

PHYSICS · JEE MAIN

Simple Harmonic Motion

Chapter-wise previous year questions, with answer key

74

PYQS

2020–2025

PAPERS

6

TOPICS

Spring-Mass Systems

Pendulums

Equation of SHM

Energy in SHM

Superposition of SHMs

Damped and Forced Oscillations

- 1 Attempt each question on paper first — they're grouped by topic, newest papers first.
- 2 Check yourself against the answer key at the end.
- 3 Got one wrong? Tap “Step-by-step solution” under it for the full working.

Stuck on a question?

Every question has a free step-by-step solution on PrepWiser — tap “Step-by-step solution” under it.

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Spring-Mass Systems · 14 PYQs

Q1 JEE Main 2025 · 23 Jan · Shift 2

A massless spring gets elongated by amount x_1 under a tension of 5 N . Its elongation is x_2 under the tension of 7 N . For the elongation of $(5x_1 - 2x_2)$, the tension in the spring will be,

- (A) 20 N (B) 39 N
(C) 11 N (D) 15 N

[Step-by-step solution ► prepwisser.in/questions/hjTkn4d1sH](https://www.prepwisser.in/questions/hjTkn4d1sH)

Q2 JEE Main 2024 · 9 Apr · Shift 2

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

(Given $\pi = \frac{22}{7}$)

Numerical answer — enter the value.

[Step-by-step solution ► prepwisser.in/questions/ZqeqkpgjQn](https://www.prepwisser.in/questions/ZqeqkpgjQn)

Q3 JEE Main 2024 · 1 Feb · Shift 2

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 answer — enter the value.

[Step-by-step solution ► prepwisser.in/questions/Lg4CCBCLP1](https://www.prepwisser.in/questions/Lg4CCBCLP1)

Q4 JEE Main 2023 · 10 Apr · Shift 2

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

Numerical answer — enter the value.

[Step-by-step solution ► prepwisser.in/questions/CAARf2CXwr](https://www.prepwisser.in/questions/CAARf2CXwr)

Q5 JEE Main 2023 · 29 Jan · Shift 2

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

Numerical answer — enter the value.

[Step-by-step solution ► prepwisser.in/questions/SAc3zhbVHg](https://www.prepwisser.in/questions/SAc3zhbVHg)

Q6 JEE Main 2023 · 24 Jan · Shift 2

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

Numerical answer — enter the value.

[Step-by-step solution ► prepwisser.in/questions/c34_-Q6ro](https://www.prepwisser.in/questions/c34_-Q6ro)

Q7 JEE Main 2022 · 28 Jul · Shift 2

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

Numerical answer — enter the value.

[Step-by-step solution ► prepwisser.in/questions/hkk-ALYnMs](https://www.prepwisser.in/questions/hkk-ALYnMs)

Q8 JEE Main 2022 · 27 Jul · Shift 1

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 answer — enter the value.

[Step-by-step solution ► prepwisser.in/questions/8o0fSxZKuW](https://www.prepwisser.in/questions/8o0fSxZKuW)

Q9 JEE Main 2022 · 24 Jun · Shift 2

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

[Step-by-step solution ► prepwisser.in/questions/JDIxPzfaZV](https://www.prepwisser.in/questions/JDIxPzfaZV)

Q10 JEE Main 2022

A block of mass 2 kg is placed on a frictionless surface and connected to a spring of spring constant $k = 200\text{ N/m}$. If the block is displaced 0.1 m from equilibrium and released, what is the maximum velocity of the block?

- (A) 0.5 m/s (B) 1.0 m/s
(C) 1.4 m/s (D) 2.0 m/s

[Step-by-step solution ► prepwisser.in/questions/Zf7YrHA7zm](https://www.prepwisser.in/questions/Zf7YrHA7zm)

Q11 JEE Main 2021 · 17 Mar · Shift 2

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

[Step-by-step solution ► prepwisser.in/questions/_AQgpcyY3T](https://www.prepwisser.in/questions/_AQgpcyY3T)

Q12 JEE Main 2021 · 26 Feb · Shift 1

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

[Step-by-step solution ► prepwisser.in/questions/cZrpbmBfRs7](https://www.prepwisser.in/questions/cZrpbmBfRs7)

Q13 JEE Main 2020 · 6 Sep · Shift 1

An object of mass m is suspended at the end of a massless wire of length L and area of crosssection 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) $f = \frac{1}{2\pi} \sqrt{\frac{YA}{mL}}$

