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NEET SYSTEM OF PARTICLES AND ROTATIONAL MOTION — PYQS

Max. Marks: 376 **Questions:** 94

Section A (MCQ) — 94 questions

Q.1 The angular speed of a flywheel is increased from 600 rpm to 1200 rpm in 10 s. The number of revolutions completed by the flywheel during this time is : [NEET (UG) 2026]

(1) 600 (2) 300 (3) 900 (4) 150

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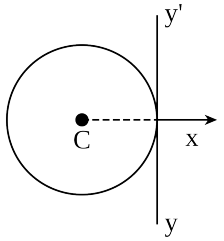
Q.2 A thin wire of length 'L' and linear mass density 'm' is bent into a circular ring (in x-y plane) with centre 'C' as shown in figure. The moment of inertia of the ring about an axis yy' will be: [NEET (UG) 2026]



(1) $\frac{3mL^3}{8\pi}$ (2) $\frac{3mL^2}{8\pi^2}$ (3) $\frac{3mL^3}{8\pi^2}$ (4) $\frac{3mL^2}{8\pi}$

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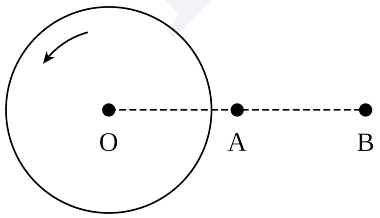
Q.3 A thin horizontal disc is rotating about a vertical axis passing through its fixed centre O. Its angular momentum is L_A and L_B computed about points A and B, respectively, with OB = 2 × OA. The value of $\frac{L_A}{L_B}$ is: [RE-NEET (UG) 2026]



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

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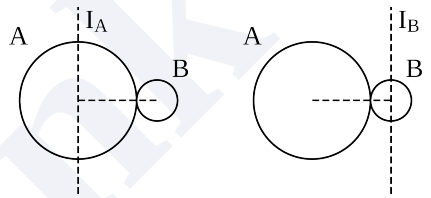
Q.4 A solid sphere A of radius R and mass M is attached at a point to a smaller solid sphere B of radius r < R and mass m < M. Assume that the line joining their centres lies along the horizontal. The moment of inertia of the system calculated about a vertical axis passing through the centre of A is I_A and that calculated about a vertical axis passing through the centre of B is I_B. The difference $I_A - I_B$ is: [RE-NEET (UG) 2026]



(1) 0 (2) $(M - m)(R + r)^2$

(3) $(m - M)(R + r)^2$ (4) $(m - M)(R - r)^2$

Scan or tap for the full solution

Q.5 A uniform rod of mass 20 kg and length 5 m leans against a smooth vertical wall making an angle of 60° with it. The other end rests on a rough horizontal floor. The friction force that the floor exerts on the rod is (Take g = 10 m/s^2) [NEET (UG) 2025]

(1) 200 N (2) $200\sqrt{3}$ N

(3) 100 N (4) $100\sqrt{3}$ N

Scan or tap for the full solution

Q.6 The Sun rotates around its centre once in 27 days. What will be the period of revolution if the Sun were to expand to twice its present radius without any external influence? Assume the Sun to be a sphere of uniform density. [NEET (UG) 2025]

(1) 115 days (2) 108 days

(3) 100 days (4) 105 days

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Q.7 A sphere of radius R is cut from a larger solid sphere of radius 2R as shown in the figure. The ratio of the moment of inertia of the smaller sphere to that of the rest part of the sphere about the Y-axis is: [NEET (UG) 2025]

[Diagram unavailable]

(1) $\frac{7}{57}$ (2) $\frac{7}{64}$ (3) $\frac{7}{8}$ (4) $\frac{7}{40}$

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Q.8 The moment of inertia of a thin rod about an axis passing through its mid point and perpendicular to the rod is 2400 g cm^2. The length of the 400 g rod is nearly: [NEET (UG) 2024]

(1) 8.5 cm (2) 17.5 cm
(3) 20.7 cm (4) 72.0 cm

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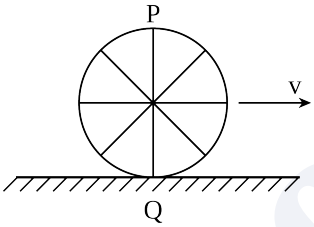
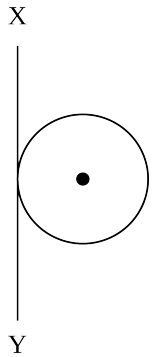
Q.9 A wheel of a bullock cart is rolling on a level road as shown in the figure below. If its linear speed is v in the direction shown, which one of the following options is correct (P and Q are any highest and lowest points on the wheel, respectively)? [NEET (UG) 2024]



(1) Point P moves slower than point Q
(2) Point P moves faster than point Q
(3) Both the points P and Q move with equal speed
(4) Point P has zero speed

Scan or tap for the full solution

Q.10 The radius of gyration of a solid sphere of mass 5 kg about XY is 5 m as shown in figure. The radius of the sphere is $\frac{5x}{\sqrt{7}}$ m, then the value of x is: [RE-NEET (UG) 2024]



(1) 5 (2) $\sqrt{2}$ (3) $\sqrt{3}$ (4) $\sqrt{5}$

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Q.11 The ratio of radius of gyration of a solid sphere of mass M and radius R about its own axis to the radius of gyration of the thin hollow sphere of same mass and radius about its axis is :- [NEET (UG) 2023]

