

PHYSICS · JEE MAIN

Rotational Motion

Chapter-wise previous year questions, with answer key

68

PYQS

2020–2025

PAPERS

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TOPICS

Moment of Inertia

Torque and Angular Momentum

Rolling Motion

Conservation of Angular Momentum

Uniform Circular Motion

Linear Momentum and Kinetic Energy

- 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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Moment of Inertia · 16 PYQs

Q1 JEE Main 2025 · 8 Apr · Shift 2

A rod of linear mass density ' λ ' and length ' L ' is bent to form a ring of radius ' R '. Moment of inertia of ring about any of its diameter is.

- (A) $\frac{\lambda L^3}{8\pi^2}$
(B) $\frac{\lambda L^3}{16\pi^2}$
(C) $\frac{\lambda L^3}{4\pi^2}$
(D) $\frac{\lambda L^3}{12}$

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

Q2 JEE Main 2025 · 2 Apr · Shift 2

The moment of inertia of a circular ring of mass M and diameter r about a tangential axis lying in the plane of the ring is :

- (A) $\frac{3}{8}Mr^2$ (B) $2Mr^2$
(C) $\frac{1}{2}Mr^2$ (D) $\frac{3}{2}Mr^2$

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

Q3 JEE Main 2023 · 15 Apr · Shift 1

A solid sphere and a solid cylinder of same mass and radius are rolling on a horizontal surface without slipping. The ratio of their radius of gyration respectively ($k_{\text{sph}} : k_{\text{cyl}}$) is $2 : \sqrt{x}$. The value of x is _____.

Numerical answer — enter the value.

[Step-by-step solution ► prepwiser.in/questions/C7arqPhsoK](https://www.prepwiser.in/questions/C7arqPhsoK)

Q4 JEE Main 2023 · 11 Apr · Shift 1

A solid sphere of mass 500g and radius 5cm is rotated about one of its diameter with angular speed of 10rad s^{-1} . If the moment of inertia of the sphere about its tangent is $x \times 10^{-2}$ times its angular momentum about the diameter. Then the value of x will be _____.

Numerical answer — enter the value.

[Step-by-step solution ► prepwiser.in/questions/7Ks7kpKue7](https://www.prepwiser.in/questions/7Ks7kpKue7)

Q5 JEE Main 2023 · 8 Apr · Shift 1

The moment of inertia of a semicircular ring about an axis, passing through the center and perpendicular to the plane of ring, is $\frac{1}{x}MR^2$, where R is the radius and M is the mass of the semicircular ring. The value of x will be _____.

Numerical answer — enter the value.

[Step-by-step solution ► prepwiser.in/questions/rGQtKX7DBB](https://www.prepwiser.in/questions/rGQtKX7DBB)

Q6 JEE Main 2023 · 6 Apr · Shift 1

Two identical solid spheres each of mass 2kg and radii 10cm are fixed at the ends of a light rod. The separation between the centres of the spheres is 40cm. The moment of inertia of the system about an axis perpendicular to the rod passing through its middle point is _____ $\times 10^{-3}\text{kgm}^2$

Numerical answer — enter the value.

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

Q7 JEE Main 2023 · 6 Apr · Shift 2

A ring and a solid sphere rotating about an axis passing through their centers have same radii of gyration. The axis of rotation is perpendicular to plane of ring. The ratio of radius of ring to that of sphere is $\sqrt{\frac{2}{x}}$. The value of x is _____.

Numerical answer — enter the value.

[Step-by-step solution](https://www.prepwisser.in/questions/CgMyznVN3D) ► [prepwisser.in/questions/CgMyznVN3D](https://www.prepwisser.in/questions/CgMyznVN3D)

Q8 JEE Main 2023 · 31 Jan · Shift 2

Two discs of same mass and different radii are made of different materials such that their thicknesses are 1cm and 0.5cm respectively. The densities of materials are in the ratio 3 : 5. The moment of inertia of these discs respectively about their diameters will be in the ratio of $\frac{x}{6}$. The value of x is _____.

Numerical answer — enter the value.

[Step-by-step solution](https://www.prepwisser.in/questions/VwD93hA6Ut) ► [prepwisser.in/questions/VwD93hA6Ut](https://www.prepwisser.in/questions/VwD93hA6Ut)

Q9 JEE Main 2023 · 30 Jan · Shift 1

A thin uniform rod of length 2m, cross sectional area 'A' and density 'd' is rotated about an axis passing through the centre and perpendicular to its length with angular velocity ω . If value of ω in terms of its rotational kinetic energy E is $\sqrt{\frac{\alpha E}{Ad}}$ then value of α is _____.

Numerical answer — enter the value.