(B) $f = \frac{1}{2\pi} \sqrt{\frac{mL}{YA}}$

(C) $f = \frac{1}{2\pi} \sqrt{\frac{YL}{mA}}$

(D) $f = \frac{1}{2\pi} \sqrt{\frac{mA}{YL}}$

Step-by-step solution ► [prepwisar.in/questions/SE_GYMqRYI](https://www.prepwisar.in/questions/SE_GYMqRYI)

Q14 JEE Main 2020 · 3 Sep · Shift 2

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) 1

(B) $\frac{1}{2}$

(C) $\sqrt{2}$

(D) $\frac{1}{\sqrt{2}}$

Step-by-step solution ► [prepwisar.in/questions/FAuUIjq6Mx](https://www.prepwisar.in/questions/FAuUIjq6Mx)

Pendulums · 14 PYQs

Q15 JEE Main 2025 · 4 Apr · Shift 1

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) $\theta_1 l_2 = \theta_2 l_1$

(B) $\theta_1 l_1 = \theta_2 l_2$

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

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

Step-by-step solution ► [prepwisar.in/questions/dAxJuy9CdM](https://www.prepwisar.in/questions/dAxJuy9CdM)

Q16 JEE Main 2025 · 29 Jan · Shift 1

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 but (R) is not the correct explanation of (A).

(B) (A) is true but (R) is false.

(C) Both (A) and (R) are true and (R) is the correct explanation of (A).

(D) (A) is false but (R) is true.

Step-by-step solution ► [prepwisar.in/questions/RcqXwm6mqe](https://www.prepwisar.in/questions/RcqXwm6mqe)

Q17 JEE Main 2024 · 1 Feb · Shift 1

If R is the radius of the earth and the acceleration due to gravity on the surface of earth is $g = \pi^2 \text{m/s}^2$, then the length of the second's pendulum at a height $h = 2R$ from the surface of earth will be, :

- (A) $\frac{1}{9} \text{m}$ (B) $\frac{8}{9} \text{m}$
(C) $\frac{2}{9} \text{m}$ (D) $\frac{4}{9} \text{m}$

[Step-by-step solution ► prepwisar.in/questions/KgLCMA4SRc](https://www.prepwisar.in/questions/KgLCMA4SRc)

Q18 JEE Main 2023 · 6 Apr · Shift 2

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

Numerical answer — enter the value.

[Step-by-step solution ► prepwisar.in/questions/K4jmP1USVM](https://www.prepwisar.in/questions/K4jmP1USVM)

Q19 JEE Main 2023 · 24 Jan · Shift 2

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

[Step-by-step solution ► prepwisar.in/questions/ynCf9gqmO9](https://www.prepwisar.in/questions/ynCf9gqmO9)

Q20 JEE Main 2022 · 29 Jul · Shift 1

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) $2\pi\sqrt{L/(g \cos \alpha)}$
(B) $2\pi\sqrt{L/(g \sin \alpha)}$
(C) $2\pi\sqrt{L/g}$
(D) $2\pi\sqrt{L/(g \tan \alpha)}$

[Step-by-step solution ► prepwisar.in/questions/pGMF7WgYkz](https://www.prepwisar.in/questions/pGMF7WgYkz)

Q21 JEE Main 2022 · 29 Jun · Shift 2

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 cm (B) 25.3 cm
(C) 99.4 cm (D) 406.1 cm

[Step-by-step solution ► prepwisar.in/questions/umXCd_ZiTM](https://www.prepwisar.in/questions/umXCd_ZiTM)

Q22 JEE Main 2022 · 26 Jun · Shift 1

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

Step-by-step solution ► [prepwisar.in/questions/tZBIEUzPAg](https://www.prepwisar.in/questions/tZBIEUzPAg)

Q23 JEE Main 2021 · 31 Aug · Shift 2

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) T

(B) $\frac{3}{2}T$

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

(D) $\frac{4}{3}T$

Step-by-step solution ► [prepwisar.in/questions/SEFfuVhW0Y](https://www.prepwisar.in/questions/SEFfuVhW0Y)

Q24 JEE Main 2021 · 22 Jul · Shift 2

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) $4 T_0$

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

(C) T_0

(D) $8\pi T_0$

Step-by-step solution ► [prepwisar.in/questions/Paqssdtx2m](https://www.prepwisar.in/questions/Paqssdtx2m)

