

JEE MAIN OSCILLATIONS — PYQS

Max. Marks: 152

Questions: 38

Section A (MCQ) — 24 questions

- Q.1** The frequency of oscillation of a mass m suspended by a spring is ν_1 . If the length of the spring is cut to half, the same mass oscillates with frequency ν_2 . The value of $\frac{\nu_2}{\nu_1}$ is _____.

[JEE Main 2026 (Online) 8th April Evening Shift]

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

Scan or tap for the full solution



- Q.2** 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.

[JEE Main 2026 (Online) 6th April Morning Shift]

- (1) $1/4$ (2) $5/4$ (3) $5/8$ (4) $3/8$

Scan or tap for the full solution



- Q.3** 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 maximum energy in the spring are _____ Hz and _____ J, respectively. (Take $g = 10 \text{ m/s}^2$)

[JEE Main 2026 (Online) 6th April Evening Shift]

(1) $\frac{5\sqrt{50}}{\pi}$ and 8×10^{-3}

(2) $\frac{5\sqrt{50}}{\pi}$ and 8

(3) $10\sqrt{50}$ and 2×10^{-3}

(4) $\frac{5\sqrt{50}}{\pi}$ and 16×10^{-3}



Solution

- Q.4** 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 : [JEE Main 2026 (Online) 5th April Evening Shift]

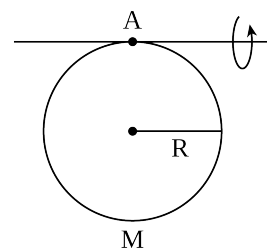
- (1) A-III, B-I, C-IV, D-II
 (2) A-II, B-I, C-III, D-IV
 (3) A-III, B-II, C-IV, D-I
 (4) A-II, B-I, C-IV, D-III



Solution

- Q.5** 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)

[JEE Main 2026 (Online) 4th April Evening Shift]



(1) $2\pi\sqrt{\frac{5R}{4g}}$

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

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

(4) $2\pi\sqrt{\frac{3R}{g}}$

Scan or tap for the full solution



- Q.6** The equation of motion of a particle is given by $x = a \sin(50t + \pi/3)$ 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 _____.

[JEE Main 2026 (Online) 2nd April Evening Shift]

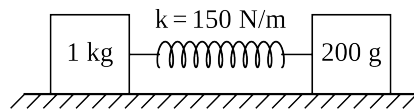
- (1) $\frac{\pi}{300}$ s, $\frac{\pi}{75}$ s (2) $\frac{\pi}{75}$ s, $\frac{\pi}{300}$ s
(3) $\frac{\pi}{300}$ s, $\frac{\pi}{25}$ s (4) $\frac{\pi}{50}$ s, $\frac{\pi}{100}$ s

Scan or tap for the full solution



- Q.7** 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 :

[JEE Main 2026 (Online) 28th January Evening Shift]



- (1) 20 (2) 5 (3) 30 (4) 27

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- Q.8** 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 _____

[JEE Main 2026 (Online) 24th January Morning Shift]

- (1) $2\pi\sqrt{\frac{\rho A}{Mg}}$ (2) $\pi\sqrt{\frac{2M}{\rho Ag}}$
(3) $2\pi\sqrt{\frac{M}{\rho Ag}}$ (4) $\pi\sqrt{\frac{\rho A}{Mg}}$

Scan or tap for the full solution



- Q.9** A spring of force constant 15 N/m is cut into two pieces. If the ratio of their lengths is 1:3, then the force constant of smaller piece is _____ N/m.

[JEE Main 2026 (Online) 24th January Morning Shift]

- (1) 20 (2) 45 (3) 60 (4) 15

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- Q.10** 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.]

[JEE Main 2026 (Online) 23rd January Morning Shift]

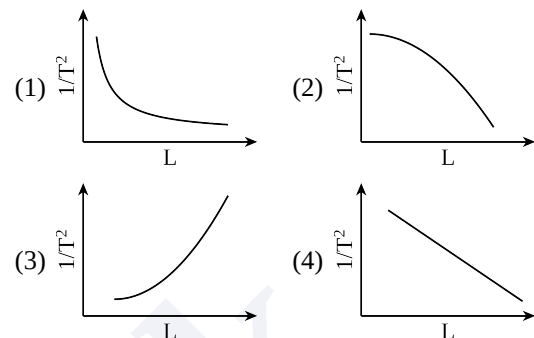
- (1) 0.75 (2) 7.5 (3) 15 (4) 120

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- Q.11** Using a simple pendulum experiment g is determined by measuring its time period T . Which of the following plots represent the correct relation between the pendulum length L and time period T ?

