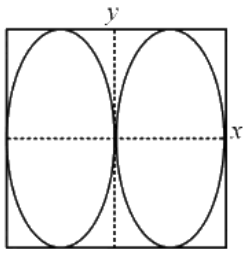
Q148 JEE Main 2015 · 10 Apr · Online MCQ

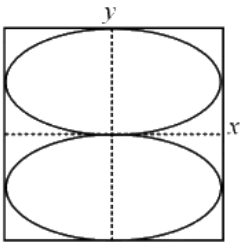
x and y displacements of a particle are given as $x(t) = a\sin\omega t$ and $y(t) = a\sin 2\omega t$. Its trajectory will look like:

Q12. x *and* y displacements of a particle are given as $x(t) = a \sin \omega t$ *and* $y(t) = a \sin 2\omega t$. Its trajectory will look like:

(1) 

(2) 

(3) 

(4) 

(A) *see figure*
(B) *see figure*
(C) *see figure*
(D) *see figure*

Answer: (C) · Key from source paper

Q149 JEE Main 2015 · 10 Apr · Online MCQ

A simple harmonic oscillator of angular frequency $2\ \mathrm{rad\,s^{-1}}$ is acted upon by an external force $F = \sin t\ N$. If the oscillator is at rest in its equilibrium position at $t = 0$, its position at later times is proportional to:

(A) $\sin t + \frac{1}{2}\cos 2t$
(B) $\cos t - \frac{1}{2}\sin 2t$
(C) $\sin t - \frac{1}{2}\sin 2t$
(D) $\sin t + \frac{1}{2}\sin 2t$

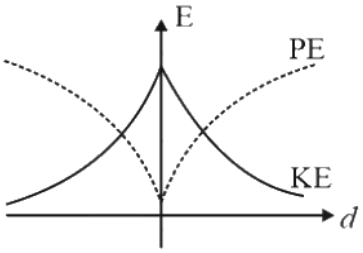
Answer: (C) $\sin t - \frac{1}{2}\sin 2t$ · Key from source paper

Q150 JEE Main 2015 · 4 Apr · Offline MCQ

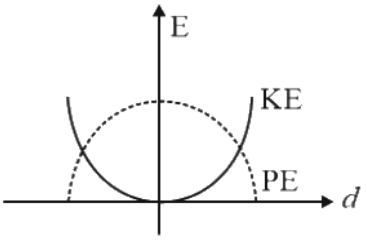
For a simple pendulum, a graph is plotted between its kinetic energy (K.E.) and potential energy (P.E.) against its displacement d. which one of the following represents these correctly? (graphs are schematic and not drawn to scale)

Q12. For a simple pendulum, a graph is plotted between its kinetic energy (K.E.) and potential energy (P.E.) against its displacement d. which one of the following represents these correctly? (graphs are schematic and not drawn to scale)

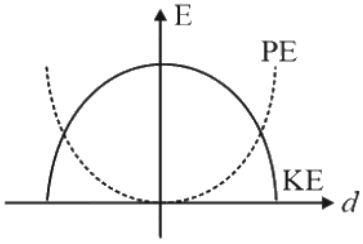
(1)



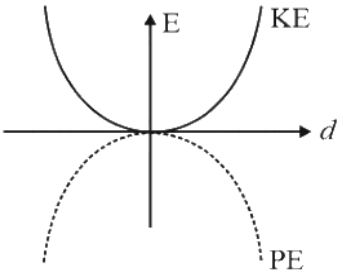
(2)



(3)



(4)



(A) *see figure*
(B) *see figure*
(C) *see figure*
(D) *see figure*

Answer: (C) · Key from source paper

Q151 JEE Main 2014 · 19 Apr · Online MCQ

A body is in simple harmonic motion with time period $T = 0.5\,\text{s}$ and amplitude $A = 1\,\text{cm}$. Find the average velocity in the interval in which it moves from equilibrium position to half of its amplitude.