Q25 JEE Main 2021 · 16 Mar · Shift 1

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

(A) $\sqrt{3}T$

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

(C) $\frac{T}{\sqrt{3}}$

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

Step-by-step solution ► [prepwisar.in/questions/WzktKKRoQL](https://www.prepwisar.in/questions/WzktKKRoQL)

Q26 JEE Main 2021 · 26 Feb · Shift 2

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 :

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

[Step-by-step solution ► prepwiser.in/questions/CExEUzJLRK](https://www.prepwiser.in/questions/CExEUzJLRK)

Q27 JEE Main 2021 · 25 Feb · Shift 1

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

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

[Step-by-step solution ► prepwiser.in/questions/VWbjqX25aQ](https://www.prepwiser.in/questions/VWbjqX25aQ)

Q28 JEE Main 2020

A simple pendulum has a time period of 2 s. What is its length in cm? (Take $g = \pi^2 \text{ m/s}^2$)

Numerical answer — enter the value.

[Step-by-step solution ► prepwiser.in/questions/gvNehhWSIs](https://www.prepwiser.in/questions/gvNehhWSIs)

Equation of SHM · 24 PYQs

Q29 JEE Main 2025 · 28 Jan · Shift 2

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

[Step-by-step solution ► prepwiser.in/questions/AIPNaSEW9Y](https://www.prepwiser.in/questions/AIPNaSEW9Y)

Q30 JEE Main 2025 · 24 Jan · Shift 1

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

[Step-by-step solution ► prepwiser.in/questions/-I4KfTMrAq](https://www.prepwiser.in/questions/-I4KfTMrAq)

Q31 JEE Main 2025 · 23 Jan · Shift 1

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, $g = 10\text{m/s}^2$, density of water = 10^3kg/m^3)

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

[Step-by-step solution ► prepwiser.in/questions/Nt9KGdfZTf](https://www.prepwiser.in/questions/Nt9KGdfZTf)

Q32 JEE Main 2024 · 9 Apr · Shift 1

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

Numerical answer — enter the value.

[Step-by-step solution ► prepwiser.in/questions/70462ASLVk](https://www.prepwiser.in/questions/70462ASLVk)

Q33 JEE Main 2024 · 6 Apr · Shift 1

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

Numerical answer — enter the value.

[Step-by-step solution ► prepwiser.in/questions/RksqJFXht1](https://www.prepwiser.in/questions/RksqJFXht1)

Q34 JEE Main 2024 · 4 Apr · Shift 2

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

Numerical answer — enter the value.

[Step-by-step solution ► prepwiser.in/questions/h3Zr8FNAQT](https://www.prepwiser.in/questions/h3Zr8FNAQT)

Q35 JEE Main 2024 · 27 Jan · Shift 1

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

Numerical answer — enter the value.

[Step-by-step solution ► prepwiser.in/questions/VPfdhzXNwI](https://www.prepwiser.in/questions/VPfdhzXNwI)

Q36 JEE Main 2023 · 15 Apr · Shift 1

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

(B) (C) and (D) only

(C) (A), (B) and (C) Only

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

[Step-by-step solution](#) ► [prepwisar.in/questions/GRT6t5upjV](https://www.prepwisar.in/questions/GRT6t5upjV)

Q37 JEE Main 2023 · 10 Apr · Shift 1

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 of δ will be

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

(B) $\frac{\pi}{3}$

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

(D) $\frac{\pi}{6}$

[Step-by-step solution](#) ► [prepwisar.in/questions/F9m5atekCB](https://www.prepwisar.in/questions/F9m5atekCB)

Q38 JEE Main 2023 · 30 Jan · Shift 2

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

Numerical answer — enter the value.