(1) 5:3 (2) 2:5
(3) $\sqrt{5}:\sqrt{3}$ (4) $\sqrt{3}:\sqrt{5}$

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Q.12 The angular acceleration of a body, moving along the circumference of a circle, is : [NEET (UG) 2023]

(1) along the radius towards the centre
(2) along the tangent to its position
(3) along the axis of rotation
(4) along the radius, away from centre

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Q.13 The angular speed of a fly wheel moving with uniform angular acceleration changes from 1200 rpm to 3120 rpm in 16 seconds. The angular acceleration in rad/s^2 is [NEET (UG) 2022]

(1) 2π (2) 4π (3) 12π (4) 104π

Scan or tap for the full solution

Q.14 Two objects of mass 10 kg and 20 kg respectively are connected to the two ends of a rigid rod of length 10 m with negligible mass. The distance of the center of mass of the system from the 10 kg mass is : [NEET (UG) 2022]

(1) $\frac{10}{3}$ m (2) $\frac{20}{3}$ m (3) 10 m (4) 5 m

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Q.15 The ratio of the radius of gyration of a thin uniform disc about an axis passing through its centre and normal to its plane to the radius of gyration of the disc about its diameter is [NEET (UG) 2022]

(1) 2:1 (2) $\sqrt{2}:1$

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

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Q.16 An energy of 484 J is spent in increasing the speed of a flywheel from 60 rpm to 360 rpm. The moment of inertia of the flywheel is : [NEET (UG) 2022 (Phase 2)]

(1) 0.07 kg m^2 (2) 0.7 kg m^2

(3) 3.22 kg m^2 (4) 30.8 kg m^2

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Q.17 Given below are two statements : One is labelled as **Assertion (A)** and the other is labelled as **Reason (R)**.

Assertion (A): When a fire cracker (rocket) explodes in mid air, its fragments fly in such a way that they continue moving in the same path, which the fire cracker would have followed, had it not exploded.

Reason (R): Explosion of cracker (rocket) occurs due to internal force only and no external force acts for this explosion.

In the light of the above statements, choose the most appropriate answer from the options given below [NEET (UG) 2022 (Phase 2)]

(1) (A) is not correct but (R) is correct

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

(3) Both (A) and (R) are correct but (R) is not the correct explanation of (A)

(4) (A) is correct but (R) is not correct

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Q.18 From a circular ring of mass 'M' and radius 'R' an arc corresponding to a 90° sector is removed. The moment of inertia of the remaining part of the ring about an axis passing through the center of the ring and perpendicular to the plane of the ring is 'K' times 'MR^2'. Then the value of 'K' is : [NEET (UG) 2021]

(1) $\frac{1}{8}$ (2) $\frac{3}{4}$ (3) $\frac{7}{8}$ (4) $\frac{1}{4}$

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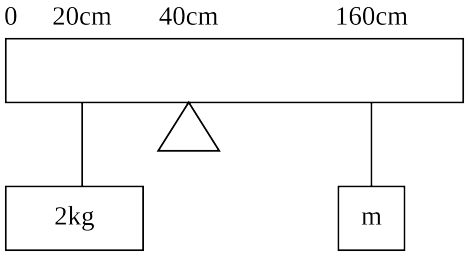
Q.19 A uniform rod of length 200 cm and mass 500 g is balanced on a wedge placed at 40 cm mark. A mass of 2 kg is suspended from the rod at 20 cm and another unknown mass 'm' is suspended from the rod at 160 cm mark as shown in the figure. Find the value of 'm' such that the rod is in equilibrium. ($g = 10\ m/s^2$) [NEET (UG) 2021]



(1) $\frac{1}{12}$ kg (2) $\frac{1}{2}$ kg (3) $\frac{1}{3}$ kg (4) $\frac{1}{6}$ kg

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Q.20 Two particles of mass 5 kg and 10 kg respectively are attached to the two ends of a rigid rod of length 1 m with negligible mass.

The centre of mass of the system from the 5 kg particle is nearly at a distance of : [NEET (UG) 2020]

(1) 50 cm (2) 67 cm (3) 80 cm (4) 33 cm

Scan or tap for the full solution

Q.21 Find the torque about the origin when a force of $3\hat{j}$ N acts on a particle whose position vector is $2\hat{k}$ m. [NEET (UG) 2020]

(1) $6\hat{j}$ N m (2) $-6\hat{i}$ N m

(3) $6\hat{k}$ N m (4) $6\hat{i}$ N m

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Q.22 A solid cylinder of mass 2 kg and radius 4 cm is rotating about its axis at the rate of 3 rpm. The torque required to stop after 2π revolutions is : [NEET (UG) 2019]

(1) 2×10^{-3} N m (2) 2×10^{-6} N m

(3) 2×10^{6} N m (4) 12×10^{-4} N m

Scan or tap for the full solution

Q.23 A disc of radius 2 m and mass 100 kg rolls on a horizontal floor. Its centre of mass has speed of 20 cm/s. How much work is needed to stop it? [NEET (UG) 2019]

(1) 1 J (2) 2 J (3) 3 J (4) 30 kJ

Scan or tap for the full solution

Q.24 A solid sphere is in rolling motion. In rolling motion a body possesses translational kinetic energy (K_t) as well as rotational kinetic energy (K_r) simultaneously. The ratio $K_t:(K_t + K_r)$ for the sphere is [NEET 2018]

(1) 7 : 10 (2) 5 : 7 (3) 10 : 7 (4) 2 : 5

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Q.25 A solid sphere is rotating freely about its symmetry axis in free space. The radius of the sphere is increased keeping its mass same. Which of the following physical quantities would remain constant for the sphere? [NEET 2018]