(A) $16\ \text{cm/s}$
(B) $6\ \text{cm/s}$
(C) $4\ \text{cm/s}$
(D) $12\ \text{cm/s}$

Answer: (D) $12\ \text{cm/s}$ · Key from source paper

Q152 JEE Main 2014 · 12 Apr · Online MCQ

Which of the following expressions corresponds to simple harmonic motion along a straight line, where x is the displacement and a, b, c are positive constants?

(A) $a + bx - cx^2$

(B) bx^2

(C) $a - bx + cx^2$

(D) $-bx$

Answer: (D) $-bx$ · Key from source paper

Q153 JEE Main 2014 · 11 Apr · Online MCQ

The angular frequency of the damped oscillator is given by, $\omega = \sqrt{\left(\frac{\mathrm{k}}{\mathrm{m}} - \frac{r^2}{4\,\mathrm{m}^2}\right)}$ where k is the spring constant, m is the mass of the oscillator and r is the damping constant. If the ratio $\frac{r^2}{\mathrm{mk}}$ is 8%, the change in time period compared to the undamped oscillator is approximately as follows:

(A) increases by 1%

(B) increases by 8%

(C) decreases by 1%

(D) decreases by 8%

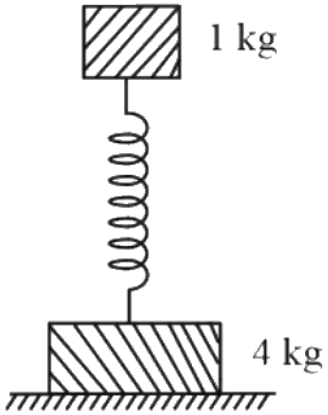
Answer: (A) increases by 1% · Key from source paper

Q154 JEE Main 2014 · 9 Apr · Online MCQ

Two bodies of masses 1 kg and 4 kg are connected to a vertical spring, as shown in the figure. The smaller mass executes simple harmonic motion of angular frequency 25 $\mathrm{rad\ s^{-1}}$, and amplitude 1.6 cm while the bigger mass remains stationary on the ground. The maximum force exerted by the system on the floor is (take g = 10 $\mathrm{m\,s^{-2}}$).

(see the figure above)

Q12. Two bodies of masses 1 kg and 4 kg are connected to a vertical spring, as shown in the figure. The smaller mass executes simple harmonic motion of angular frequency 25 $\mathrm{rad\ s^{-1}}$, and amplitude 1.6 cm while the bigger mass remains stationary on the ground. The maximum force exerted by the system on the floor is (take $g = 10\ \mathrm{m\,s^{-2}}$).



(1) 20 N

(2) 60 N

(3) 40 N

(4) 10 N

(A) 20 N
(B) 60 N
(C) 40 N
(D) 10 N

Answer: (B) 60 N · Key from source paper

Q155 JEE Main 2014 · 9 Apr · Online MCQ

The amplitude of a simple pendulum, oscillating in air with a small spherical bob, decreases from 10 cm to 8 cm in 40 seconds. Assuming that Stokes law is valid, and ratio of the coefficient of viscosity of air to that of carbon dioxide is 1.3, the time in which amplitude of this pendulum will reduce from 10 cm to 5 cm in carbondioxide will be close to (ln 5 = 1.601, ln 2 = 0.693).

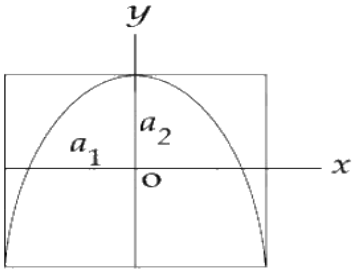
(A) 231 s
(B) 142 s
(C) 208 s
(D) 161 s

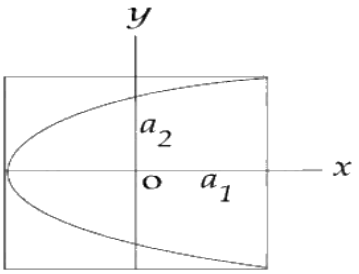
Answer: (D) 161 s · Key from source paper