[Step-by-step solution](#) ► [prepwisar.in/questions/18t3WCyn30](https://www.prepwisar.in/questions/18t3WCyn30)

Q39 JEE Main 2023 · 25 Jan · Shift 2

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) 4 s

(B) 1.5 s

(C) 3 s

(D) 2 s

[Step-by-step solution](#) ► [prepwisar.in/questions/tNs2usVw4I](https://www.prepwisar.in/questions/tNs2usVw4I)

Q40 JEE Main 2023 · 25 Jan · Shift 1

Assume that the earth is a solid sphere of uniform density and a tunnel is dug along its diameter throughout the earth. It is found that when a particle is released in this tunnel, it executes a simple harmonic motion. The mass of the particle is 100 g. The time period of the motion of the particle will be (approximately)

(Take $g = 10 \text{ m s}^{-2}$, radius of earth = 6400 km)

(A) 12 hours

(B) 1 hour 24 minutes

(C) 24 hours

(D) 1 hour 40 minutes

[Step-by-step solution ► prepwiser.in/questions/i1M6sPHtYi](https://www.prepwiser.in/questions/i1M6sPHtYi)

Q41 JEE Main 2022 · 26 Jul · Shift 1

When a particle executes Simple Harmonic Motion, the nature of graph of velocity as a function of displacement will be :

(A) Circular

(B) Elliptical

(C) Sinusoidal

(D) Straight line

[Step-by-step solution ► prepwiser.in/questions/V9ZJ4gZnvE](https://www.prepwiser.in/questions/V9ZJ4gZnvE)

Q42 JEE Main 2022 · 27 Jun · Shift 1

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) 6 s

(B) 8 s

(C) 12 s

(D) 36 s

[Step-by-step solution ► prepwiser.in/questions/uWf5RuxlIq](https://www.prepwiser.in/questions/uWf5RuxlIq)

Q43 JEE Main 2022 · 27 Jun · Shift 2

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

(Given : $\pi = 3.14$)

(A) 0 cm s^{-1}

(B) 157 cm s^{-1}

(C) 272 cm s^{-1}

(D) 314 cm s^{-1}

[Step-by-step solution ► prepwiser.in/questions/SbAToZAcY2](https://www.prepwiser.in/questions/SbAToZAcY2)

Q44 JEE Main 2022 · 27 Jun · Shift 2

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 answer — enter the value.

[Step-by-step solution ► prepwiser.in/questions/eo8hej2HbF](https://www.prepwiser.in/questions/eo8hej2HbF)

Q45 JEE Main 2021 · 26 Aug · Shift 2

Two simple harmonic motions are represented by the equations

$x_1 = 5 \sin(2\pi t + \frac{\pi}{4})$ and $x_2 = 5\sqrt{2}(\sin 2\pi t + \cos 2\pi t)$. The amplitude of second motion is times the amplitude in first motion.

Numerical answer — enter the value.

[Step-by-step solution ► prepwisser.in/questions/GGWxfw6D_I](https://www.prepwisser.in/questions/GGWxfw6D_I)

Q46 JEE Main 2021 · 27 Jul · Shift 2

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 $t = 0$ s are 2 cm and 2ω cm s⁻¹ respectively, then its amplitude is $x\sqrt{2}$ cm where the value of x is _____.

Numerical answer — enter the value.

[Step-by-step solution ► prepwisser.in/questions/2JlhREdFy8](https://www.prepwisser.in/questions/2JlhREdFy8)

Q47 JEE Main 2021 · 20 Jul · Shift 2

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

[Step-by-step solution ► prepwisser.in/questions/OI_CLAq0ag](https://www.prepwisser.in/questions/OI_CLAq0ag)

Q48 JEE Main 2021 · 18 Mar · Shift 1

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 answer — enter the value.

[Step-by-step solution ► prepwisser.in/questions/TSbvPPBC5L](https://www.prepwisser.in/questions/TSbvPPBC5L)

Q49 JEE Main 2021 · 18 Mar · Shift 2

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

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

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

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

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

[Step-by-step solution ► prepwisser.in/questions/EewNPTmBmj](https://www.prepwisser.in/questions/EewNPTmBmj)

Q50 JEE Main 2021 · 26 Feb · Shift 2

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 answer — enter the value.

[Step-by-step solution ► prepwisser.in/questions/mFbVcPoiIA](https://www.prepwisser.in/questions/mFbVcPoiIA)

Q51 JEE Main 2021 · 26 Feb · Shift 2

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

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

[Step-by-step solution ► prepwisser.in/questions/34oBh-MZBZ](https://www.prepwisser.in/questions/34oBh-MZBZ)

Q52 JEE Main 2021 · 24 Feb · Shift 2

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

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

[Step-by-step solution ► prepwisser.in/questions/D47jDBDyXD](https://www.prepwisser.in/questions/D47jDBDyXD)

Energy in SHM · 15 PYQs

Q53 JEE Main 2024 · 8 Apr · Shift 2

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

Numerical answer — enter the value.