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

Q10 JEE Main 2023 · 24 Jan · Shift 2

A uniform solid cylinder with radius R and length L has moment of inertia I_1 , about the axis of the cylinder. A concentric solid cylinder of radius $R' = \frac{R}{2}$ and length $L' = \frac{L}{2}$ is carved out of the original cylinder. If I_2 is the moment of inertia of the carved out portion of the cylinder then $\frac{I_1}{I_2} = \frac{x}{y}$. (Both I_1 and I_2 are about the axis of the cylinder)

Numerical answer — enter the value.

[Step-by-step solution](https://www.prepwisser.in/questions/MITiy4dH9v) ► [prepwisser.in/questions/MITiy4dH9v](https://www.prepwisser.in/questions/MITiy4dH9v)

Q11 JEE Main 2022 · 26 Jul · Shift 2

The radius of gyration of a cylindrical rod about an axis of rotation perpendicular to its length and passing through the center will be _____ m.

Given, the length of the rod is $10\sqrt{3}$ m.

Numerical answer — enter the value.

[Step-by-step solution](https://www.prepwisser.in/questions/mTWTaEMk0-) ► [prepwisser.in/questions/mTWTaEMk0-](https://www.prepwisser.in/questions/mTWTaEMk0-)

Q12 JEE Main 2022 · 29 Jun · Shift 2

The moment of inertia of a uniform thin rod about a perpendicular axis passing through one end is I_1 . The same rod is bent into a ring and its moment of inertia about a diameter is I_2 . If $\frac{I_1}{I_2}$ is $\frac{x\pi^2}{3}$, then the value of x will be _____.

Numerical answer — enter the value.

[Step-by-step solution](https://www.prepwisser.in/questions/gl33cEFyMO) ► [prepwisser.in/questions/gl33cEFyMO](https://www.prepwisser.in/questions/gl33cEFyMO)

Q13 JEE Main 2022 · 25 Jun · Shift 2

Moment of Inertia (M.I.) of four bodies having same mass 'M' and radius '2R' are as follows:

I_1 = M.I. of solid sphere about its diameter

I_2 = M.I. of solid cylinder about its axis

I_3 = M.I. of solid circular disc about its diameter

I_4 = M.I. of thin circular ring about its diameter

If $2(I_2 + I_3) + I_4 = x \cdot I_1$, then the value of x will be _____.

Numerical answer — enter the value.

[Step-by-step solution ► prepwisser.in/questions/S067ZwaSoP](https://www.prepwisser.in/questions/S067ZwaSoP)

Q14 JEE Main 2021 · 25 Jul · Shift 1

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

Assertion A : Moment of inertia of a circular disc of mass 'M' and radius 'R' about X, Y axes (passing through its plane) and Z-axis which is perpendicular to its plane were found to be I_x , I_y and I_z respectively. The respectively radii of gyration about all the three axes will be the same.

Reason R : A rigid body making rotational motion has fixed mass and shape. 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 not correct but R is correct.

(C) A is correct but R is not correct.

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

[Step-by-step solution ► prepwisser.in/questions/zn_tQpICs1](https://www.prepwisser.in/questions/zn_tQpICs1)

Q15 JEE Main 2021 · 24 Feb · Shift 1

Moment of inertia (M. I.) of four bodies, having same mass and radius, are reported as;

I_1 = M.I. of thin circular ring about its diameter,

I_2 = M.I. of circular disc about an axis perpendicular to disc and going through the centre,

I_3 = M.I. of solid cylinder about its axis and

I_4 = M.I. of solid sphere about its diameter.

Then :

(A) $I_1 = I_2 = I_3 > I_4$

(B) $I_1 + I_3 < I_2 + I_4$

(C) $I_1 = I_2 = I_3 < I_4$

(D) $I_1 + I_2 = I_3 + \frac{5}{2} I_4$

[Step-by-step solution ► prepwisser.in/questions/vuRvA6feDI](https://www.prepwisser.in/questions/vuRvA6feDI)

Q16 JEE Main 2020 · 4 Sep · Shift 2

Consider two uniform discs of the same thickness and different radii $R_1 = R$ and $R_2 = \alpha R$ made of the same material. If the ratio of their moments of inertia I_1 and I_2 , respectively, about their axes is $I_1 : I_2 = 1 : 16$ then the value of α is :

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

[Step-by-step solution](#) ► [prepwisser.in/questions/HtVfIAB4DF](https://www.prepwisser.in/questions/HtVfIAB4DF)

Torque and Angular Momentum · 17 PYQs

Q17 JEE Main 2025 · 8 Apr · Shift 2

A thin solid disk of 1 kg is rotating along its diameter axis at the speed of 1800 rpm . By applying an external torque of $25\pi \text{ Nm}$ for 40 s , the speed increases to 2100 rpm . The diameter of the disk is _____ m.

Numerical answer — enter the value.