(1) Angular velocity
(2) Moment of inertia
(3) Rotational kinetic energy
(4) Angular momentum

Solution

Q.26 Three objects, A : (a solid sphere), B : (a thin circular disk) and C : (a circular ring), each have the same mass M and radius R. They all spin with the same angular speed ω about their own symmetry axes. The amounts of work (W) required to bring them to rest, would satisfy the relation [NEET 2018]

(1) $W_C > W_B > W_A$ (2) $W_A > W_B > W_C$
(3) $W_B > W_A > W_C$ (4) $W_A > W_C > W_B$

Scan or tap for the full solution

Q.27 The moment of the force, $\vec{F} = 4\hat{i} + 5\hat{j} - 6\hat{k}$ at (2, 0, −3), about the point (2, −2, −2), is given by [NEET 2018]

(1) $-8\hat{i} - 4\hat{j} - 7\hat{k}$ (2) $-4\hat{i} - \hat{j} - 8\hat{k}$
(3) $-7\hat{i} - 8\hat{j} - 4\hat{k}$ (4) $-7\hat{i} - 4\hat{j} - 8\hat{k}$

Scan or tap for the full solution

Q.28 A rope is wound around a hollow cylinder of mass 3 kg and radius 40 cm. What is the angular acceleration of the cylinder if the rope is pulled with a force of 30 N? [NEET 2017]

(1) 0.25 rad s^{-2} (2) 25 rad s^{-2}
(3) 5 m s^{-2} (4) 25 m s^{-2}

Scan or tap for the full solution

Q.29 Two discs of same moment of inertia rotating about their regular axis passing through centre and perpendicular to the plane of disc with angular velocities ω_1 and ω_2. They are brought into contact face to face coinciding the axis of rotation. The expression for loss of energy during this process is [NEET 2017]

(1) $\frac{1}{4}I(\omega_1 - \omega_2)^2$ (2) $I(\omega_1 - \omega_2)^2$
(3) $\frac{1}{8}I(\omega_1 - \omega_2)^2$ (4) $\frac{1}{2}I(\omega_1 + \omega_2)^2$

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Q.30 Which of the following statements are correct ?

A. Centre of mass of a body always coincides with the centre of gravity of the body.
B. Centre of mass of a body is the point at which the total gravitational torque on the body is zero.
C. A couple on a body produces both translational and rotational motion in a body
D. Mechanical advantage greater than one means that small effort can be used to lift a large load.

[NEET 2017]

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

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Q.31 A disc and a sphere of same radius but different masses roll off on two inclined planes of the same altitude and length. Which one of the two objects gets to the bottom of the plane first? [NEET 2016 (Phase 1)]

(1) Both reach at the same time
(2) Depends on their masses
(3) Disc
(4) Sphere

Solution

Q.32 From a disc of radius R and mass M, a circular hole of diameter R, whose rim passes through the centre is cut. What is the moment of inertia of the remaining part of the disc about a perpendicular axis, passing through the centre? [NEET 2016 (Phase 1)]

(1) $\frac{11MR^2}{32}$ (2) $\frac{9MR^2}{32}$
(3) $\frac{15MR^2}{32}$ (4) $\frac{13MR^2}{32}$

Scan or tap for the full solution

Q.33 A uniform circular disc of radius 50 cm at rest is free to turn about an axis which is perpendicular to its plane and passes through its centre. It is subjected to a torque which produces a constant angular acceleration of 2.0 rad s^{-2}. Its net acceleration in m s^{-2} at the end of 2.0 s is approximately [NEET 2016 (Phase 1)]

(1) 6.0 (2) 3.0 (3) 8.0 (4) 7.0

Scan or tap for the full solution

Q.34 Two rotating bodies A and B of masses m and 2m with moments of inertia I_A and I_B ($I_B > I_A$) have equal kinetic energy of rotation. If L_A and L_B be their angular momenta respectively, then [NEET 2016 (Phase 2)]

(1) $L_A = \frac{L_B}{2}$ (2) $L_A = 2L_B$
(3) $L_B > L_A$ (4) $L_A > L_B$

Scan or tap for the full solution

Q.35 A solid sphere of mass m and radius R is rotating about its diameter. A solid cylinder of same mass and same radius is also rotating about its geometrical axis with an angular speed twice that of the sphere. The ratio of their kinetic energies of rotation ($E_{sphere}/E_{cylinder}$) will be

[NEET 2016 (Phase 2)]

(1) 2 : 3 (2) 1 : 5 (3) 1 : 4 (4) 3 : 1

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Q.36 A light rod of length l has two masses m_1 and m_2 attached to its two ends. The moment of inertia of the system about an axis perpendicular to the rod and passing through the centre of mass is

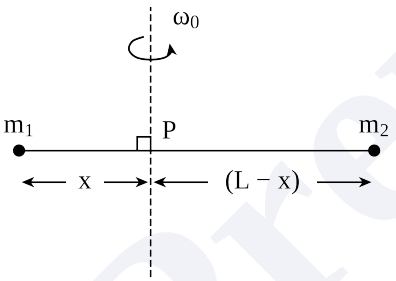
[NEET 2016 (Phase 2)]

