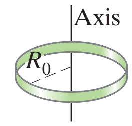
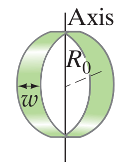
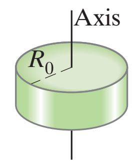
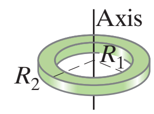
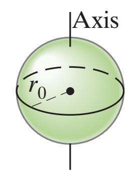
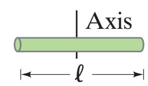
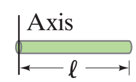
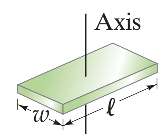
	Object	Location of axis		Moment of inertia
(a)	**Thin hoop**, radius R_0	Through center		MR_0^2
(b)	**Thin hoop**, radius R_0 width w	Through central diameter		$\frac{1}{2}MR_0^2 + \frac{1}{12}Mw^2$
(c)	**Solid cylinder**, radius R_0	Through center		$\frac{1}{2}MR_0^2$
(d)	**Hollow cylinder**, inner radius R_1 outer radius R_2	Through center		$\frac{1}{2}M(R_1^2 + R_2^2)$
(e)	**Uniform sphere**, radius r_0	Through center		$\frac{2}{5}Mr_0^2$
(f)	**Long uniform rod**, length ℓ	Through center		$\frac{1}{12}M\ell^2$
(g)	**Long uniform rod**, length ℓ	Through end		$\frac{1}{3}M\ell^2$
(h)	**Rectangular thin plate**, length ℓ, width w	Through center		$\frac{1}{12}M(\ell^2 + w^2)$

FIGURE 10–21 Moments of inertia for various objects of uniform composition, each with mass M. [We use R for radial distance from an axis, and r for distance from a point (only in e, the sphere), as discussed in Fig. 10–2.]

For most ordinary objects, the mass is distributed continuously, and the calculation of the moment of inertia, ΣmR^2, can be difficult. Expressions can, however, be worked out (using calculus) for the moments of inertia of regularly shaped objects in terms of the dimensions of the objects, as we will discuss in Section 10–7. Figure 10–21 gives these expressions for a number of solids rotated about the axes specified. The only one for which the result is obvious is that for the thin hoop or ring rotated about an axis passing through its center perpendicular to the plane of the hoop (Fig. 10–21a). For this hoop, all the mass is concentrated at the same distance from the axis, R_0. Thus $\Sigma mR^2 = (\Sigma m)R_0^2 = MR_0^2$, where M is the total mass of the hoop.

When calculation is difficult, I can be determined experimentally by measuring the angular acceleration α about a fixed axis due to a known net torque, $\Sigma\tau$, and applying Newton's second law, $I = \Sigma\tau/\alpha$, Eq. 10–14.

10–6 Solving Problems in Rotational Dynamics

When working with torque and angular acceleration (Eq. 10–14), it is important to use a consistent set of units, which in SI is: α in rad/s^2; τ in m·N; and the moment of inertia, I, in kg·m^2.