[Step-by-step solution](#) ► [prepwisser.in/questions/c-FBdcFRi9](https://www.prepwisser.in/questions/c-FBdcFRi9)

Q18 JEE Main 2025 · 4 Apr · Shift 1

Which of the following are correct expression for torque acting on a body?

- A. $\vec{\tau} = \vec{r} \times \vec{L}$
B. $\vec{\tau} = \frac{d}{dt}(\vec{r} \times \vec{p})$
C. $\vec{\tau} = \vec{r} \times \frac{d\vec{p}}{dt}$
D. $\vec{\tau} = I\vec{\alpha}$
E. $\vec{\tau} = \vec{r} \times \vec{F}$

($\vec{r}$ = position vector; $\vec{p}$ = linear momentum; $\vec{L}$ = angular momentum; $\vec{\alpha}$ = angular acceleration; I = moment of inertia; $\vec{F}$ = force; t = time)

Choose the correct answer from the options given below:

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

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

Q19 JEE Main 2025 · 29 Jan · Shift 1

The coordinates of a particle with respect to origin in a given reference frame is (1, 1, 1) meters. If a force of $\vec{F} = \hat{i} - \hat{j} + \hat{k}$ acts on the particle, then the magnitude of torque (with respect to origin) in z-direction is _____.

Numerical answer — enter the value.

[Step-by-step solution](#) ► [prepwisser.in/questions/crYdGTKO8i](https://www.prepwisser.in/questions/crYdGTKO8i)

Q20 JEE Main 2025 · 24 Jan · Shift 1

An object of mass 'm' is projected from origin in a vertical xy plane at an angle 45° with the x-axis with an initial velocity v_0 . The magnitude and direction of the angular momentum of the object with respect to origin, when it reaches at the maximum height, will be [g is acceleration due to gravity]

- (A) $\frac{mv_0^3}{2\sqrt{2}g}$ along negative z-axis
 (B) $\frac{mv_0^3}{2\sqrt{2}g}$ along positive z-axis
 (C) $\frac{mv_0^3}{4\sqrt{2}g}$ along positive z-axis
 (D) $\frac{mv_0^3}{4\sqrt{2}g}$ along negative z-axis

Step-by-step solution ► [prepwiser.in/questions/z1slflq6VJ](https://www.prepwiser.in/questions/z1slflq6VJ)

Q21 JEE Main 2025 · 23 Jan · Shift 2

A circular disk of radius R meter and mass M kg is rotating around the axis perpendicular to the disk. An external torque is applied to the disk such that $\theta(t) = 5t^2 - 8t$, where $\theta(t)$ is the angular position of the rotating disc as a function of time t. How much power is delivered by the applied torque, when $t = 2s$?

- (A) $60MR^2$ (B) $72MR^2$
 (C) $8MR^2$ (D) $108MR^2$

Step-by-step solution ► [prepwiser.in/questions/lpN5FKm4IA](https://www.prepwiser.in/questions/lpN5FKm4IA)

Q22 JEE Main 2024 · 9 Apr · Shift 1

A string is wrapped around the rim of a wheel of moment of inertia 0.40kgm^2 and radius 10cm. The wheel is free to rotate about its axis. Initially the wheel is at rest. The string is now pulled by a force of 40N. The angular velocity of the wheel after 10s is $x\text{rad/s}$, where x is _____.

Numerical answer — enter the value.

Step-by-step solution ► [prepwiser.in/questions/IN7IOvOMkz](https://www.prepwiser.in/questions/IN7IOvOMkz)

Q23 JEE Main 2024 · 29 Jan · Shift 2

A body of mass 5kg moving with a uniform speed $3\sqrt{2}\text{ms}^{-1}$ in X – Y plane along the line $y = x + 4$. The angular momentum of the particle about the origin will be _____ $\text{kgm}^2\text{s}^{-1}$.

Numerical answer — enter the value.

Step-by-step solution ► [prepwiser.in/questions/HIdC7KMScq](https://www.prepwiser.in/questions/HIdC7KMScq)

Q24 JEE Main 2023 · 13 Apr · Shift 2

A light rope is wound around a hollow cylinder of mass 5 kg and radius 70 cm. The rope is pulled with a force of 52.5 N. The angular acceleration of the cylinder will be _____ rad s^{-2} .

Numerical answer — enter the value.

Step-by-step solution ► [prepwiser.in/questions/NrI_1y12XD](https://www.prepwiser.in/questions/NrI_1y12XD)

Q25 JEE Main 2023 · 10 Apr · Shift 2

A force of $-P\hat{k}$ acts on the origin of the coordinate system. The torque about the point $(2, -3)$ is $P(a\hat{i} + b\hat{j})$, The ratio of $\frac{a}{b}$ is $\frac{x}{2}$. The value of x is -

Numerical answer — enter the value.