[Step-by-step solution ► prepwisser.in/questions/p6LwSd-qkc](https://www.prepwisser.in/questions/p6LwSd-qkc)

Q54 JEE Main 2024 · 31 Jan · Shift 1

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 answer — enter the value.

[Step-by-step solution ► prepwisser.in/questions/xQHTSW5fpf](https://www.prepwisser.in/questions/xQHTSW5fpf)

Q55 JEE Main 2024 · 29 Jan · Shift 1

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 answer — enter the value.

[Step-by-step solution ► prepwisser.in/questions/fZuQ6vDmMT](https://www.prepwisser.in/questions/fZuQ6vDmMT)

Q56 JEE Main 2023 · 13 Apr · Shift 2

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) $\frac{1}{2}A$

(C) $2A$

(D) $\sqrt{2}A$

[Step-by-step solution ► prepwisar.in/questions/LLdz2HXnqr](https://www.prepwisar.in/questions/LLdz2HXnqr)

Q57 JEE Main 2023 · 13 Apr · Shift 1

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 40cm and kinetic energy at that time is 200J, the value of force constant is $1.0 \times 10^x \text{Nm}^{-1}$. The value of x is _____.

Numerical answer — enter the value.

[Step-by-step solution ► prepwisar.in/questions/t8bFJaYmPO](https://www.prepwisar.in/questions/t8bFJaYmPO)

Q58 JEE Main 2023 · 12 Apr · Shift 1

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 : 4

(C) 2 : 1

(D) 1 : 3

[Step-by-step solution ► prepwisar.in/questions/i6GkRnNXHY](https://www.prepwisar.in/questions/i6GkRnNXHY)

Q59 JEE Main 2023 · 1 Feb · Shift 1

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

Numerical answer — enter the value.

[Step-by-step solution ► prepwisar.in/questions/3GqV_sCibh](https://www.prepwisar.in/questions/3GqV_sCibh)

Q60 JEE Main 2023 · 31 Jan · Shift 1

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

(A) 9.75 J

(B) 37.5 J

(C) 18.75 J

(D) 12.5 J

[Step-by-step solution ► prepwisar.in/questions/wmnT6ETzm2](https://www.prepwisar.in/questions/wmnT6ETzm2)

Q61 JEE Main 2023 · 30 Jan · Shift 1

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 answer — enter the value.

[Step-by-step solution ► prepwisar.in/questions/LwKugD6j6a](https://www.prepwisar.in/questions/LwKugD6j6a)

Q62 JEE Main 2022 · 29 Jun · Shift 1

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

Numerical answer — enter the value.

[Step-by-step solution ► prepwiser.in/questions/hhflU16z-i](https://www.prepwiser.in/questions/hhflU16z-i)

Q63 JEE Main 2021 · 31 Aug · Shift 2

For a body executing S.H.M. :

- (1) Potential energy is always equal to its K.E.
- (2) Average potential and kinetic energy over any given time interval are always equal.
- (3) Sum of the kinetic and potential energy at any point of time is constant.
- (4) 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) (3) and (4)
- (B) only (3)
- (C) (2) and (3)
- (D) only (2)

[Step-by-step solution ► prepwiser.in/questions/eAVAGIMKRq](https://www.prepwiser.in/questions/eAVAGIMKRq)

Q64 JEE Main 2021 · 27 Jul · Shift 1

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) $y = \frac{a}{2}$

[Step-by-step solution ► prepwiser.in/questions/w6kdsCyHuu](https://www.prepwiser.in/questions/w6kdsCyHuu)

Q65 JEE Main 2021 · 27 Jul · Shift 2

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

- (A) 0.62 J
- (B) 6.2×10^{-3} J
- (C) 1.2×10^3 J
- (D) 6.2×10^3 J

[Step-by-step solution ► prepwiser.in/questions/rvu4eJfRg-](https://www.prepwiser.in/questions/rvu4eJfRg-)

Q66 JEE Main 2021 · 25 Jul · Shift 2

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) $\frac{1}{4}$

Step-by-step solution ► [prepwiser.in/questions/nB3pL0AyBD](https://www.prepwiser.in/questions/nB3pL0AyBD)

Q67 JEE Main 2021 · 17 Mar · Shift 1

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

- (A) $x = \frac{A}{2}$ (B) $x = \pm A$
(C) $x = \pm \frac{A}{\sqrt{2}}$ (D) $x = 0$