(1) $\frac{m_1m_2}{m_1+m_2}l^2$ (2) $\frac{m_1+m_2}{m_1m_2}l^2$

(3) $(m_1 + m_2)l^2$ (4) $\sqrt{m_1m_2}\,l^2$

Scan or tap for the full solution

Q.37 Point masses m_1 and m_2 are placed at the opposite ends of a rigid rod of length L, and negligible mass. The rod is to be set rotating about an axis perpendicular to it. The position of point P on this rod through which the axis should pass so that the work required to set the rod rotating with angular velocity ω_0 is minimum, is given by [AIPMT 2015]



(1) $x = \frac{m_2}{m_1}L$ (2) $x = \frac{m_2L}{m_1+m_2}$

(3) $x = \frac{m_1L}{m_1+m_2}$ (4) $x = \frac{m_1}{m_2}L$

Scan or tap for the full solution

Q.38 An automobile moves on a road with a speed of 54 km h^{-1}. The radius of its wheels is 0.45 m and the moment of inertia of the wheel about its axis of rotation is 3 kg m^2. If the vehicle is brought to rest in 15 s, the magnitude of average torque transmitted by its brakes to the wheel is [AIPMT 2015]

(1) 10.86 kg m^2 s^{-2} (2) 2.86 kg m^2 s^{-2}

(3) 6.66 kg m^2 s^{-2} (4) 8.58 kg m^2 s^{-2}

Scan or tap for the full solution

Q.39 A force $\vec{F} = \alpha\hat{i} + 3\hat{j} + 6\hat{k}$ is acting at a point $\vec{r} = 2\hat{i} - 6\hat{j} - 12\hat{k}$. The value of α for which angular momentum about origin is conserved is

[AIPMT 2015]

(1) zero (2) 1 (3) −1 (4) 2

Scan or tap for the full solution

Q.40 A rod of weight W is supported by two parallel knife edges A and B and is in equilibrium in a horizontal position. The knives are at a distance d from each other. The centre of mass of the rod is at distance x from A. The normal reaction on A is

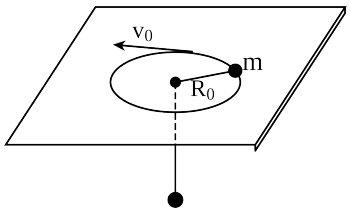
[AIPMT 2015 (Cancelled)]

(1) $\frac{W(d-x)}{x}$ (2) $\frac{W(d-x)}{d}$

(3) $\frac{Wx}{d}$ (4) $\frac{Wd}{x}$

Scan or tap for the full solution

Q.41 A mass m moves in a circle on a smooth horizontal plane with velocity v_0 at a radius R_0. The mass is attached to a string which passes through a smooth hole in the plane as shown. The tension in the string is increased gradually and finally m moves in a circle of radius $\frac{R_0}{2}$.



The final value of the kinetic energy is

[AIPMT 2015 (Cancelled)]

(1) $2mv_0^2$ (2) $\frac{1}{2}mv_0^2$ (3) mv_0^2 (4) $\frac{1}{4}mv_0^2$

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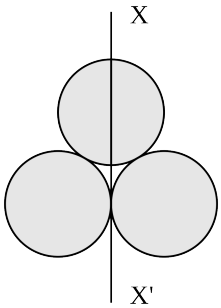
Q.42 Three identical spherical shells, each of mass m and radius r are placed as shown in figure. Consider an axis XX' which is touching to two shells and passing through diameter of third shell. Moment of inertia of the system consisting of these three spherical shells about XX' axis is

[AIPMT 2015 (Cancelled)]



(1) $\frac{16}{5}mr^2$ (2) $4mr^2$

(3) $\frac{11}{5}mr^2$ (4) $3mr^2$

Solution

Q.43 A solid cylinder of mass 50 kg and radius 0.5 m is free to rotate about the horizontal axis. A massless string is wound round the cylinder with one end attached to it and other hanging freely. Tension in the string required to produce an angular acceleration of 2 revolutions s^{-2} is [AIPMT 2014]

(1) 25 N (2) 50 N (3) 78.5 N (4) 157 N

Scan or tap for the full solution

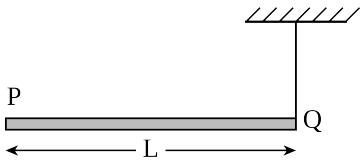
Q.44 The ratio of the accelerations for a solid sphere (mass m and radius R) rolling down an incline of angle θ without slipping and slipping down the incline without rolling is [AIPMT 2014]

(1) 5 : 7 (2) 2 : 3 (3) 2 : 5 (4) 7 : 5

Scan or tap for the full solution

Q.45 A rod PQ of mass M and length L is hinged at end P. The rod is kept horizontal by a massless string tied to point Q as shown in figure. When string is cut, the initial angular acceleration of the rod is

[NEET 2013]



(1) $\frac{2g}{L}$ (2) $\frac{2g}{3L}$ (3) $\frac{3g}{2L}$ (4) $\frac{g}{L}$

Scan or tap for the full solution

Q.46 A small object of uniform density rolls up a curved surface with an initial velocity 'v'. It reaches upto a maximum height of $\frac{3v^2}{4g}$ with respect to the initial position. The object is [NEET 2013]

(1) hollow sphere (2) disc

(3) ring (4) solid sphere

Scan or tap for the full solution

Q.47 The ratio of radii of gyration of a circular ring and a circular disc, of the same mass and radius, about an axis passing through their centres and perpendicular to their planes are [NEET 2013 (Karnataka)]

