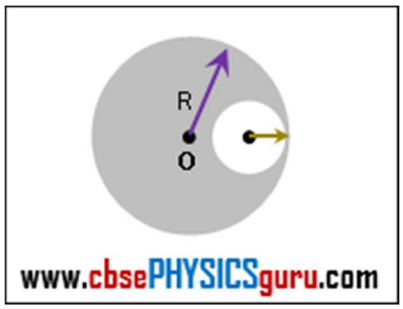
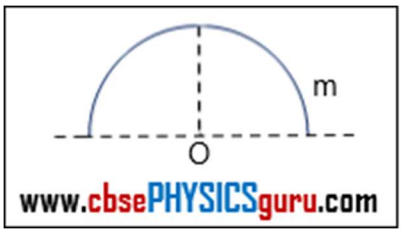
MOMENT OF INERTIA

1. Three point masses, each of mass m, are placed at the corner of an equilateral triangle of side L. Then the moment of inertia of this system about an axis along one side of the triangle is:
   (a) $\frac{3mL^2}{4}$ (b) $\frac{3mL^2}{2}$ (c) $\frac{5mL^2}{2}$ (d) $\frac{mL^2}{2}$
2. From a circular disc of radius R and mass 9m, a small disc of radius R/3 is removed. The moment00 of inertia of the remaining disc about an axis perpendicular to the plane of the disc and passing through centre O is:
   (a) $\frac{40mR^2}{9}$ **(b)** $\frac{32mR^2}{9}$ (c) $4mR^2$ (d) $32mR^2$

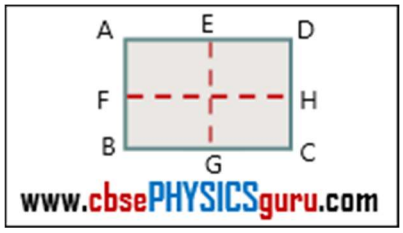


3. Two particles of masses m_1 and m_2 are connected to a rigid massless rod of length L to constitute a dumb bell. The moment of inertia of the dumb bell about an axis perpendicular to the plane passing through the centre of mass is:
   (a) $(m_1+m_2)L^2$ (b) $(m_1-m_2)L^2$ (c) $\frac{m_1m_2L^2}{m_1-m_1}$ **(d)** $\frac{m_1m_2L^2}{m_1+m_1}$
4. The radius of gyration of a uniform rod of length L about an axis passing through its centre of mass and perpendicular to its length is:
   (a) $\frac{L}{\sqrt{2}}$ (b) $\frac{L}{3\sqrt{2}}$ **(c)** $\frac{L}{2\sqrt{3}}$ (d) $\frac{L}{\sqrt{3}}$
5. A circular disc A of radius R is made from an iron plate of thickness t, and another disc B of radius 3R is made from an iron plate of thickness t/2. The ratio of the moment of inertia of A and B is:
   (a) 1/32 (b) 3/16 (c) 2/27 **(d)** 2/81
6. A thin wire of length L and mass m is bent in the form of a semicircle as shown in the figure. Its moment of inertia about an axis joining its free ends will be:
   (a) $\frac{mL^2}{2\pi^2}$ (b) $\frac{mL^2}{\pi^2}$ (c) $\frac{3mL^2}{2\pi^2}$ (d) $\frac{mL^2}{3\pi^2}$



7. A uniform rod of mass m and length L makes an angle θ with an axis of rotation which passes through one end of the rod. Its moment of inertia about this axis is:
   (a) $\frac{mL^2}{3}\ cos^2\ \theta$ (b) $\frac{mL^2}{3}\ sin\ \theta$ **(c)** $\frac{mL^2}{3}\ sin^2\ \theta$ (d) $\frac{mL^2}{3}$
8. A disc of mass m and radius r having moment of inertia *I* about the axis passes through its centre and perpendicular to its plane. It is recast into a uniform disc of radius 3r. What will be the moment of inertia about the same axis?
   (a) *I*/2 (b) *I*/6 (c) 6*I* **(d)** 9*I*
9. A fly wheel is a uniform disc of mass 32 kg and radius 50 cm. When it is rotating at the rate of 60 rpm, its kinetic energy is:
   (a) 107 J **(b)** 158 J (c) 222 J (d) 324 J
10. From a circular ring of mass M and radius R, an arc of length 1/4th of the circumference is removed. The moment of inertia of the remaining part of the ring about an axis passing through the centre of the ring and perpendicular to the plane of the ring is:
    (a) $\frac{3MR^2}{4}$ (b) $\frac{MR^2}{4}$ (c) $\frac{2MR^2}{3}$ (d) MR^2