Step-by-step solution ► [prepwiser.in/questions/nlSTsd-TzI](https://www.prepwiser.in/questions/nlSTsd-TzI)

Superposition of SHMs · 5 PYQs

Q68 JEE Main 2023 · 10 Apr · Shift 2

For a periodic motion represented by the equation

$$y = \sin \omega t + \cos \omega t$$

the amplitude of the motion is

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

Step-by-step solution ► [prepwiser.in/questions/1v5Uv26cuW](https://www.prepwiser.in/questions/1v5Uv26cuW)

Q69 JEE Main 2023 · 29 Jan · Shift 1

Two simple harmonic waves having equal amplitudes of 8 cm and equal frequency of 10 Hz are moving along the same direction. The resultant amplitude is also 8 cm. The phase difference between the individual waves is _____ degree.

Numerical answer — enter the value.

Step-by-step solution ► [prepwiser.in/questions/oNISWk95Ck](https://www.prepwiser.in/questions/oNISWk95Ck)

Q70 JEE Main 2022 · 25 Jul · Shift 2

Two waves executing simple harmonic motions travelling in the same direction with same amplitude and frequency are superimposed. The resultant amplitude is equal to the $\sqrt{3}$ times of amplitude of individual motions. The phase difference between the two motions is _____ (degree).

Numerical answer — enter the value.

Step-by-step solution ► [prepwiser.in/questions/S1_kCCVYoX](https://www.prepwiser.in/questions/S1_kCCVYoX)

Q71 JEE Main 2022 · 28 Jun · Shift 1

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

- (A) circular (B) helical
(C) parabolic (D) elliptical

Step-by-step solution ► [prepwiser.in/questions/C-7-UNYQtC](https://www.prepwiser.in/questions/C-7-UNYQtC)

Q72 JEE Main 2021 · 27 Aug · Shift 2

Two simple harmonic motion, are represented by the equations $y_1 = 10 \sin \left(3\pi t + \frac{\pi}{3} \right)$ $y_2 = 5(\sin 3\pi t + \sqrt{3} \cos 3\pi t)$ Ratio of amplitude of y_1 to $y_2 = x : 1$. The value of x is _____.

Numerical answer — enter the value.

[Step-by-step solution ► prepwiser.in/questions/GtGEiQTT6q](https://www.prepwiser.in/questions/GtGEiQTT6q)

Damped and Forced Oscillations · 2 PYQs

Q73 JEE Main 2021 · 17 Mar · Shift 2

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

- (A) $0.69 \times 10^2 \text{ kg s}^{-1}$
- (B) $3.3 \times 10^2 \text{ kg s}^{-1}$
- (C) $1.16 \times 10^{-2} \text{ kg s}^{-1}$
- (D) $5.7 \times 10^{-3} \text{ kg s}^{-1}$

[Step-by-step solution ► prepwiser.in/questions/_T-jYs2lsY](https://www.prepwiser.in/questions/_T-jYs2lsY)

Q74 JEE Main 2021 · 16 Mar · Shift 2

Amplitude of a mass-spring system, which is executing simple harmonic motion decreases with time. If mass = 500g, Decay constant = 20 g/s 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) 17.32 s | (B) 34.65 s |
| (C) 0.034 s | (D) 15.01 s |

[Step-by-step solution ► prepwiser.in/questions/a3qF76MeEY](https://www.prepwiser.in/questions/a3qF76MeEY)

Answer key — Simple Harmonic Motion

Numbers match the question numbers above. For full working, open the solution link under each question.

1	C	2	22	3	3	4	20	5	40	6	1	7	2	8	16
9	B	10	B	11	D	12	C	13	A	14	D	15	A	16	C
17	A	18	101	19	D	20	A	21	C	22	C	23	D	24	B
25	B	26	B	27	B	28	100	29	D	30	C	31	A	32	17
33	12	34	10	35	12	36	C	37	D	38	88	39	A	40	B
41	B	42	D	43	B	44	1	45	2	46	2	47	D	48	6
49	D	50	3	51	C	52	D	53	6	54	7	55	9	56	A
57	4	58	D	59	2	60	C	61	8	62	700	63	A	64	D
65	A	66	B	67	C	68	B	69	120	70	60	71	A	72	1
73	C	74	B												

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