(1) $1 : \sqrt{2}$ (2) 3 : 2

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

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Q.48 Two discs are rotating about their axes, normal to the discs and passing through the centres of the discs. Disc D_1 has 2 kg mass and 0.2 m radius and initial angular velocity of 50 rad s^{-1}. Disc D_2 has 4 kg mass, 0.1 m radius and initial angular velocity of 200 rad s^{-1}. The two discs are brought in contact face to face, with their axes of rotation coincident. The final angular velocity (in rad s^{-1}) of the system is [NEET 2013 (Karnataka)]

(1) 60 (2) 100 (3) 120 (4) 40

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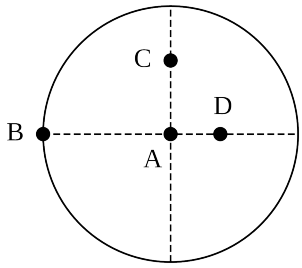
Q.49 A circular platform is mounted on a frictionless vertical axle. Its radius R = 2 m and its moment of inertia about the axle is 200 kg m^2. It is initially at rest. A 50 kg man stands on the edge of the platform and begins to walk along the edge at the speed of 1 m s^{-1} relative to the ground. Time taken by the man to complete one revolution is

[AIPMT 2012 (Mains)]

(1) π s (2) $\frac{3\pi}{2}$ s (3) 2π s (4) $\frac{\pi}{2}$ s

Scan or tap for the full solution

Q.50 The moment of inertia of a uniform circular disc is maximum about an axis perpendicular to the disc and passing through [AIPMT 2012 (Mains)]



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

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Q.51 Three masses are placed on the x-axis : 300 g at origin, 500 g at x = 40 cm and 400 g at x = 70 cm. The distance of the centre of mass from the origin is : [AIPMT 2012 (Mains)]

(1) 40 cm (2) 45 cm (3) 50 cm (4) 30 cm

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Q.52 A solid cylinder of mass 3 kg is rolling on a horizontal surface with velocity 4 m s^{-1}. It collides with a horizontal spring of force constant 200 N m^{-1}. The maximum compression produced in the spring will be [AIPMT 2012 (Prelims)]

(1) 0.5 m (2) 0.6 m (3) 0.7 m (4) 0.2 m

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Q.53 When a mass is rotating in a plane about a fixed point, its angular momentum is directed along [AIPMT 2012 (Prelims)]

(1) a line perpendicular to the plane of rotation

(2) the line making an angle of 45° to the plane of rotation

(3) the radius

(4) the tangent to the orbit

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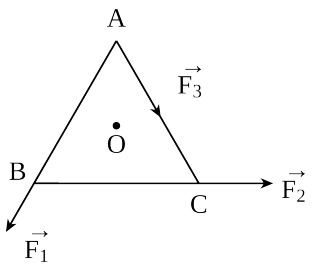
Q.54 Two persons of masses 55 kg and 65 kg respectively, are at the opposite ends of a boat. The length of the boat is 3.0 m and weighs 100 kg. The 55 kg man walks up to the 65 kg man and sits with him. If the boat is in still water the centre of mass of the system shifts by: [AIPMT 2012 (Prelims)]

(1) 3.0 m (2) 2.3 m (3) zero (4) 0.75 m

Scan or tap for the full solution

Q.55 ABC is an equilateral triangle with O as its centre. $\vec{F_1}$, $\vec{F_2}$ and $\vec{F_3}$ represent three forces acting along the sides AB, BC and AC respectively. If the total torque about O is zero then magnitude of $\vec{F_3}$ is [AIPMT 2012 (Prelims)]

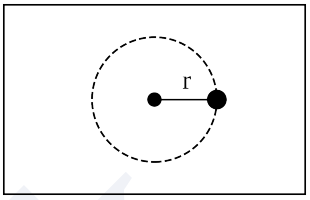


(1) $F_1 + F_2$ (2) $F_1 - F_2$

(3) $\frac{F_1 + F_2}{2}$ (4) $2(F_1 + F_2)$

Scan or tap for the full solution

Q.56 A small mass attached to a string rotates on a frictionless table top as shown. If the tension in the string is increased by pulling the string causing the radius of the circular motion to decrease by a factor of 2, the kinetic energy of the mass will [AIPMT 2011 (Mains)]



(1) decrease by a factor of 2

(2) remain constant

(3) increase by a factor of 2

(4) increase by a factor of 4

Solution

Q.57 The instantaneous angular position of a point on a rotating wheel is given by the equation
$\theta(t) = 2t^3 - 6t^2$
The torque on the wheel becomes zero at [AIPMT 2011 (Prelims)]

(1) t = 1 s (2) t = 0.5 s

(3) t = 0.25 s (4) t = 2 s

Scan or tap for the full solution

Q.58 The moment of inertia of a thin uniform rod of mass M and length L about an axis passing through its midpoint and perpendicular to its length is I_0. Its moment of inertia about an axis passing through one of its ends and perpendicular to its length is [AIPMT 2011 (Prelims)]

(1) $I_0 + ML^2/2$ (2) $I_0 + ML^2/4$

(3) $I_0 + 2ML^2$ (4) $I_0 + ML^2$

Scan or tap for the full solution

Q.59 From a circular disc of radius R and mass 9M, a small disc of mass M and radius $\frac{R}{3}$ is removed concentrically. The moment of inertia of the remaining disc about an axis perpendicular to the plane of the disc and passing through its centre is [AIPMT 2010 (Mains)]

(1) $\frac{40}{9}MR^2$ (2) MR^2

(3) $4MR^2$ (4) $\frac{4}{9}MR^2$

Scan or tap for the full solution

Q.60 A solid cylinder and a hollow cylinder, both of the same mass and same external diameter are released from the same height at the same time on an inclined plane. Both roll down without slipping. Which one will reach the bottom first?

