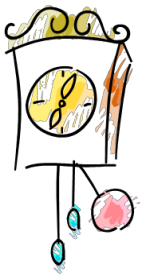
# Rotational Inertia

## Objectives

Calculate Rotational Inertia.

Calculate angular momentum.

Use conservation of angular momentum to analyze changes in velocity & radius.

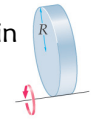


## Rotational Inertia (I)

inertia depends on .... mass, radius, shape → moment of inertia

## Rotational Inertia (I)

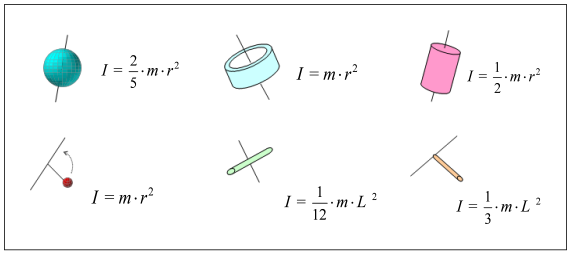
objects that aren't spinning tend to remain NOT spinning




objects that spin tend to remain spinning

UNLESS acted on by an outside force (torque)

## Rotational Inertia Equations




Unit: $kg \cdot m^2$

## Rotational Inertia Problem

**m = .5 kg** **r = .06 m**

**Ball**

$I = \frac{2}{5} m r^2$

$= \frac{2}{5} (.5 kg)(.06)^2$

$I = .00072 \ kg \cdot m^2$

faster

**Ring**

$I = mr^2$

$= (.5 kg)(.06 m)^2$

$I = .0018 \ kg \cdot m^2$

↑ I

slower

## Angular Momentum (L)

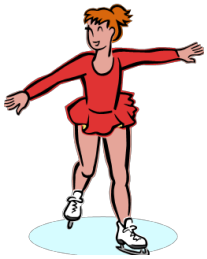
depends on mass, velocity and radius

$L = m \cdot v_t \cdot r$ Unit: $kg \cdot m^2/s$

## Conservation of Angular Momentum

total L remains constant

$L = m \cdot v_t \cdot r$



## Angular Momentum Problem

$m = 2$ kg
$r_1 = .6$ m
$v_{t1} = 4$ m/s

$L = m \cdot v_t \cdot r$
$= 2kg \cdot 4\frac{m}{s} \cdot .6m$
$L = 4.8\ kg \cdot \frac{m^2}{s}$

## Angular Momentum Problem

$m = 2$ kg
$r_1 = .6$ m
$v_{t1} = 4$ m/s

$L = m \cdot v_t \cdot r$
$= (2\ kg)(.6\ m)(4\ m/s)$
$= 4.8\ kg\ m^2/s$

$r_2 = .2$ m
$v_{t2} = ?$

$L = m \cdot v_t \cdot r$
$4.8 = 2kg \cdot (v_t) \cdot .2_4$
$v_t = 12\frac{m}{s}$

## Assignments . . .

- Chapter 10 Homework #7 - 11

- Discuss ideas for Mobile Project with your lab group