PART 1 - PHYSICS

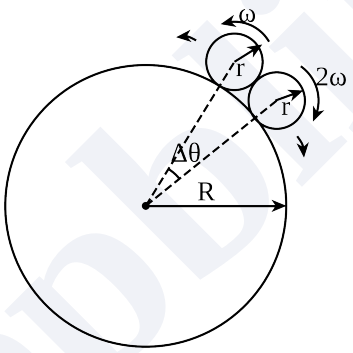
Topic : System of particles and rotational motion, Oscillations

SECTION–1 : (Maximum Marks : 6)

- This section contains **TWO** questions.
- Each question has **FOUR** options (A), (B), (C) and (D). **ONLY ONE** of these four options is the correct answer.
- For each question, choose the option corresponding to the correct answer.
- Answer to each question will be evaluated according to the following marking scheme :

Full Marks	: +3	If ONLY the correct option is chosen;
Zero Marks	: 0	If none of the options is chosen (i.e. the question is unanswered);
Negative Marks	: −1	In all other cases.

1. Consider a large disk of radius R and two smaller disks, each of radius r = R/50, lying on its circumference, as shown in the figure. The smaller disks are initially in contact with each other, with an angular separation $\Delta\theta$ between their centers. They are made to roll without slipping in opposite directions, with constant angular velocities ω and 2ω while the large disk is held stationary. The time τ at which the smaller disks are again in contact is:
[Use $\sin(\Delta\theta) = \Delta\theta$ and ignore gravity.] [JEE Advanced 2026 Paper 1]



(A) $\tau = 51 \times \left(2\pi - \frac{4}{51}\right)/\omega$

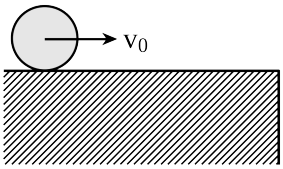
(B) $\tau = 51 \times \left(2\pi - \frac{2}{51}\right)/3\omega$

(C) $\tau = 51 \times \left(2\pi - \frac{4}{51}\right)/3\omega$

(D) $\tau = 51 \times \left(2\pi - \frac{2}{51}\right)/\omega$

Scan or tap for the full solution

2. A solid cylinder of radius R rolls without slipping with a center of mass speed $v_0 = \sqrt{\frac{gR}{3}}$ on a horizontal surface with a vertical edge, as shown in the figure. Here, g is the acceleration due to the gravity. At the moment when the cylinder loses contact with the surface due to rotation around the corner, the speed of its center of mass is: [JEE Advanced 2026 Paper 1]



Space for Rough Work

(A) 0 (B) $\sqrt{\frac{5gR}{7}}$ (C) $\sqrt{\frac{gR}{15}}$ (D) $\sqrt{\frac{3gR}{7}}$

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Space for Rough Work

SECTION–2 : (Maximum Marks : 12)

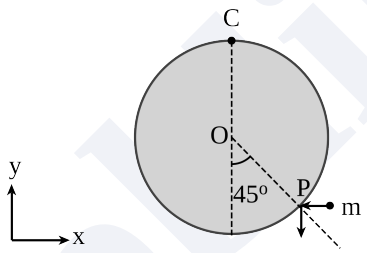
- This section contains **TWO** paragraphs.
- Based on each paragraph, there are **THREE** questions.
- The answer to each question is a **NUMERICAL VALUE**.
- For each question, enter the correct numerical value of the answer (in decimal notation, truncated / rounded-off to the **SECOND DECIMAL PLACE**; e.g. 6.25, 7.00, −0.33, −.30, 30.27, −127.30) in the place designated to enter the answer.
- Answer to each question will be evaluated according to the following marking scheme :

Full Marks : +2 If ONLY the correct answer is entered;
Zero Marks : 0 In all other cases.

Paragraph for Questions 3 and 4

A uniform circular disk of radius 0.2 m and mass 1 kg is pivoted at its top point C such that it can rotate freely around C in the XY plane, as shown in the figure. Initially, when the disk is at rest, a particle of mass 20 g, travelling along negative x direction in the XY plane with speed 100 m s^{-1}, hits the circumference of the disk at a point P. After collision the particle moves along negative y direction at a speed of 90 m s^{-1}.

[Given: the acceleration due to gravity (g) $= -10\hat{j}$ m s^{-2}]



3. After the collision the disk starts to rotate around point C in the XY plane. The maximum change in the height (in m) of its center O is: [JEE Advanced 2026 Paper 2]

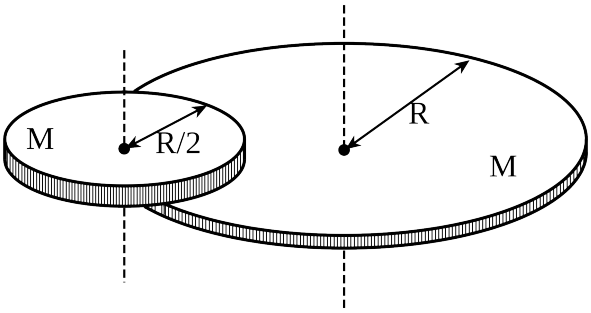
Scan or tap for the full solution

4. Amount of energy loss (in J) in the collision is: [JEE Advanced 2026 Paper 2]

Scan or tap for the full solution

5. A disc of mass M and radius R is free to rotate about its vertical axis as shown in the figure. A battery operated motor of negligible mass is fixed to this disc at a point on its circumference. Another disc of the same mass M and radius R/2 is fixed to the motor's thin shaft. Initially, both the discs are at rest. The motor is switched on so that the smaller disc rotates at a uniform angular speed ω. If the angular speed at which the large disc rotates is ω/n, then the value of n is _____. [JEE Advanced 2024 Paper 1]