11. Three thin uniform rods each of mass M and length L are placed along the three axes of a Cartesian coordinate system. The moment of inertia of the system about y-axis is:
    (a) $\frac{4mL^2}{3}$ (b) $\frac{mL^2}{6}$ **(c)** $\frac{2mL^2}{3}$ (d) $\frac{mL^2}{3}$
12. In the rectangular lamina shown in the figure, AB = BC/2. The moment of inertia of the lamina is minimum along the axis passing through:
    (a) AB (b) BC (c) EG **(d)** FH



13. The moment of inertia of a rod about an axis passing through its centre and perpendicular to it is *I*. The rod is bent in the middle so that the two halves make an angle of 60°. The moment of inertia of the bent rod about the same axis would be:
    (a) 2*I* **(b)** *I* (c) *I*/2(d) 4*I*
14. From a given sample of uniform thin wire, two circular loops A and B are made, A of radius r and B of radius nr. If the moment of inertia of B about its axis is 4 times that of A about its axis, the value of n is:
    (a) $(4)^{1/3}$ (b) $(4)^{2/3}$ (c) $(2)^{1/3}$ (d) $(4)^{2/5}$
15. Two rings of the same radius R and mass M are placed such that their centres are at a common point and their planes are perpendicular to each other. The moment of inertia of the system about an axis passing through the centre and perpendicular to the plane of one of the rings is:
    (a) $\frac{3MR^2}{8}$ (b) $\frac{3MR^2}{4}$ **(c)** $\frac{3MR^2}{2}$ (d) $2MR^2$
16. A hoop of mass M and radius R is hung from a nail fixed in a wall. Its moment of inertia about the nail is:
    (a) $3MR^2$ **(b)** $2MR^2$ (c) MR^2 (d) $\frac{3MR^2}{2}$
17. The moment of inertia of a circular ring about one of its diameters is *I*. What will be its moment of inertia about a tangent perpendicular to the diameter?
    (a) 4*I* (b) 3*I* (c) 2*I* (d) *I*/2
18. Four spheres of diameter 2*a* and mass m are placed with their centres on the four corners of a square of side *b*. Then the moment of inertia of the system about an axis along one of the sides of the square is:
    (a) $\frac{8}{5}\ ma^2 + mb^2$ (b) $\frac{4}{5}\ ma^2 + 2mb^2$ **(c)** $\frac{8}{5}\ ma^2 + 2mb^2$ (d) $\frac{4}{5}\ ma^2 + mb^2$
19. A square plate of side L has mass m. What is its moment of inertia about one of its diagonals?
    (a) $\frac{mL^2}{12}$ (b) $\frac{mL^2}{9}$ (c) $\frac{mL^2}{6}$ (d) $\frac{mL^2}{4}$
20. Three identical thin rods each of length L and mass m are joined together to form a letter H. What is the moment of inertia of the system about one of the sides of H?
    (a) $\frac{mL^2}{3}$ (b) $\frac{3mL^2}{4}$ (c) $\frac{mL^2}{4}$ **(d)** $\frac{4mL^2}{3}$
21. A circular thin disc of mass m kg has a diameter 2R. Calculate its moment of inertia about an axis passing through the edge and perpendicular to the plane of the disc:
    (a) $\frac{MR^2}{2}$ **(b)** $\frac{3MR^2}{2}$ (c) $\frac{3MR^2}{4}$ (d) $\frac{MR^2}{4}$