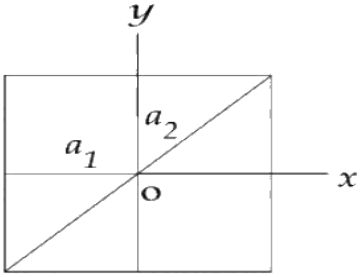
Q156 JEE Main 2014 · 9 Apr · Online MCQ

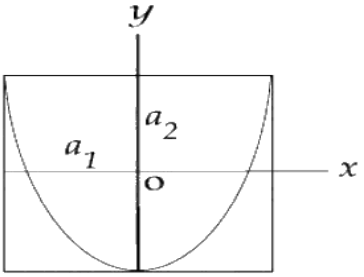
A particle which is simultaneously subjected to two perpendicular simple harmonic motions represented by; $x = a_1 \cos \omega t$ and $y = a_2 \cos 2\omega t$ traces a curve given by :

Q14. A particle which is simultaneously subjected to two perpendicular simple harmonic motions represented by; $x = a_1 \cos \omega t$ and $y = a_2 \cos 2\omega t$ traces a curve given by :

(1)


(2)


(3)


(4)


(A) *see figure*
(B) *see figure*
(C) *see figure*
(D) *see figure*

Answer: (D) · Key from source paper

Q157 JEE Main 2014 · 6 Apr · Offline MCQ

A particle moves with simple harmonic motion in a straight line. In first τ s, after starting from rest it travels a distance a, and in next τ s it travels 2a, in same direction, then :

(A) Amplitude of motion is 3a
(B) Time period of oscillations is 8τ
(C) Amplitude of motion is 4a
(D) Time period of oscillations is 6τ

Answer: (D) Time period of oscillations is 6τ · Key from source paper

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Q158 JEE Main 2013 · 25 Apr · Online MCQ

A uniform cylinder of length L and mass M having cross-sectional area A is suspended, with its length vertical, from a fixed point by a massless spring, such that it is half submerged in a liquid of density σ at equilibrium position. When the cylinder is given a downward push and released, it starts oscillating vertically with a small amplitude. The time period T of the oscillations of the cylinder will be :

(A) Smaller than $2\pi\left[\frac{M}{(k+A\sigma g)}\right]^{1/2}$
(B) $2\pi\sqrt{\frac{M}{k}}$
(C) Larger than $2\pi\left[\frac{M}{(k+A\sigma g)}\right]^{1/2}$
(D) $2\pi\left[\frac{M}{(k+A\sigma g)}\right]^{1/2}$

Answer: (D) $2\pi\left[\frac{M}{(k+A\sigma g)}\right]^{1/2}$ · Checked by our team

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Q159 JEE Main 2013 · 23 Apr · Online MCQ

Bob of a simple pendulum of length l is made of iron. The pendulum is oscillating over a horizontal coil carrying direct current. If the time period of the pendulum is T then :

(A) $T < 2\pi\sqrt{\frac{l}{g}}$ and damping is smaller than in air alone.

(B) $T = 2\pi\sqrt{\frac{l}{g}}$ and damping is larger than in air alone.

(C) $T > 2\pi\sqrt{\frac{l}{g}}$ and damping is smaller than in air alone.

(D) $T < 2\pi\sqrt{\frac{l}{g}}$ and damping is larger than in air alone.

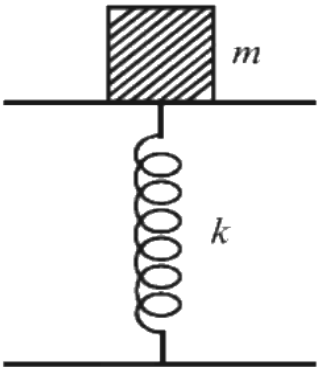
Answer: (D) $T < 2\pi\sqrt{\frac{l}{g}}$ **and damping is larger than in air alone.** · Key from source paper

Q160 JEE Main 2013 · 22 Apr · Online MCQ

A mass $m = 1.0\ \text{kg}$ is put on a flat pan attached to a vertical spring fixed on the ground. The mass of the spring and the pan is negligible. When pressed slightly and released, the mass executes simple harmonic motion. The spring constant is $500\ \text{N/m}$. What is the amplitude A of the motion, so that the mass m tends to get detached from the pan ? (Take $g = 10\ \text{m/s}^2$). The spring is stiff enough so that it does not get distorted during the motion.