Space for Rough Work



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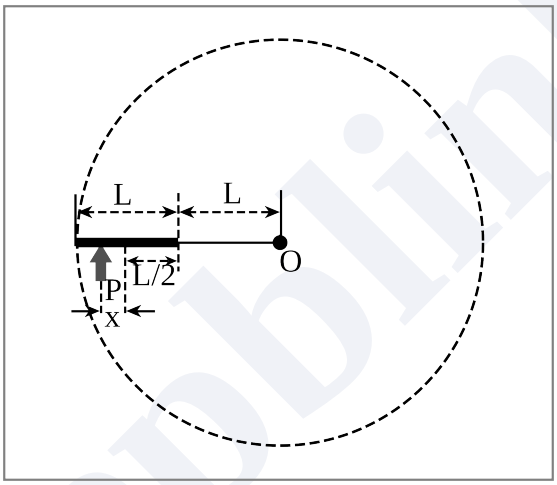
6. A thin uniform rod of length L and certain mass is kept on a frictionless horizontal table with a massless string of length L fixed to one end (top view is shown in the figure). The other end of the string is pivoted to a point O. If a horizontal impulse P is imparted to the rod at a distance x = L/n from the mid-point of the rod (see figure), then the rod and string revolve together around the point O, with the rod remaining aligned with the string. In such a case, the value of n is _____. [JEE Advanced 2024 Paper 1]



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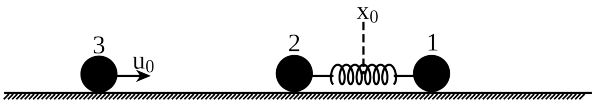
Paragraph for Questions 7 and 8

Two particles, 1 and 2, each of mass m, are connected by a massless spring, and are on a horizontal frictionless plane, as shown in the figure. Initially, the two particles, with their center of mass at x_0, are oscillating with amplitude a and angular frequency ω. Thus, their positions at time t are given by $x_1(t) = (x_0 + d) + a\sin\omega t$ and $x_2(t) = (x_0 - d) - a\sin\omega t$, respectively, where d > 2a. Particle 3 of mass m moves towards this system with speed $u_0 = a\omega/2$, and undergoes instantaneous elastic collision with particle 2, at time t_0. Finally, particles 1 and 2 acquire a center of mass speed v_{cm} and oscillate with amplitude b and the same angular frequency ω.



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7. If the collision occurs at time $t_0 = 0$, the value of $v_{cm}/(a\omega)$ will be _____. [JEE Advanced 2024 Paper 2]

Scan or tap for the full solution

8. If the collision occurs at time $t_0 = \pi/(2\omega)$, then the value of $4b^2/a^2$ will be _____.

[JEE Advanced 2024 Paper 2]

Scan or tap for the full solution

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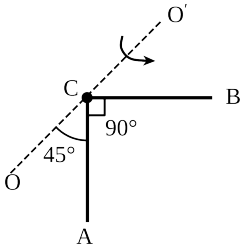
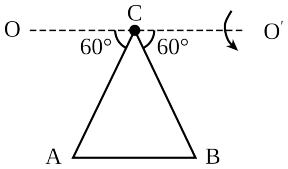
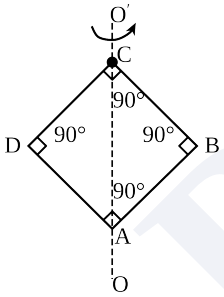
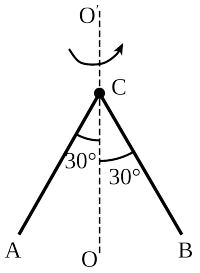
Space for Rough Work

SECTION–3 : (Maximum Marks : 4)

- This section contains **ONE** question.
- Each question has **TWO** lists: **List-I** and **List-II**.
- Four options are given representing matching of elements from List-I and List-II. **ONLY ONE** of these four options corresponds to a correct matching.
- For each question, choose the option corresponding to the correct answer.
- Answer to each question will be evaluated according to the following marking scheme :

Full Marks	: +4	If ONLY the correct option is chosen;
Zero Marks	: 0	If none of the options is chosen (i.e. the question is unanswered);
Negative Marks	: −1	In all other cases.

9. **List-I** shows four planar structures made of uniform solid rods each of mass m and length l. In the **List-II** the possible moment of inertia of these structures about an axis OCO', which lies in the plane of the structures, are given.

	List-I		List-II
P.		1.	$\frac{5}{4}ml^2$
Q.		2.	$\frac{1}{6}ml^2$
R.		3.	$\frac{1}{12}ml^2$
S.		4.	$\frac{2}{3}ml^2$
		5.	$\frac{1}{3}ml^2$

Space for Rough Work

Choose the option that describes the correct match between the entries in List-I to those in List-II.

[JEE Advanced 2026 Paper 1]

(A) $P \to 5, Q \to 1, R \to 4, S \to 2$

(B) $P \to 1, Q \to 3, R \to 4, S \to 2$

(C) $P \to 5, Q \to 3, R \to 2, S \to 1$

(D) $P \to 5, Q \to 4, R \to 2, S \to 1$

Solution

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Space for Rough Work

JEE ADVANCED SYSTEM OF PARTICLES AND ROTATIONAL MOTION — PYQS

Test Pattern : **JEE (Advanced)**

ANSWER KEY

SECTION–1

Ques.	1	2
Ans.	C	B

SECTION–2

Ques.	3	4	5	6	7	8
Ans.	0.14 to 0.16	17 to 18	12	18	0.75	4.25

SECTION–3

Ques.	9
Ans.	A

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