[AIPMT 2010 (Mains)]

(1) Both together only when angle of inclination of plane is 45°
(2) Both together
(3) Hollow cylinder
(4) Solid cylinder

Solution

Q.61 A thin circular ring of mass M and radius r is rotating about its axis with constant angular velocity ω. Two objects each of mass m are attached gently to the opposite ends of a diameter of the ring. The ring now rotates with angular velocity given by

[AIPMT 2010 (Mains)]

(1) $\frac{(M+2m)\omega}{2m}$ (2) $\frac{2M\omega}{M+2m}$
(3) $\frac{(M+2m)\omega}{M}$ (4) $\frac{M\omega}{M+2m}$

Scan or tap for the full solution

Q.62 Which one of the following pairs of statements is correct ?

A. Centre of gravity (C.G.) of a body is the point at which the weight of the body acts
B. Centre of mass coincides with the centre of gravity if the earth is assumed to have infinitely large radius.
C. To evaluate the gravitational field intensity due to any body at an external point, the entire mass of the body can be considered to be concentrated at its C.G.
D. The radius of gyration of any body rotating about an axis is the length of the perpendicular dropped from the C.G. of the body to the axis.

[AIPMT 2010 (Mains)]

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

Scan or tap for the full solution

Q.63 A circular disk of moment of inertia I_t is rotating in a horizontal plane, about its symmetry axis, with a constant angular speed ω_i. Another disk of moment of inertia I_b is dropped coaxially onto the rotating disk. Initially the second disk has zero angular speed. Eventually both the disks rotate with a constant angular speed ω. The energy lost by the initially rotating disc to friction is

[AIPMT 2010 (Prelims)]

(1) $\frac{1}{2}\frac{I_b^2}{(I_t+I_b)}\omega_i^2$ (2) $\frac{1}{2}\frac{I_t^2}{(I_t+I_b)}\omega_i^2$
(3) $\frac{I_b-I_t}{(I_t+I_b)}\omega_i^2$ (4) $\frac{1}{2}\frac{I_bI_t}{(I_t+I_b)}\omega_i^2$

Scan or tap for the full solution

Q.64 Two particles which are initially at rest, move towards each other under the action of their internal attraction. If their speeds are v and 2v at any instant, then the speed of centre of mass of the system will be :

[AIPMT 2010 (Prelims)]

(1) 2v (2) zero (3) 1.5 v (4) v

Scan or tap for the full solution

Q.65 A thin circular ring of mass M and radius R is rotating in a horizontal plane about an axis vertical to its plane with a constant angular velocity ω. If two objects each of mass m be attached gently to the opposite ends of a diameter of the ring, the ring will then rotate with an angular velocity

[AIPMT 2009]

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

Scan or tap for the full solution

Q.66 If $\vec{F}$ is the force acting on a particle having position vector $\vec{r}$ and $\vec{\tau}$ be the torque of this force about the origin, then

[AIPMT 2009]

(1) $\vec{r}\cdot\vec{\tau}>0$ and $\vec{F}\cdot\vec{\tau}<0$
(2) $\vec{r}\cdot\vec{\tau}=0$ and $\vec{F}\cdot\vec{\tau}=0$
(3) $\vec{r}\cdot\vec{\tau}=0$ and $\vec{F}\cdot\vec{\tau}\neq 0$
(4) $\vec{r}\cdot\vec{\tau}\neq 0$ and $\vec{F}\cdot\vec{\tau}=0$

Solution

Q.67 Four identical thin rods each of mass M and length l, form a square frame. Moment of inertia of this frame about an axis through the centre of the square and perpendicular to its plane is

[AIPMT 2009]

(1) $\frac{2}{3}Ml^2$ (2) $\frac{13}{3}Ml^2$
(3) $\frac{1}{3}Ml^2$ (4) $\frac{4}{3}Ml^2$

Scan or tap for the full solution

Q.68 Two bodies of mass 1 kg and 3 kg have position vectors $\hat{i}+2\hat{j}+\hat{k}$ and $-3\hat{i}-2\hat{j}+\hat{k}$, respectively. The centre of mass of this system has a position vector :

[AIPMT 2009]

(1) $-2\hat{i}-\hat{j}+\hat{k}$ (2) $2\hat{i}-\hat{j}-2\hat{k}$
(3) $-\hat{i}+\hat{j}+\hat{k}$ (4) $-2\hat{i}+2\hat{k}$

Scan or tap for the full solution

Q.69 A thin rod of length L and mass M is bent at its midpoint into two halves so that the angle between them is 90°. The moment of inertia of the bent rod about an axis passing through the bending point and perpendicular to the plane defined by the two halves of the rod is [AIPMT 2008]

(1) $\frac{ML^2}{6}$ (2) $\frac{\sqrt{2}\,ML^2}{24}$

(3) $\frac{ML^2}{24}$ (4) $\frac{ML^2}{12}$

Scan or tap for the full solution

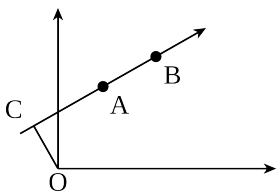
Q.70 The ratio of the radii of gyration of a circular disc to that of a circular ring, each of same mass and radius, around their respective axes is [AIPMT 2008]