(see the figure above)

Q12. A mass $m = 1.0\ \text{kg}$ is put on a flat pan attached to a vertical spring fixed on the ground. The mass of the spring and the pan is negligible. When pressed slightly and released, the mass executes simple harmonic motion. The spring constant is $500\ \text{N/m}$. What is the amplitude A of the motion, so that the mass m tends to get detached from the pan ? (Take $g = 10\ \text{m/s}^2$). The spring is stiff enough so that it does not get distorted during the motion.



(1) $\text{A} > 2.0\ \text{cm}$ (2) $\text{A} = 2.0\ \text{cm}$

(3) $\text{A} < 2.0\ \text{cm}$ (4) $\text{A} = 1.5\ \text{cm}$

(A) $\text{A} > 2.0\ \text{cm}$

(B) $\text{A} = 2.0\ \text{cm}$

(C) $\text{A} < 2.0\ \text{cm}$

(D) $\text{A} = 1.5\ \text{cm}$

Answer: (A) $\text{A} > 2.0\ \text{cm}$ · Checked by our team

Q161 JEE Main 2013 · 9 Apr · Online MCQ

Two springs of force constants 300 N/m (Spring A) and 400 N/m (Spring B) are joined together in series. The combination is compressed by 8.75 cm. The ratio of energy stored in A and B is $\frac{E_A}{E_B}$. Then

$\frac{E_A}{E_B}$ is equal to:

(A) $\frac{4}{3}$

(B) $\frac{16}{9}$

(C) $\frac{3}{4}$

(D) $\frac{9}{16}$

Answer: (A) $\frac{4}{3}$ · Key from source paper

Q162 JEE Main 2013 · 9 Apr · Online MCQ

Two simple pendulums of length 1 m and 4 m respectively are both given small displacement in the same direction at the same instant. They will be again in phase after the shorter pendulum has completed number of oscillations equal to:

(A) 2

(B) 7

(C) 5

(D) 3

Answer: (A) 2 · Key from source paper

Q163 JEE Main 2013 · 7 Apr · Offline MCQ

An ideal gas enclosed in a vertical cylindrical container supports a freely moving piston of mass M. The piston and the cylinder have equal cross-sectional area A. When the piston is in equilibrium, the volume of the gas is V_0 and its pressure is P_0. The piston is slightly displaced from the equilibrium position and released. Assuming that the system is completely isolated from its surrounding, the piston executes a simple harmonic motion with frequency

(A) $\frac{1}{2\pi}\sqrt{\frac{A^2\gamma P_0}{MV_0}}$.

(B) $\frac{1}{2\pi}\sqrt{\frac{MV_0}{A\gamma P_0}}$.

(C) $\frac{1}{2\pi}\frac{A\gamma P_0}{V_0 M}$

(D) $\frac{1}{2\pi}\frac{V_0 M P_0}{A^2\gamma}$.

Answer: (A) $\frac{1}{2\pi}\sqrt{\frac{A^2\gamma P_0}{MV_0}}$. · Key from source paper

Q164 JEE Main 2013 · 7 Apr · Offline MCQ

The amplitude of a damped oscillator decreases to 0.9 times its original magnitude in 5s. In another 10s it will decrease to α times its original magnitude, where α equals :