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

Q26 JEE Main 2022 · 28 Jun · Shift 2

A ball is spun with angular acceleration $\alpha = 6t^2 - 2t$ where t is in second and α is in rads^{-2} . At $t = 0$, the ball has angular velocity of 10 rads^{-1} and angular position of 4 rad. The most appropriate expression for the angular position of the ball is :

- (A) $\frac{3}{2}t^4 - t^2 + 10t$
 (B) $\frac{t^4}{2} - \frac{t^3}{3} + 10t + 4$
 (C) $\frac{2t^4}{3} - \frac{t^3}{6} + 10t + 12$
 (D) $2t^4 - \frac{t^3}{2} + 5t + 4$

Step-by-step solution ► [prepwisser.in/questions/UsgA51NxTd](https://www.prepwisser.in/questions/UsgA51NxTd)

Q27 JEE Main 2022 · 28 Jun · Shift 1

The position vector of 1 kg object is $\vec{r} = (3\hat{i} - \hat{j}) \text{ m}$ and its velocity $\vec{v} = (3\hat{j} + \hat{k}) \text{ ms}^{-1}$. The magnitude of its angular momentum is $\sqrt{x} \text{ Nm}$ where x is _____.

Numerical answer — enter the value.

Step-by-step solution ► [prepwisser.in/questions/O7C2BZ5-p1](https://www.prepwisser.in/questions/O7C2BZ5-p1)

Q28 JEE Main 2022 · 24 Jun · Shift 2

A fly wheel is accelerated uniformly from rest and rotates through 5 rad in the first second. The angle rotated by the fly wheel in the next second, will be :

- (A) 7.5 rad (B) 15 rad
 (C) 20 rad (D) 30 rad

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

Q29 JEE Main 2021 · 25 Jul · Shift 1

A particle of mass 'm' is moving in time 't' on a trajectory given by

$$\vec{r} = 10\alpha t^2 \hat{i} + 5\beta(t - 5)\hat{j}$$

Where α and β are dimensional constants.

The angular momentum of the particle becomes the same as it was for $t = 0$ at time $t =$ _____ seconds.

Numerical answer — enter the value.

Step-by-step solution ► [prepwisser.in/questions/7E8-sxSFpS](https://www.prepwisser.in/questions/7E8-sxSFpS)

Q30 JEE Main 2021 · 25 Jul · Shift 2

A solid disc of radius 20 cm and mass 10 kg is rotating with an angular velocity of 600 rpm, about an axis normal to its circular plane and passing through its centre of mass. The retarding torque required to bring the disc at rest in 10 s is _____ $\pi \times 10^{-1} \text{ Nm}$.

Numerical answer — enter the value.

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

Q31 JEE Main 2021 · 16 Mar · Shift 2

A force $\vec{F} = 4\hat{i} + 3\hat{j} + 4\hat{k}$ is applied on an intersection point of $x = 2$ plane and x -axis. The magnitude of torque of this force about a point $(2, 3, 4)$ is _____. (Round off to the Nearest Integer)

Numerical answer — enter the value.

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

Q32 JEE Main 2020 · 5 Sep · Shift 1

A force $\vec{F} = (\hat{i} + 2\hat{j} + 3\hat{k})$ N acts at a point $(4\hat{i} + 3\hat{j} - \hat{k})$ m. Then the magnitude of torque about the point $(\hat{i} + 2\hat{j} + \hat{k})$ m will be $\sqrt{x}$ N m. The value of x is _____.

Numerical answer — enter the value.

[Step-by-step solution ► prepwiser.in/questions/5Ua_WPR6-6](https://www.prepwiser.in/questions/5Ua_WPR6-6)

Q33 JEE Main 2020 · 4 Sep · Shift 2

A circular coil has moment of inertia 0.8 kg m^2 around any diameter and is carrying current to produce a magnetic moment of 20 Am^2 . The coil is kept initially in a vertical position and it can rotate freely around a horizontal diameter. When a uniform magnetic field of 4 T is applied along the vertical, it starts rotating around its horizontal diameter. The angular speed the coil acquires after rotating by 60° will be:

- (A) $10 \pi \text{ rad s}^{-1}$
- (B) $20 \pi \text{ rad s}^{-1}$
- (C) $10(3)^{1/4} \text{ rad s}^{-1}$
- (D) 20 rad s^{-1}

[Step-by-step solution ► prepwiser.in/questions/zM11UDvW6z](https://www.prepwiser.in/questions/zM11UDvW6z)

Rolling Motion · 19 PYQs

Q34 JEE Main 2025 · 4 Apr · Shift 1

A circular ring and a solid sphere having same radius roll down on an inclined plane from rest without slipping. The ratio of their velocities when reached at the bottom of the plane is $\sqrt{\frac{x}{5}}$ where $x =$ _____.

Numerical answer — enter the value.