[JEE Main 2026 (Online) 22nd January Evening Shift]



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- Q.12** 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 $\pi = \frac{22}{7}$]

[JEE Main 2026 (Online) 21st January Evening Shift]

- (1) 88 (2) 14 (3) 28 (4) 176

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- Q.13** 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

[JEE Main 2025 (Online) 8th April Evening Shift]

- (1) $10[1 - (2 - x)^2]^{\frac{1}{2}}$ m/s
(2) $10[1 - (2 - x)^2]^{\frac{3}{2}}$ m/s
(3) $10[1 - (2 - x)^2]$ m/s
(4) $10[1 - (2 - x)^2]^2$ m/s

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- Q.14** 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? [JEE Main 2025 (Online) 4th April Morning Shift]

$$(1) \theta_1 l_2 = \theta_2 l_1$$

$$(3) \theta_1 l_2^2 = \theta_2 l_1^2$$

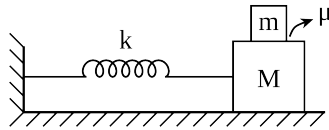
$$(2) \theta_1 l_1 = \theta_2 l_2$$

$$(4) \theta_1 l_1^2 = \theta_2 l_2^2$$

Scan or tap for the full solution



Q.15



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

$$\text{blocks is } T = 2\pi\sqrt{\frac{(m+M)}{k}}$$

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 : [JEE Main 2025 (Online) 3rd April Morning Shift]

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

Scan or tap for the full solution



Q.16 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 $x \times 10^{-2} \text{ m s}^{-2}$. The value of x is :

[JEE Main 2025 (Online) 2nd April Morning Shift]

- (1) $5\sqrt{7}$ (2) 125
(3) $25\sqrt{7}$ (4) 175

Solution

Q.17 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 :

[JEE Main 2025 (Online) 29th January Morning Shift]

- (1) Both (A) and (R) are true but (R) is not the correct explanation of (A).
(2) (A) is true but (R) is false.
(3) Both (A) and (R) are true and (R) is the correct explanation of (A).
(4) (A) is false but (R) is true.

Scan or tap for the full solution



Q.18 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

[JEE Main 2025 (Online) 29th January Evening Shift]

- (1) $\sqrt{\frac{k_2}{k_1}}$ (2) $\sqrt{\frac{k_1}{k_2}}$ (3) $\frac{k_2}{k_1}$ (4) $\frac{k_1}{k_2}$

Scan or tap for the full solution



Q.19 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 :

[JEE Main 2025 (Online) 28th January Evening Shift]

- (1) (A) is true but (R) is false
(2) Both (A) and (R) are true but (R) is NOT the correct explanation of (A)
(3) (A) is false but (R) is true
(4) Both (A) and (R) are true and (R) is the correct explanation of (A)

Scan or tap for the full solution



Q.20 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

[JEE Main 2025 (Online) 24th January Morning Shift]

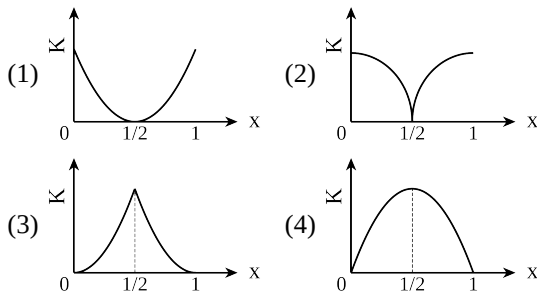
- (1) 10 (2) $\frac{16}{5}$ (3) 25 (4) $\frac{15}{4}$

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- Q.21** 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

[JEE Main 2025 (Online) 24th January Evening Shift]



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- Q.22** 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/s², density of water = 10^3 kg/m³)

[JEE Main 2025 (Online) 23rd January Morning Shift]

- (1) 2 (2) 4 (3) 1 (4) 6

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- Q.23** Given below are two statements. One is labelled as **Assertion (A)** and the other is labelled as **Reason (R)**.