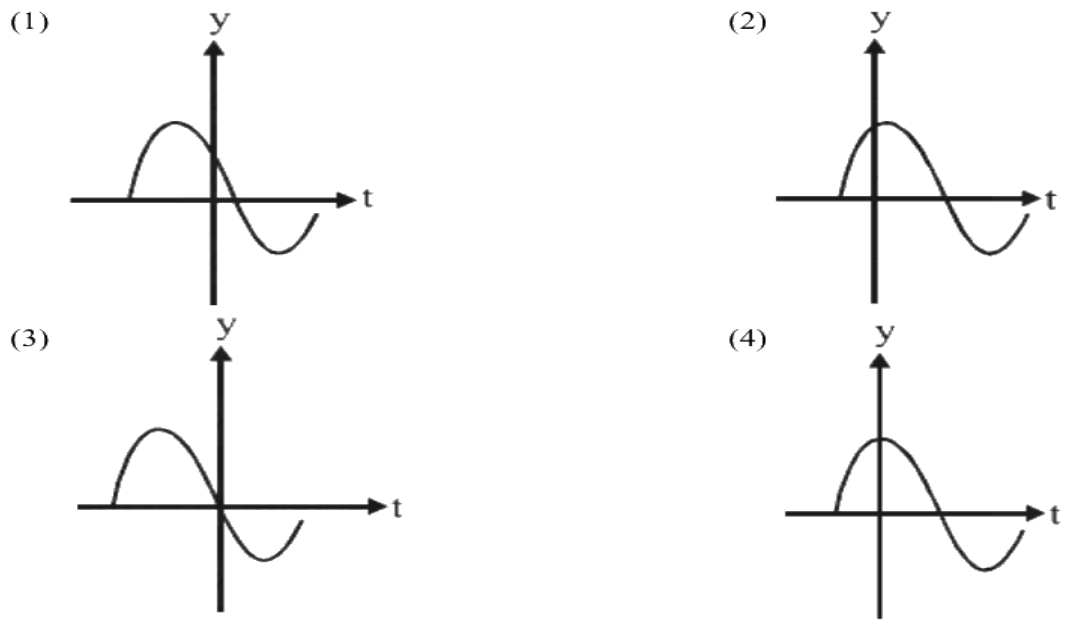
(A) 0.729
(B) 0.6
(C) 0.7
(D) 0.81

Answer: (A) 0.729 · Key from source paper

Q165 AIEEE 2012 · 19 May · Online MCQ

The displacement $y(t) = A\sin(\omega t + \phi)$ of a pendulum for $\phi = \frac{2\pi}{3}$ is correctly represented by

Q12. The displacement $y(t) = A\sin(\omega t + \phi)$ of a pendulum for $\phi = \frac{2\pi}{3}$ is correctly represented by



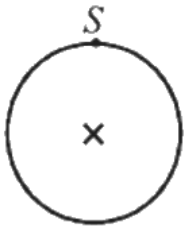
(A) *see figure*
(B) *see figure*
(C) *see figure*
(D) *see figure*

Answer: (A) · Key from source paper

Q166 AIEEE 2012 · 19 May · Online MCQ

A ring is suspended from a point S on its rim as shown in the figure. When displaced from equilibrium, it *(see the figure above)* oscillates with time period of 1 second. The radius of the ring is (take $g = \pi^2$)

Q13. A ring is suspended from a point S on its rim as shown in the figure. When displaced from equilibrium, it



oscillates with time period of 1 second. The radius of the ring is (take $g = \pi^2$)

(1) 0.15 m (2) 1.5 m
(3) 1.0 m (4) 0.5 m

(A) $0.15\ \text{m}$
(B) $1.5\ \text{m}$
(C) $1.0\ \text{m}$
(D) $0.5\ \text{m}$

Answer: (A) $0.15\ \text{m}$ · Key from source paper

Q167 AIEEE 2012 · Offline MCQ

If a simple pendulum has significant amplitude (up to a factor of $1/e$ of original) only in the period between $t = 0$s to $t = \tau$s, then τ may be called the average life of the pendulum. When the spherical bob of the pendulum suffers a retardation (due to viscous drag) proportional to its velocity, with 'b' as the constant of proportionality, the average life time of the pendulum is (assuming damping is small) in seconds:

