

CSD2301 Practice

**12. Rotation and Moment of  
Inertia Part 2**

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# Practice Question 1

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Calculate the moment of inertia of each of the following uniform objects about the axes indicated.

- (a) A thin 2.50 kg rod of length 75.0 cm, about an axis perpendicular to it and passing through (i) one end and (ii) its center, and (iii) about an axis parallel to the rod and passing through it.
- (b) A 3.00 kg sphere 38.0 cm in diameter, about an axis through its center, if the sphere is (i) solid and (ii) a thin-walled hollow shell.
- (c) An 8.00 kg cylinder, of length 19.5 cm and diameter 12.0 cm, about the central axis of the cylinder, if the cylinder is (i) thin-walled and hollow, and (ii) solid.

## Practice Question 2

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Energy is to be stored in a 70.0 kg flywheel in the shape of a uniform solid disk with radius  $R=1.20$  m. To prevent structural failure of the flywheel, the maximum allowed radial acceleration of a point on its rim is  $3500 \text{ m/s}^2$ . What is the maximum kinetic energy that can be stored in the flywheel?



# Practice Question 3

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About what axis will a uniform sphere have the same moment of inertia as does a thin-walled, hollow, lead sphere of the same mass and radius, with the axis along a diameter?

## Practice Question 4

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A thin, rectangular sheet of metal has mass  $M$  and sides of length  $a$  and  $b$ . Use the parallel-axis theorem to calculate the moment of Inertia of the sheet for an axis that is perpendicular to the plane of the sheet and that passes through one corner of the sheet.



## Practice Question 5

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A thin uniform rod 50.0 cm long with mass 0.320 kg is bent at its center into a V shape, with a  $70.0^\circ$  angle at its vertex. Find the moment of inertia of this V-shaped object about an axis perpendicular to the plane of the V at its vertex.

## Practice Question 6

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A passenger bus in Zurich, Switzerland, derived its motive power from the energy stored in a large flywheel. The wheel was brought up to speed periodically, when the bus stopped at a station, by an electric motor, which could then be attached to the electric power lines. The flywheel was a solid cylinder with mass 1000 kg and diameter 1.80 m. Its top angular speed was 3000 rev/min. (a) At this angular speed, what is the kinetic energy of the flywheel? (b) If the average power required to operate the bus is  $1.86 \times 10^4$  W, how long could it operate between stops?