Engineering Physics I Name _____
PHYS 1210 Spring 2015

Discussion 8 – Rotational Kinematics and more (Ch 9)

Equations

$\theta = x / r$

$\omega = v / r$

$\alpha = a / r$

$\theta_f = \frac{1}{2}\alpha t^2 + \omega_o t + \theta_0$

$\omega_f = \omega_0 + \alpha t$

$\omega_f^2 = \omega_0^2 + 2\alpha\Delta\theta$

$K = \frac{1}{2} I\omega^2$

$I = \int r^2\, dm$

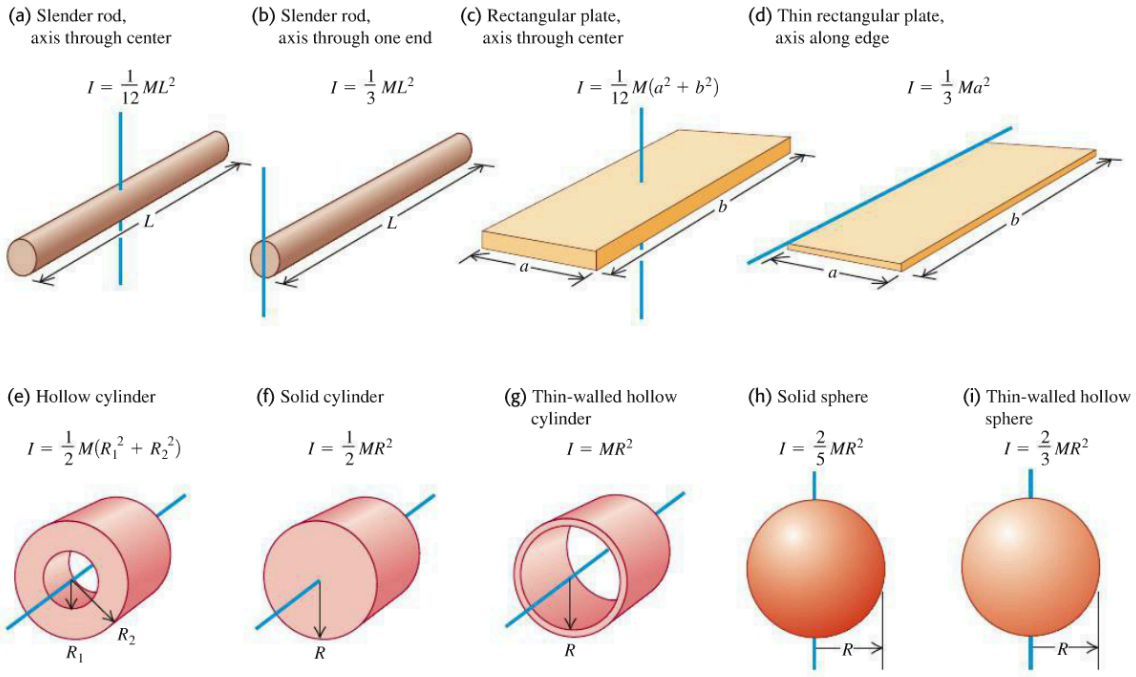
$= \sum_i m_i r_i^2$

$= \# MR^2$

Parallel Axis Theorem

$I_p = I_{CM} + Md^2$

Table 9.2 Moments of Inertia of Various Bodies

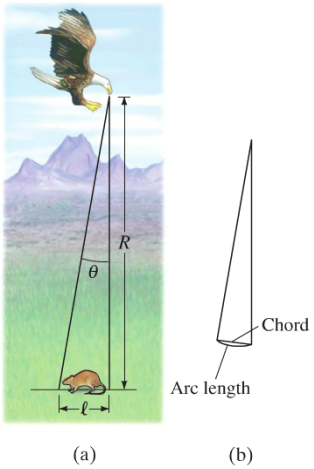


My Problem Solving Approach (for Rotation)

1. Draw a picture
2. List Know/Need
   a. Write down the letters for each thing
   b. Find the equivalent translational quantity
3. Find formulae
   a. Compare to translational versions
4. Do Math
5. Sanity Check

Problems (some from Giancoli, 4e)

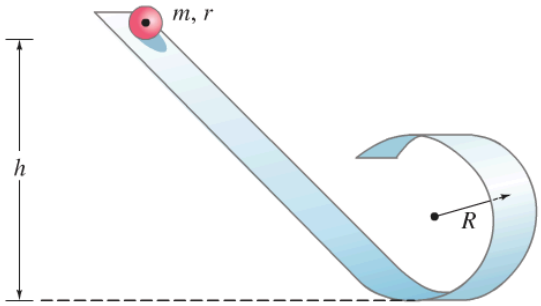
EXAMPLE 10–1 **Birds of prey—in radians.** A particular bird's eye can just distinguish objects that subtend an angle no smaller than about 3×10^{-4} rad. (*a*) How many degrees is this? (*b*) How small an object can the bird just distinguish when flying at a height of 100 m (Fig. 10–3a)?



2) A square (shown above) is made out of four rods and then spun around an axis through its center (indicated by the star). If each rod has a mass of 0.50kg and a length of 0.75m, what is the square's moment of inertia?

9) Based on P10-9
- a) What is the linear speed of a point on the Earth's equator due to the Earth's rotation? Take the Earth's radius to be 6,371km.
- b) …At the Arctic Circle (latitude 66.5ºN)?
- c) …At Laramie's latitude, 41.3ºN?
- d) What is the angular velocity due to the Earth's rotation here in Laramie?
- e) Bonus: Since 1972, approximately 25 leap seconds have been added to the year. What is the Earth's angular acceleration?

94. A marble of mass m and radius r rolls along the looped rough track of Fig. 10–67. What is the minimum value of the vertical height h that the marble must drop if it is to reach the highest point of the loop without leaving the track?



Hint: Compare with the loop-the-loop problem from Disc 6 (Ch 7: Cons of E)