(A) $\frac{0.693}{b}$
(B) b
(C) $\frac{1}{b}$
(D) $\frac{2}{b}$

Answer: (D) $\frac{2}{b}$ · Key from source paper

Q168 AIEEE 2011 MCQ

Two particles are executing simple harmonic motion of the same amplitude A and frequency ω along the x-axis. Their mean position is separated by distance X_0 ($X_0 > A$). If the maximum separation between them is $(X_0 + A)$, the phase difference between their motion is :

(A) $\frac{\pi}{3}$
(B) $\frac{\pi}{4}$
(C) $\frac{\pi}{6}$
(D) $\frac{\pi}{2}$

Answer: (A) $\frac{\pi}{3}$ · Checked by our team

Q169 AIEEE 2011 MCQ

A mass M, attached to a horizontal spring, executes S.H.M. with amplitude A_1. When the mass M passes through its mean position then a smaller mass m is placed over it and both of them move together with amplitude A_2. The ratio of $\left(\frac{A_1}{A_2}\right)$ is :

(A) $\frac{M+m}{M}$
(B) $\left(\frac{M}{M+m}\right)^{1/2}$
(C) $\left(\frac{M+m}{M}\right)^{1/2}$
(D) $\frac{M}{M+m}$

Answer: (C) $\left(\frac{M+m}{M}\right)^{1/2}$ · Key from source paper

Q170 AIEEE 2007 MCQ

The displacement of an object attached to a spring and executing simple harmonic motion is given by $x = 2 \times 10^{-2} \cos \pi t$ metres. The time at which the maximum speed first occurs is

(A) 0.5 s
(B) 0.75 s
(C) 0.125 s
(D) 0.25 s

Answer: (A) 0.5 s · Key from source paper

Q171 AIEEE 2007 MCQ

A point mass oscillates along the x-axis according to the law $\mathrm{x} = \mathrm{x}_0 \cos(\omega \mathrm{t} - \pi/4)$. If the acceleration of the particle is written as $\mathrm{a} = \mathrm{A} \cos(\omega \mathrm{t} + \delta)$

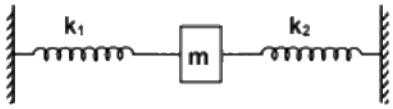
(A) $\mathrm{A} = \mathrm{x}_0,\ \delta = -\pi/4$
(B) $\mathrm{A} = \mathrm{x}_0\omega^2,\ \delta = -\pi/4$
(C) $\mathrm{A} = \mathrm{x}_0\omega^2,\ \delta = -\pi/4$
(D) $\mathrm{A} = \mathrm{x}_0\omega^2,\ \delta = 3\pi/4$

Answer: (D) $\mathrm{A} = \mathrm{x}_0\omega^2,\ \delta = 3\pi/4$ · Key from source paper

Q172 AIEEE 2007 MCQ

see figure

Q17. Two springs, of force constants k_1 and k_2, are connected to a mass m as shown. The frequency of oscillation of the mass is f. If both k_1 and k_2 are made four times their original values, the frequency of oscillation becomes



(1) f/2
(2) f/4
(3) 4f
(4) 2f

(A) f/2
(B) f/4
(C) 4f
(D) 2f

Answer: (D) 2f · Key from source paper

Q173 AIEEE 2007 MCQ

A particle of mass m executes simple harmonic motion with amplitude ' a ' and frequency ' v '. The average kinetic energy during its motion from the position of equilibrium to the end is

(A) $\pi^2 \mathrm{ma}^2 v^2$
(B) $\frac{1}{4}\pi^2 m a^2 v^2$
(C) $4\pi^2 \mathrm{ma}^2 v^2$
(D) $2\pi^2 m a^2 v^2$

Answer: (A) $\pi^2 \mathrm{ma}^2 v^2$ · Key from source paper

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Q174 AIEEE 2006 MCQ

Starting from the origin, a body oscillates simple harmonically with a period of 2 s. After what time will its kinetic energy be 75% of the total energy?