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

Q35 JEE Main 2025 · 24 Jan · Shift 2

A solid sphere is rolling without slipping on a horizontal plane. The ratio of the linear kinetic energy of the centre of mass of the sphere and rotational kinetic energy is :

- | | |
|-------------------|-------------------|
| (A) $\frac{3}{4}$ | (B) $\frac{4}{3}$ |
| (C) $\frac{5}{2}$ | (D) $\frac{2}{5}$ |

[Step-by-step solution ► prepwiser.in/questions/x1jfB668z-](https://www.prepwiser.in/questions/x1jfB668z-)

Q36 JEE Main 2025 · 24 Jan · Shift 1

A uniform solid cylinder of mass ' m ' and radius ' r ' rolls along an inclined rough plane of inclination 45° . If it starts to roll from rest from the top of the plane then the linear acceleration of the cylinder's axis will be

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

Step-by-step solution ► [prepwiser.in/questions/ZGbNk5Mfyr](https://www.prepwiser.in/questions/ZGbNk5Mfyr)

Q37 JEE Main 2025 · 23 Jan · Shift 1

A solid sphere of mass ' m ' and radius ' r ' is allowed to roll without slipping from the highest point of an inclined plane of length ' L ' and makes an angle 30° with the horizontal. The speed of the particle at the bottom of the plane is v_1 . If the angle of inclination is increased to 45° while keeping L constant. Then the new speed of the sphere at the bottom of the plane is v_2 . The ratio $v_1^2 : v_2^2$ is

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

Step-by-step solution ► [prepwiser.in/questions/0BIZwvTZYd](https://www.prepwiser.in/questions/0BIZwvTZYd)

Q38 JEE Main 2024 · 9 Apr · Shift 2

A circular disc reaches from top to bottom of an inclined plane of length l . When it slips down the plane, it takes ts . When it rolls down the plane then it takes $\left(\frac{\alpha}{2}\right)^{1/2}ts$, where α is _____.

Numerical answer — enter the value.

Step-by-step solution ► [prepwiser.in/questions/_1UdCq5C8B](https://www.prepwiser.in/questions/_1UdCq5C8B)

Q39 JEE Main 2024 · 5 Apr · Shift 2

A hollow sphere is rolling on a plane surface about its axis of symmetry. The ratio of rotational kinetic energy to its total kinetic energy is $\frac{x}{5}$. The value of x is _____.

Numerical answer — enter the value.

Step-by-step solution ► [prepwiser.in/questions/O479W0yrnq](https://www.prepwiser.in/questions/O479W0yrnq)

Q40 JEE Main 2024 · 4 Apr · Shift 1

A solid sphere and a hollow cylinder roll up without slipping on same inclined plane with same initial speed v . The sphere and the cylinder reaches upto maximum heights h_1 and h_2 respectively, above the initial level. The ratio $h_1 : h_2$ is $\frac{n}{10}$. The value of n is _____.

Numerical answer — enter the value.

Step-by-step solution ► [prepwiser.in/questions/yEECGmNZ3Y](https://www.prepwiser.in/questions/yEECGmNZ3Y)

Q41 JEE Main 2024 · 31 Jan · Shift 1

A solid circular disc of mass 50kg rolls along a horizontal floor so that its center of mass has a speed of 0.4m/s. The absolute value of work done on the disc to stop it is _____ J.

Numerical answer — enter the value.

Step-by-step solution ► [prepwiser.in/questions/RzDLkKIG4a](https://www.prepwiser.in/questions/RzDLkKIG4a)

Q42 JEE Main 2024 · 29 Jan · Shift 1

A cylinder is rolling down on an inclined plane of inclination 60° . Its acceleration during rolling down will be $\frac{x}{\sqrt{3}}m/s^2$, where $x = \underline{\hspace{2cm}}$ (use $g = 10m/s^2$).

Numerical answer — enter the value.

[Step-by-step solution ► prepwiser.in/questions/Dlp9IpvoYk](https://www.prepwiser.in/questions/Dlp9IpvoYk)

Q43 JEE Main 2024 · 27 Jan · Shift 2

A ring and a solid sphere roll down the same inclined plane without slipping. They start from rest. The radii of both bodies are identical and the ratio of their kinetic energies is $\frac{7}{x}$, where x is $\underline{\hspace{2cm}}$.

Numerical answer — enter the value.

[Step-by-step solution ► prepwiser.in/questions/YMZ-X4S-T](https://www.prepwiser.in/questions/YMZ-X4S-T)

Q44 JEE Main 2023 · 13 Apr · Shift 1

A solid sphere is rolling on a horizontal plane without slipping. If the ratio of angular momentum about axis of rotation of the sphere to the total energy of moving sphere is $\pi : 22$ then, the value of its angular speed will be $\underline{\hspace{2cm}}$ rad/s.

Numerical answer — enter the value.