(1) $\sqrt{2}:1$ (2) $\sqrt{2}:\sqrt{3}$

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

Scan or tap for the full solution

Q.71 A particle of mass m moves in the XY plane with a velocity v along the straight line AB. If the angular momentum of the particle with respect to origin O is L_A when it is at A and L_B when it is at B, then [AIPMT 2007]



(1) $L_A = L_B$

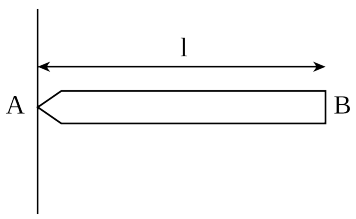
(2) the relationship between L_A and L_B depends upon the slope of the line AB

(3) $L_A < L_B$

(4) $L_A > L_B$

Scan or tap for the full solution

Q.72 A uniform rod AB of length l and mass m is free to rotate about point A. The rod is released from rest in the horizontal position. Given that the moment of inertia of the rod about A is $\frac{ml^2}{3}$, the initial angular acceleration of the rod will be [AIPMT 2007]



(1) $\frac{mgl}{2}$ (2) $\frac{3}{2}gl$ (3) $\frac{3g}{2l}$ (4) $\frac{2g}{3l}$

Scan or tap for the full solution

Q.73 A wheel has angular acceleration of 3.0 rad/sec^2 and an initial angular speed of 2.00 rad/sec. In a time of 2 sec it has rotated through an angle (in radian) of [AIPMT 2007]

(1) 10 (2) 12 (3) 4 (4) 6

Scan or tap for the full solution

Q.74 A uniform rod AB of length l and mass m is free to rotate about point A. The rod is released from rest in the horizontal position. Given that the moment of inertia of the rod about A is $\frac{ml^2}{3}$, the initial angular acceleration of the rod will be [AIPMT 2006]

(1) $\frac{mgl}{2}$ (2) $\frac{3}{2}gl$ (3) $\frac{3g}{2l}$ (4) $\frac{2g}{3l}$

Scan or tap for the full solution

Q.75 The moment of inertia of a uniform circular disc of radius R and mass M about an axis touching the disc at its diameter and normal to the disc [AIPMT 2006]

(1) $\frac{1}{2}MR^2$ (2) MR^2 (3) $\frac{2}{5}MR^2$ (4) $\frac{3}{2}MR^2$

Scan or tap for the full solution

Q.76 The moment of inertia of a uniform circular disc of radius R and mass M about an axis passing through the edge of the disc and normal to the disc is [AIPMT 2005]

(1) MR^2 (2) $\frac{1}{2}MR^2$ (3) $\frac{3}{2}MR^2$ (4) $\frac{7}{2}MR^2$

Scan or tap for the full solution

Q.77 A drum of radius R and mass M, rolls down without slipping along an inclined plane of angle θ. The frictional force [AIPMT 2005]

(1) dissipates energy as heat

(2) decreases the rotational motion

(3) decreases the rotational and translational motion

(4) converts translational energy to rotational energy.

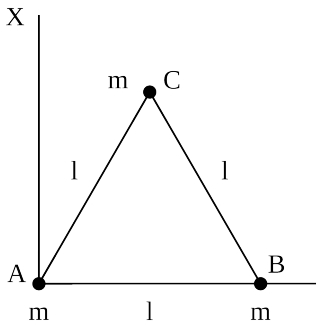
Scan or tap for the full solution

Q.78 Two bodies have their moments of inertia I and 2I respectively about their axis of rotation. If their kinetic energies of rotation are equal, their angular velocity will be in the ratio [AIPMT 2005]

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

Scan or tap for the full solution

Q.79 Three particles, each of mass m gram, are situated at the vertices of an equilateral triangle ABC of side l cm (as shown in the figure). The moment of inertia of the system about a line AX perpendicular to AB and in the plane of ABC, in gram − cm^2 units will be [AIPMT 2004]



(1) $\frac{3}{4}ml^2$ (2) $2ml^2$ (3) $\frac{5}{4}ml^2$ (4) $\frac{3}{2}ml^2$

Scan or tap for the full solution

Q.80 Consider a system of two particles having masses m_1 and m_2. If the particle of mass m_1 is pushed towards the mass centre of particles through a distance d, by what distance would the particle of mass m_2 move so as to keep the mass centre of particles at the original position? [AIPMT 2004]

(1) $\frac{m_1}{m_1+m_2}d$ (2) $\frac{m_1}{m_2}d$
(3) d (4) $\frac{m_2}{m_1}d$

Scan or tap for the full solution

Q.81 A wheel having moment of inertia 2 kg m^2 about its vertical axis, rotates at the rate of 60 rpm about this axis. The torque which can stop the wheel's rotation in one minute would be [AIPMT 2004]

(1) $\frac{2\pi}{15}$ N m (2) $\frac{\pi}{12}$ N m
(3) $\frac{\pi}{15}$ N m (4) $\frac{\pi}{18}$ N m

Scan or tap for the full solution

Q.82 A round disc of moment of inertia I_2 about its axis perpendicular to its plane and passing through its centre is placed over another disc of moment of inertia I_1 rotating with an angular velocity ω about the same axis. The final angular velocity of the combination of discs is [AIPMT 2004]

(1) $\frac{I_2\omega}{I_1+I_2}$ (2) ω
(3) $\frac{I_1\omega}{I_1+I_2}$ (4) $\frac{(I_1+I_2)\omega}{I_1}$

Scan or tap for the full solution

Q.83 The ratio of the radii of gyration of a circular disc about a tangential axis in the plane of the disc and of a circular ring of the same radius about a tangential axis in the plane of the ring is [AIPMT 2004]