(A) $\frac{1}{12}$ s
(B) $\frac{1}{6}$ s
(C) $\frac{1}{4}$ s
(D) $\frac{1}{3} s$

Answer: (B) $\frac{1}{6}$ s · Key from source paper

Q175 AIEEE 2006 MCQ

The maximum velocity of a particle, executing simple harmonic motion with an amplitude 7 mm, is 4.4 m/s. The period of oscillation is

(A) 100 s
(B) 0.01 s
(C) 10 s
(D) 0.1 s

Answer: (B) 0.01 s · Key from source paper

Q176 AIEEE 2005 MCQ

The function $\sin^2(\omega t)$ represents

(A) a periodic, but not simple harmonic motion with a period $2\pi/\omega$
(B) a periodic, but not simple harmonic motion with a period π/ω
(C) a simple harmonic motion with a period $2\pi/\omega$
(D) a simple harmonic motion with a period π/ω

Answer: (D) a simple harmonic motion with a period π/ω · Key from source paper

Q177 AIEEE 2005 MCQ

Two simple harmonic motions are represented by the equation $y_1 = 0.1 \sin\left(100\pi t + \frac{\pi}{3}\right)$ and $y_2 = 0.1 \cos \pi t$. The phase difference of the velocity of particle 1 w.r.t. the velocity of the particle 2 is

(A) $-\pi/6$
(B) $\pi/3$
(C) $-\pi/3$
(D) $\pi/6$

Answer: (A) $-\pi/6$ · Key from source paper

Q178 AIEEE 2005 MCQ

If a simple harmonic motion is represented by $\frac{d^2x}{dt^2} + \alpha x = 0$, its time period is

(A) $\frac{2\pi}{\alpha}$
(B) $\frac{2\pi}{\sqrt{\alpha}}$
(C) $2\pi\alpha$
(D) $2\pi\sqrt{\alpha}$

Answer: (B) $\frac{2\pi}{\sqrt{\alpha}}$ · Key from source paper

Q179 AIEEE 2005 MCQ

The bob of a simple pendulum is a spherical hollow ball filled with water. A plugged hole near the bottom of the oscillation bob gets suddenly unplugged. During observation, till water is coming out, the time period of oscillation would

(A) first increase and then decrease to the original value.
(B) first decreased then increase to the original value.
(C) remain unchanged.
(D) increase towards a saturation value.

Answer: (A) first increase and then decrease to the original value. · Key from source paper

Q180 AIEEE 2004 MCQ

The bob of a simple pendulum executes simple harmonic motion in water with a period t, while the period of oscillation of the bob is t_0 in air. Neglecting frictional force of water and given that the density of the bob is $\left(\frac{4}{3}\right) \times 1000\ \mathrm{kg/m^3}$. What relationship between t and t_0 is true?

(A) $t = t_0$
(B) $t = t_0/2$
(C) $t = 2t_0$
(D) $\mathrm{t} = 4\mathrm{t}_0$

Answer: (C) $t = 2t_0$ · Key from source paper

Q181 AIEEE 2004 MCQ

A particle at the end of a spring executes simple harmonic motion with a period t_1, while the corresponding period for another spring is t_2. If the period of oscillation with the two springs in series is T, then

(A) $\mathrm{T} = \mathrm{t}_1 + \mathrm{t}_2$
(B) $\mathrm{T}^2 = \mathrm{t}_1^2 + \mathrm{t}_2^2$
(C) $\mathrm{T}^{-1} = \mathrm{t}_1^{-1} + \mathrm{t}_2^{-1}$
(D) $\mathrm{T}^{-2} = \mathrm{t}_1^{-2} + \mathrm{t}_2^{-2}$

Answer: (B) $\mathrm{T}^2 = \mathrm{t}_1^2 + \mathrm{t}_2^2$ · Key from source paper

