Moment of Inertia

Four particles are attached by spokes of negligible mass to a central axis. As the axis spins, the particles rotate about the axis at constant angular speed as shown below.

Question: How can we calculate the rotational kinetic energy of this 4 particle system?

Answer: _____

Definition:

1. The moment of inertia is the rotational analog of _____.

It tells us how difficult it is to _____ the object's

_____.

2. Unlike _____, the Moment of Inertia is NOT a property of just the

body. It depends on the _____ of _____

and how the object's mass is _____.

If the _____ of _____ or the object's _____

changes then the object's moment of inertia changes.

Ways of Finding An Object's Moment of Inertia

A. It is told to you in the problem statement

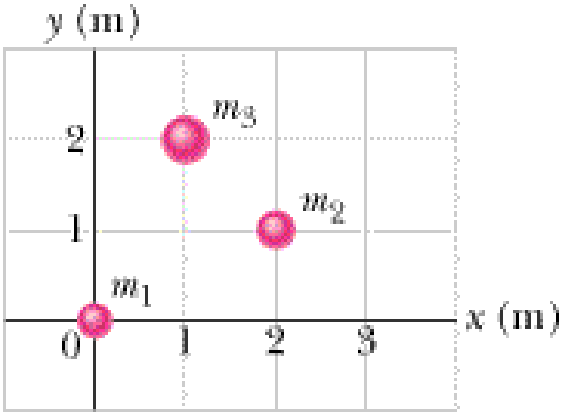
B. Use the definition to calculate it

C. For some uniform objects the moment of inertia about their center of mass axis are in tables like Table 8-21 on pg 208 of Ginacoli.

D. Use the Parallel Axis Theorem to expand tables for non-center of mass axis.

E. Solve for it using Newton II or other physics equations.

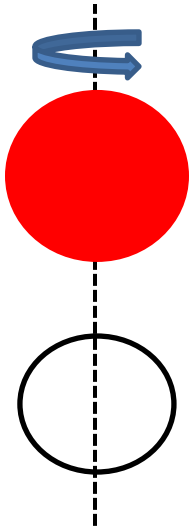
Example: Find the Moment of Inertia for the following system



A. An axis through the origin

B. An axis located at (2, 0)

Example: A uniform solid sphere and a hoop rotate about a vertical axis as shown. If the hoop's mass and radius are 2.5 kg and 0.3 m and the sphere's mass and radius are 4.0 kg and 0.5 m, what is the moment of inertia of the system?



Parallel Axis Theorem

If the moment of inertia for the center of mass axis is known for a rigid body then the moment of inertia for any parallel axis can be found by adding the product of the object's mass times the square of the distance between the new axis and the center of mass axis to the object's moment of inertia about the center of mass axis.

Example: What is the moment of inertia for a uniform wooden rod of mass M and length L rotating about its end?