[Step-by-step solution ► prepwiser.in/questions/6G_0n1u4Ad](https://www.prepwiser.in/questions/6G_0n1u4Ad)

Q45 JEE Main 2023 · 31 Jan · Shift 1

A solid sphere of mass 1kg rolls without slipping on a plane surface. Its kinetic energy is $7 \times 10^{-3}J$. The speed of the centre of mass of the sphere is $\underline{\hspace{2cm}}$ cm s $^{-1}$

Numerical answer — enter the value.

[Step-by-step solution ► prepwiser.in/questions/1-Rb9uWghS](https://www.prepwiser.in/questions/1-Rb9uWghS)

Q46 JEE Main 2023 · 29 Jan · Shift 1

A solid sphere of mass 2 kg is making pure rolling on a horizontal surface with kinetic energy 2240 J. The velocity of centre of mass of the sphere will be $\underline{\hspace{2cm}}$ ms $^{-1}$.

Numerical answer — enter the value.

[Step-by-step solution ► prepwiser.in/questions/6Dswsszq4h](https://www.prepwiser.in/questions/6Dswsszq4h)

Q47 JEE Main 2022 · 25 Jul · Shift 1

A solid cylinder and a solid sphere, having same mass M and radius R , roll down the same inclined plane from top without slipping. They start from rest. The ratio of velocity of the solid cylinder to that of the solid sphere, with which they reach the ground, will be :

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

(B) $\sqrt{\frac{4}{5}}$

(C) $\sqrt{\frac{3}{5}}$

(D) $\sqrt{\frac{14}{15}}$

[Step-by-step solution ► prepwiser.in/questions/en2Yw3FFzc](https://www.prepwiser.in/questions/en2Yw3FFzc)

Q48 JEE Main 2022 · 26 Jun · Shift 2

A solid spherical ball is rolling on a frictionless horizontal plane surface about its axis of symmetry. The ratio of rotational kinetic energy of the ball to its total kinetic energy is

- (A) $\frac{2}{5}$ (B) $\frac{2}{7}$
(C) $\frac{1}{5}$ (D) $\frac{7}{10}$

[Step-by-step solution ► prepwiser.in/questions/Pvy7tXLRZS](https://www.prepwiser.in/questions/Pvy7tXLRZS)

Q49 JEE Main 2021 · 22 Jul · Shift 2

Consider a situation in which a ring, a solid cylinder and a solid sphere roll down on the same inclined plane without slipping. Assume that they start rolling from rest and having identical diameter.

The correct statement for this situation is

- (A) All of them will have same velocity.
(B) The ring has greatest and the cylinder has the least velocity of the centre of mass at the bottom of the inclined plane.
(C) The sphere has the greatest and the ring has the least velocity of the centre of mass at the bottom of the inclined plane.
(D) The cylinder has the greatest and the sphere has the least velocity of the centre of mass at the bottom of the inclined plane.

[Step-by-step solution ► prepwiser.in/questions/8hQrv2Adm3](https://www.prepwiser.in/questions/8hQrv2Adm3)

Q50 JEE Main 2021 · 20 Jul · Shift 2

A body rolls down an inclined plane without slipping. The kinetic energy of rotation is 50% of its translational kinetic energy. The body is :

- (A) Solid sphere (B) Solid cylinder
(C) Hollow cylinder (D) Ring

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

Q51 JEE Main 2021 · 20 Jul · Shift 2

Two bodies, a ring and a solid cylinder of same material are rolling down without slipping an inclined plane. The radii of the bodies are same. The ratio of velocity of the centre of mass at the bottom of the inclined plane of the ring to that of the cylinder is $\frac{\sqrt{x}}{2}$. Then, the value of x is _____.

Numerical answer — enter the value.

[Step-by-step solution ► prepwiser.in/questions/www-ul8eML](https://www.prepwiser.in/questions/www-ul8eML)

Q52 JEE Main 2020 · 8 Jan · Shift 2

A uniform sphere of mass 500 g rolls without slipping on a plane horizontal surface with its centre moving at a speed of 5.00 cm/s. Its kinetic energy is :

- (A) 8.75×10^{-3} J
(B) 1.13×10^{-3} J
(C) 8.75×10^{-4} J
(D) 6.25×10^{-4} J

[Step-by-step solution ► prepwiser.in/questions/MKD6ely7Ue](https://www.prepwiser.in/questions/MKD6ely7Ue)

Conservation of Angular Momentum · 12 PYQs

Q53 JEE Main 2025 · 4 Apr · Shift 2

A solid sphere with uniform density and radius R is rotating initially with constant angular velocity (ω_1) about its diameter. After some time during the rotation it starts losing mass at a uniform rate, with no change in its shape. The angular velocity of the sphere when its radius becomes $R/2$ is $x\omega_1$. The value of x is _____.

Numerical answer — enter the value.