Q182 AIEEE 2004 MCQ

The total energy of particle, executing simple harmonic motion is

(A) $\propto$ X
(B) $\propto x^2$
(C) independent of x
(D) $\propto x^{1/2}$

Answer: (C) independent of x · Key from source paper

Q183 AIEEE 2004 MCQ

A particle of mass m is attached to a spring (of spring constant k) and has a natural angular frequency ω_0. An external force $F(t)$ proportional to $\cos \omega t$ $(\omega \neq \omega_0)$ is applied to the oscillator. The

time displacement of the oscillator will be proportional to

(A) $\frac{m}{\omega_0^2-\omega^2}$

(B) $\frac{1}{m(\omega_0^2-\omega^2)}$

(C) $\frac{1}{m(\omega_0^2+\omega^2)}$

(D) $\frac{m}{\omega_0^2+\omega^2}$

Answer: (B) $\frac{1}{m(\omega_0^2-\omega^2)}$ · Key from source paper

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Q184 AIEEE 2003 MCQ

The length of a simple pendulum executing simple harmonic motion is increased by 21%. The percentage increase in the time period of the pendulum of increased length is

(A) 11%

(B) 21%

(C) 42%

(D) 10%

Answer: (D) 10% · Key from source paper

Q185 AIEEE 2003 MCQ

A mass M is suspended from a spring of negligible mass. The spring is pulled a little and then released so that the mass executes SHM of time period T. If the mass is increased by m, the time period becomes $\frac{5T}{3}$. Then the ratio of $\frac{m}{M}$ is

(A) $\frac{3}{5}$

(B) $\frac{25}{9}$

(C) $\frac{16}{9}$

(D) $\frac{5}{3}$

Answer: (C) $\frac{16}{9}$ · Key from source paper

Q186 AIEEE 2003 MCQ

Two particles A and B of equal masses are suspended from two massless springs of spring constant k_1 and k_2, respectively. If the maximum velocities, during oscillation, are equal, the ratio of amplitude of A and B is

(A) $\sqrt{\frac{k_1}{k_2}}$

(B) $\frac{k_2}{k_1}$

(C) $\sqrt{\frac{k_2}{k_1}}$

(D) $\frac{k_1}{k_2}$

Answer: (C) $\sqrt{\frac{k_2}{k_1}}$ · Key from source paper

Q187 AIEEE 2003 MCQ

The displacement of a particle varies according to the relation $x = 4(\cos \pi t + \sin \pi t)$. The amplitude of the particle is

(A) -4
(B) 4
(C) $4\sqrt{2}$
(D) 8

Answer: (C) $4\sqrt{2}$ · Key from source paper

Q188 AIEEE 2003 MCQ

A body executes simple harmonic motion. The potential energy (P.E), the kinetic energy (K.E) and total energy (T.E) are measured as a function of displacement x. Which of the following statements is true?

(A) K.E. is maximum when $x = 0$
(B) T.E is zero when $x = 0$
(C) K.E is maximum when x is maximum
(D) P.E. is maximum when $x = 0$

Answer: (A) K.E. is maximum when $x = 0$ · Key from source paper

Q189 AIEEE 2002 MCQ

In a simple harmonic oscillator, at the mean position

(A) kinetic energy is minimum, potential energy is maximum
(B) both kinetic and potential energies are maximum
(C) kinetic energy is maximum, potential energy is minimum
(D) both kinetic and potential energies are minimum

Answer: (C) kinetic energy is maximum, potential energy is minimum · Key from source paper

Q190 AIEEE 2002 MCQ

If a spring has time period T, and is cut into n equal parts, then the time period of each part will be

(A) $\mathrm{T}\sqrt{\mathrm{n}}$
(B) $\mathrm{T}/\sqrt{\mathrm{n}}$
(C) nT
(D) T

Answer: (B) $\mathrm{T}/\sqrt{\mathrm{n}}$ · Key from source paper

Q191 AIEEE 2002 MCQ

A child swinging on a swing in sitting position, stands up, then the time period of the swing will

(A) increase
(B) decrease
(C) remains same
(D) increases if the child is tall and decreases if the child is short

Answer: (B) decrease · Key from source paper

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