(1) 2:3 (2) 2:1
(3) $\sqrt{5}:\sqrt{6}$ (4) $1:\sqrt{2}$

Scan or tap for the full solution

Q.84 A ball rolls without slipping. The radius of gyration of the ball about an axis passing through its centre of mass is K. If radius of the ball be R, then the fraction of total energy associated with its rotational energy will be [AIPMT 2003]

(1) $\frac{K^2+R^2}{R^2}$ (2) $\frac{K^2}{R^2}$
(3) $\frac{K^2}{K^2+R^2}$ (4) $\frac{R^2}{K^2+R^2}$

Scan or tap for the full solution

Q.85 A solid cylinder of mass M and radius R rolls without slipping down an inclined plane of length L and height h. What is the speed of its centre of mass when the cylinder reaches its bottom ? [AIPMT 2003]

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

Scan or tap for the full solution

Q.86 A thin circular ring of mass M and radius r is rotating about its axis with a constant angular velocity ω. Four objects each of mass m, are kept gently to the opposite ends of two perpendicular diameters of the ring. The angular velocity of the ring will be : [AIPMT 2003]

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

Scan or tap for the full solution

Q.87 A rod of length 3 m and its mass acting per unit length is directly proportional to distance x from one of its end then its centre of gravity from that end will be at : [AIPMT 2002]

(1) 1.5 m (2) 2 m (3) 2.5 m (4) 3.0 m

Scan or tap for the full solution

Q.88 A point P is considered at contact point of a wheel on ground which rolls on ground without slipping then value of displacement of point P when wheel completes half of rotation (if radius of wheel is 1 m) [AIPMT 2002]

(1) 2 m (2) $\sqrt{\pi^2+4}$ m

(3) π m (4) $\sqrt{\pi^2+2}$ m

Scan or tap for the full solution

Q.89 A solid sphere of radius R is placed on smooth horizontal surface. A horizontal force F is applied at height h from the lowest point. For the maximum acceleration of centre of mass, which is correct ? [AIPMT 2002]

(1) h = R

(2) h = 2R

(3) h = 0

(4) no relation between h and R.

Solution

Q.90 A disc is rotating with angular speed ω. If a child sits on it, what is conserved [AIPMT 2002]

(1) linear momentum (2) angular momentum

(3) kinetic energy (4) potential energy

Scan or tap for the full solution

Q.91 A circular disc is to be made by using iron and aluminium so that it acquired maximum moment of inertia about geometrical axis. It is possible with [AIPMT 2002]

(1) aluminium at interior and iron surround to it

(2) iron at interior and aluminium surround to it

(3) using iron and aluminium layers in alternate order

(4) sheet of iron is used at both external surface and aluminium sheet as internal layers.

Scan or tap for the full solution

Q.92 A disc is rolling, the velocity of its centre of mass is v_{cm}. Which one will be correct? [AIPMT 2001]

(1) the velocity of the highest point is $2v_{cm}$ and of the point of contact is zero

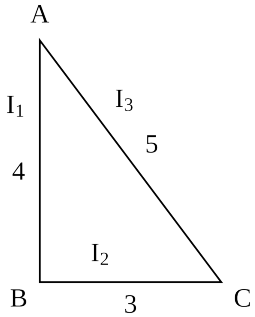
(2) the velocity of the highest point is v_{cm} and of the point of contact is v_{cm}

(3) the velocity of the highest point is $2v_{cm}$ and of the point of contact is v_{cm}

(4) the velocity of the highest point is $2v_{cm}$ and of the point of contact is $2v_{cm}$.

Scan or tap for the full solution

Q.93 For the adjoining diagram (a uniform right-angled triangular plate ABC), the correct relation between I_1, I_2 and I_3 is (I – moment of inertia about the marked side) [AIPMT 2000]



(1) $I_1 > I_2$ (2) $I_2 > I_1$ (3) $I_3 > I_1$ (4) $I_3 > I_2$

Scan or tap for the full solution

Q.94 For a hollow cylinder and a solid cylinder rolling without slipping on an inclined plane, then which of these reaches earlier [AIPMT 2000]

(1) solid cylinder (2) hollow cylinder

(3) both simultaneously (4) can't say anything

Scan or tap for the full solution

ANSWER KEY

Ques.	1	2	3	4	5	6	7	8	9	10	11
Ans.	4	3	4	3	4	2	1	1	2	4	4
Ques.	12	13	14	15	16	17	18	19	20	21	22
Ans.	3	2	2	2	2	1	2	1	2	2	2
Ques.	23	24	25	26	27	28	29	30	31	32	33
Ans.	3	2	4	1	4	2	1	4	4	4	3
Ques.	34	35	36	37	38	39	40	41	42	43	44
Ans.	3	2	1	2	3	3	2	1	2	4	1
Ques.	45	46	47	48	49	50	51	52	53	54	55
Ans.	3	2	4	2	3	1	1	2	1	3	1
Ques.	56	57	58	59	60	61	62	63	64	65	66
Ans.	4	1	2	1	4	4	1	4	2	1	2
Ques.	67	68	69	70	71	72	73	74	75	76	77
Ans.	4	1	4	4	1	3	1	3	4	3	4
Ques.	78	79	80	81	82	83	84	85	86	87	88
Ans.	3	3	2	3	3	3	3	3	2	2	2
Ques.	89	90	91	92	93	94					
Ans.	4	2	1	1	2	1					