[Step-by-step solution ► prepwisser.in/questions/KJcji5v6oq](https://www.prepwisser.in/questions/KJcji5v6oq)

Q54 JEE Main 2024 · 8 Apr · Shift 2

A thin circular disc of mass M and radius R is rotating in a horizontal plane about an axis passing through its centre and perpendicular to its plane with angular velocity ω . If another disc of same dimensions but of mass $M/2$ is placed gently on the first disc co-axially, then the new angular velocity of the system is :

(A) $\frac{4}{5}\omega$

(B) $\frac{5}{4}\omega$

(C) $\frac{3}{2}\omega$

(D) $\frac{2}{3}\omega$

[Step-by-step solution ► prepwisser.in/questions/-KI0BZkMon](https://www.prepwisser.in/questions/-KI0BZkMon)

Q55 JEE Main 2024 · 6 Apr · Shift 1

If the radius of earth is reduced to three-fourth of its present value without change in its mass then value of duration of the day of earth will be _____ hours 30 minutes.

Numerical answer — enter the value.

[Step-by-step solution ► prepwisser.in/questions/JNf_kb6SHH](https://www.prepwisser.in/questions/JNf_kb6SHH)

Q56 JEE Main 2024 · 30 Jan · Shift 2

Two discs of moment of inertia $I_1 = 4\text{kgm}^2$ and $I_2 = 2\text{kgm}^2$, about their central axes & normal to their planes, rotating with angular speeds 10rad/s & 4rad/s respectively are brought into contact face to face with their axes of rotation coincident. The loss in kinetic energy of the system in the process is _____ J.

Numerical answer — enter the value.

[Step-by-step solution ► prepwisser.in/questions/Opo9UgyKos](https://www.prepwisser.in/questions/Opo9UgyKos)

Q57 JEE Main 2023 · 11 Apr · Shift 2

A circular plate is rotating in horizontal plane, about an axis passing through its center and perpendicular to the plate, with an angular velocity ω . A person sits at the center having two dumbbells in his hands. When he stretches out his hands, the moment of inertia of the system becomes triple. If E be the initial Kinetic energy of the system, then final Kinetic energy will be $\frac{E}{x}$. The value of x is

Numerical answer — enter the value.

[Step-by-step solution ► prepwisser.in/questions/9eFAa-iii5](https://www.prepwisser.in/questions/9eFAa-iii5)

Q58 JEE Main 2022 · 26 Jun · Shift 1

A thin circular ring of mass M and radius R is rotating with a constant angular velocity 2 rads^{-1} in a horizontal plane about an axis vertical to its plane and passing through the center of the ring. If two objects each of mass m be attached gently to the opposite ends of a diameter of ring, the ring will then rotate with an angular velocity (in rads^{-1}).

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

(B) $\frac{(M+2m)}{2M}$

(C) $\frac{2M}{(M+2m)}$

(D) $\frac{2(M+2m)}{M}$

[Step-by-step solution ► prepwiser.in/questions/cQTDtVnj7D](https://www.prepwiser.in/questions/cQTDtVnj7D)

Q59 JEE Main 2021 · 27 Aug · Shift 2

Two discs have moments of inertia I_1 and I_2 about their respective axes perpendicular to the plane and passing through the centre. They are rotating with angular speeds, ω_1 and ω_2 respectively and are brought into contact face to face with their axes of rotation coaxial. The loss in kinetic energy of the system in the process is given by :

(A) $\frac{I_1 I_2}{(I_1 + I_2)} (\omega_1 - \omega_2)^2$

(B) $\frac{(I_1 - I_2)^2 \omega_1 \omega_2}{2(I_1 + I_2)}$

(C) $\frac{I_1 I_2}{2(I_1 + I_2)} (\omega_1 - \omega_2)^2$

(D) $\frac{(\omega_1 - \omega_2)^2}{2(I_1 + I_2)}$

[Step-by-step solution ► prepwiser.in/questions/Q4cq7b022B](https://www.prepwiser.in/questions/Q4cq7b022B)

Q60 JEE Main 2021 · 18 Mar · Shift 1

A thin circular ring of mass M and radius r is rotating about its axis with an angular speed ω . Two particles having mass m each are now attached at diametrically opposite points. The angular speed of the ring will become :

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

(B) $\omega \frac{M+2m}{M}$

(C) $\omega \frac{M}{M+2m}$

(D) $\omega \frac{M-2m}{M+2m}$

[Step-by-step solution ► prepwiser.in/questions/DJ3iAK1hdN](https://www.prepwiser.in/questions/DJ3iAK1hdN)

Q61 JEE Main 2020 · 5 Sep · Shift 1

A wheel is rotating freely with an angular speed ω on a shaft. The moment of inertia of the wheel is I and the moment of inertia of the shaft is negligible. Another wheel of moment of inertia $3I$ initially at rest is suddenly coupled to the same shaft. The resultant fractional loss in the kinetic energy of the system is :

(A) 0

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

(C) $\frac{1}{4}$

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

[Step-by-step solution ► prepwiser.in/questions/Fm7tM60lbn](https://www.prepwiser.in/questions/Fm7tM60lbn)

Q62 JEE Main 2020 · 4 Sep · Shift 1

A circular disc of mass M and radius R is rotating about its axis with angular speed ω_1 . If another stationary disc having radius $\frac{R}{2}$ and same mass M is dropped co-axially on to the rotating disc. Gradually both discs attain constant angular speed ω_2 the energy lost in the process is $p\%$ of the initial energy. Value of p is _____.