Assertion (A): A simple pendulum is taken to a planet of mass and radius, 4 times and 2 times, respectively, that of the Earth. The time period of the pendulum remains same on earth and the planet.

Reason (R): The mass of the pendulum remains unchanged at Earth and the other planet.

In the light of the above statements, choose the correct answer from the options given below :

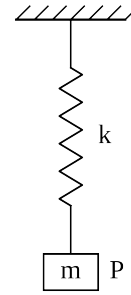
[JEE Main 2025 (Online) 22nd January Evening Shift]

- (1) Both (A) and (R) are true and (R) is the correct explanation of (A)
 (2) (A) is false but (R) is true
 (3) (A) is true but (R) is false
 (4) Both (A) and (R) are true but (R) is NOT the correct explanation of (A)

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- Q.24** 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:

[JEE Main 2024 (Online) 4th April Evening Shift]



- (1) $E/\sqrt{2}$ (2) $2E$ (3) $E\sqrt{2}$ (4) E

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Section B (Numerical) — 14 questions

- Q.25** 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 _____. [JEE Main 2026 (Online) 4th April Morning Shift]

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- Q.26** 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 _____. [JEE Main 2026 (Online) 28th January Morning Shift]

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- Q.27** 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 _____. [JEE Main 2024 (Online) 9th April Morning Shift]

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- Q.28** A particle of mass 0.50 kg 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 _____. [JEE Main 2024 (Online) 9th April Evening Shift]

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

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- Q.29** 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.

[JEE Main 2024 (Online) 8th April Evening Shift]

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- Q.30** 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.

[JEE Main 2024 (Online) 6th April Morning Shift]

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- Q.31** The displacement of a particle executing SHM is given by $x = 10\sin\left(\omega t + \frac{\pi}{3}\right)$ m. The time period of motion is 3.14 s. The velocity of the particle at $t = 0$ is _____ m/s.

[JEE Main 2024 (Online) 4th April Evening Shift]

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- Q.32** 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 _____.

[JEE Main 2024 (Online) 1st February Evening Shift]

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- Q.33** 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 _____.

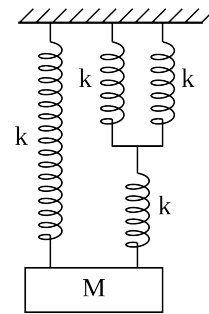
[JEE Main 2024 (Online) 31st January Morning Shift]

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- Q.34** 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 _____.

[JEE Main 2024 (Online) 31st January Evening Shift]



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- Q.35** A simple pendulum is placed at a place where its distance from the earth's surface is equal to the radius of the earth. If the length of the string is 4 m, then the time period of small oscillations will be _____ s. [take $g = \pi^2 \text{ m s}^{-2}$]

[JEE Main 2024 (Online) 30th January Evening Shift]

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- Q.36** 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 $x =$ _____.

[JEE Main 2024 (Online) 29th January Morning Shift]

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- Q.37** 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 $x =$ _____.

[JEE Main 2024 (Online) 29th January Evening Shift]

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- Q.38** A particle executes simple harmonic motion with an amplitude of 4 cm. At the mean position, velocity of the particle is 10 cm/s. The distance of the particle from the mean position when its speed becomes 5 cm/s is $\sqrt{\alpha}$ cm, where $\alpha =$ _____.

[JEE Main 2024 (Online) 27th January Morning Shift]

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ANSWER KEY

Section A (MCQ) — 24 questions

Ques.	1	2	3	4	5	6	7	8	9	10	11
Ans.	3	3	1	1	1	1	3	3	3	2	1
Ques.	12	13	14	15	16	17	18	19	20	21	22
Ans.	2	1	1	3	4	3	2	4	3	4	1
Ques.	23	24									
Ans.	4	4									

Section B (Numerical) — 14 questions

Ques.	25	26	27	28	29	30	31	32	33	34	35
Ans.	44	2	17	22	6	12	10	3	7	12	8
Ques.	36	37	38								
Ans.	9	2	12								