Answer Note that the result for the moment of inertia of a cylinder does not depend on L, the length of the cylinder. In other words, it applies equally well to a long cylinder and a flat disk having the same mass M and radius R. Thus, the moment of inertia of the cylinder would not be affected by changing its length.

Table 10.2 gives the moments of inertia for a number of objects about specific axes. The moments of inertia of rigid objects with simple geometry (high symmetry) are relatively easy to calculate provided the rotation axis coincides with an axis of symm… The calculation of moments of inertia about an arbitrary axis can be cumbers… however, even for a highly symmetric object. Fortunately, use of an important the… called the **parallel-axis theorem,** often simplifies the calculation. Suppose… moment of inertia about an axis through the center of mass of an object is I_{CM}… parallel-axis theorem states that the moment of inertia about any axis parallel to… a distance D away from this axis is

Parallel-axis theorem

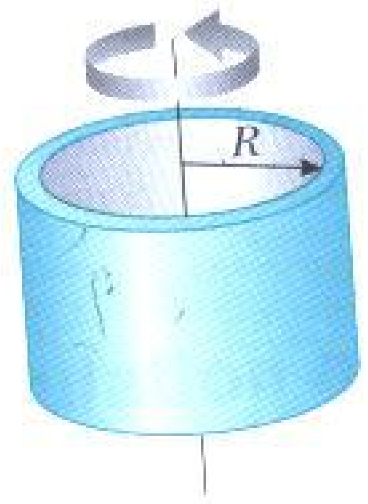
$$I = I_{CM} + MD^2$$

To prove the parallel-axis theorem, suppose that an object rotates in the xy… about the z axis, as shown in Figure 10.12, and that the coordinates of the cen… mass are x_{CM}, y_{CM}. Let the mass element dm have coordinates x, y. Because…

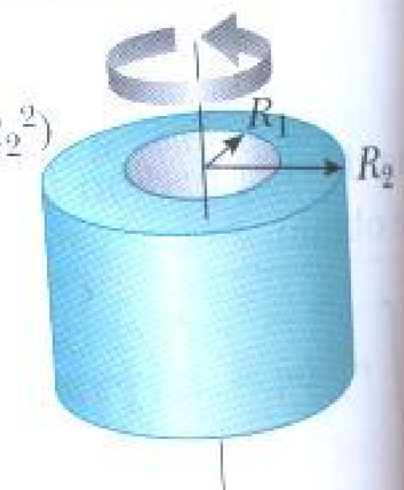
Table 10.2

Moments of Inertia of Homogeneous Rigid Objects with Different Geometries

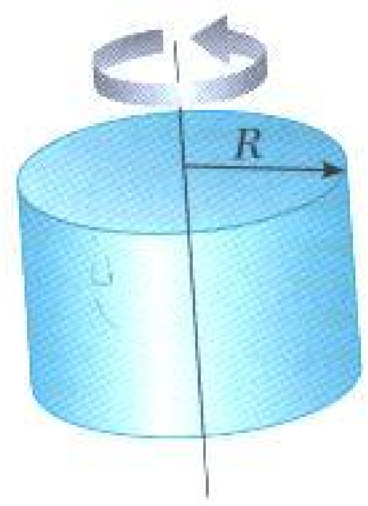
Hoop or thin cylindrical shell
$I_{CM} = MR^2$



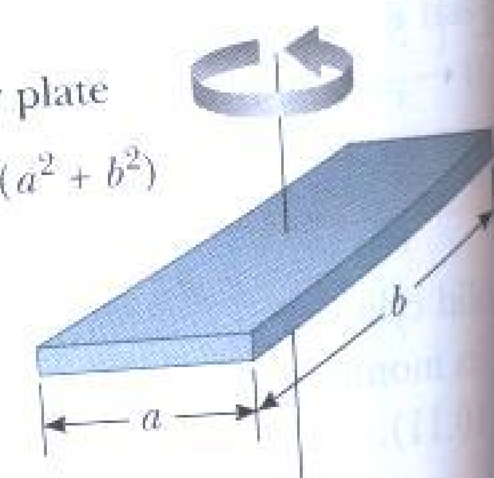
Hollow cylinder
$I_{CM} = \frac{1}{2}M(R_1^{\,2} + R_2^{\,2})$



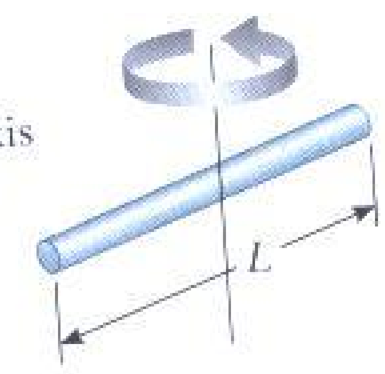
Solid cylinder or disk
$I_{CM} = \frac{1}{2}MR^2$



Rectangular plate
$I_{CM} = \frac{1}{12}M(a^2 + b^2)$

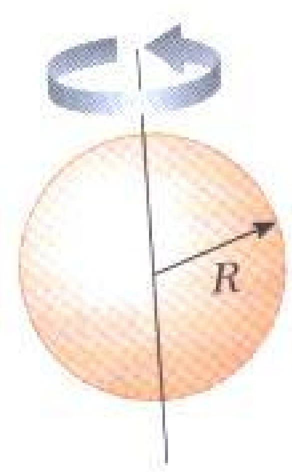


Long thin rod with rotation axis through center
$I_{CM} = \frac{1}{12}ML^2$



Long thin rod with rotation axis through end
$I = \frac{1}{3}ML^2$

Solid sphere
$I_{CM} = \frac{2}{5}MR^2$



Thin spherical shell
$I_{CM} = \frac{2}{3}MR^2$