Numerical answer — enter the value.

[Step-by-step solution ► prepwiser.in/questions/k2VzBALqIL](https://www.prepwiser.in/questions/k2VzBALqIL)

Q63 JEE Main 2020 · 3 Sep · Shift 1

A person of 80 kg mass is standing on the rim of a circular platform of mass 200 kg rotating about its axis at 5 revolutions per minute (rpm). The person now starts moving towards the centre of the platform. What will be the rotational speed (in rpm) of the platform when the person reaches its centre _____.

Numerical answer — enter the value.

[Step-by-step solution ► prepwiser.in/questions/yVoxg0Vq1H](https://www.prepwiser.in/questions/yVoxg0Vq1H)

Q64 JEE Main 2020 · 2 Sep · Shift 2

Two uniform circular discs are rotating independently in the same direction around their common axis passing through their centres. The moment of inertia and angular velocity of the first disc are 0.1 kg-m^2 and 10 rad s^{-1} respectively while those for the second one are 0.2 kg-m^2 and 5 rad s^{-1} respectively. At some instant they get stuck together and start rotating as a single system about their common axis with some angular speed. The kinetic energy of the combined system is :

(A) $\frac{20}{3} J$

(B) $\frac{5}{3} J$

(C) $\frac{10}{3} J$

(D) $\frac{2}{3} J$

[Step-by-step solution ► prepwiser.in/questions/RDjtOC0Q88](https://www.prepwiser.in/questions/RDjtOC0Q88)

Uniform Circular Motion · 3 PYQs

Q65 JEE Main 2021 · 27 Aug · Shift 1

A huge circular arc of length 4.4 ly subtends an angle '4s' at the centre of the circle. How long it would take for a body to complete 4 revolution if its speed is 8 AU per second?

Given : $1 \text{ ly} = 9.46 \times 10^{15} \text{ m}$

$1 \text{ AU} = 1.5 \times 10^{11} \text{ m}$

(A) $4.1 \times 10^8 \text{ s}$

(B) $4.5 \times 10^{10} \text{ s}$

(C) $3.5 \times 10^6 \text{ s}$

(D) $7.2 \times 10^8 \text{ s}$

[Step-by-step solution ► prepwiser.in/questions/5ugf42N8gw](https://www.prepwiser.in/questions/5ugf42N8gw)

Q66 JEE Main 2021 · 20 Jul · Shift 2

A body rotating with an angular speed of 600 rpm is uniformly accelerated to 1800 rpm in 10 sec. The number of rotations made in the process is _____.

Numerical answer — enter the value.

[Step-by-step solution ► prepwiser.in/questions/KJUEuKn8TJ](https://www.prepwiser.in/questions/KJUEuKn8TJ)

Q67 JEE Main 2021 · 17 Mar · Shift 1

The angular speed of truck wheel is increased from 900 rpm to 2460 rpm in 26 seconds. The number of revolutions by the truck engine during this time is _____. (Assuming the acceleration to be uniform).

Numerical answer — enter the value.

[Step-by-step solution ► prepwiser.in/questions/6Mnifz6iFf](https://www.prepwiser.in/questions/6Mnifz6iFf)

Linear Momentum and Kinetic Energy · 1 PYQs

Q68 JEE Main 2023 · 12 Apr · Shift 1

For a rolling spherical shell, the ratio of rotational kinetic energy and total kinetic energy is $\frac{x}{5}$. The value of x is _____.

Numerical answer — enter the value.

Step-by-step solution ► prepwiser.in/questions/_1aj4vv_c

Answer key — Rotational Motion

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

1	A	2	A	3	5	4	35	5	1	6	176	7	5	8	5
9	3	10	32	11	5	12	8	13	5	14	B	15	A	16	B
17	40	18	C	19	2	20	D	21	A	22	100	23	60	24	15
25	3	26	B	27	91	28	B	29	10	30	4	31	20	32	195
33	C	34	4	35	C	36	D	37	C	38	3	39	2	40	7
41	6	42	10	43	7	44	4	45	10	46	40	47	D	48	B
49	C	50	B	51	3	52	C	53	32	54	D	55	13	56	24
57	3	58	C	59	C	60	C	61	D	62	20	63	9	64	A
65	B	66	200	67	728	68	2								

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