Science Virtual Learning

MPI Physics 210

Rotational Dynamics 8 – Moment of Inertia 2

April 28, 2020

Lesson: MPI Moment of Inertia 2
April 28, 2020

Objective: To be able to calculate the moment of inertia of objects spinning on their own axis

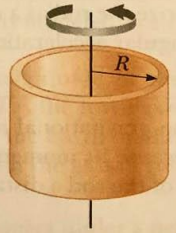
This video discusses Moment of Inertia “I” for objects rotating about their own internal axis.

https://youtu.be/2KszqUuxpr8

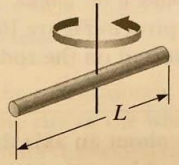
Video: Moment of Inertia 2

TABLE 10.2 Moments of Inertia of Homogeneous Rigid Objects with Different Geometries

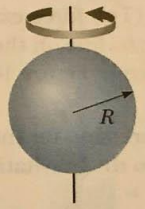
Hoop or thin cylindrical shell
$I_{CM} = MR^2$



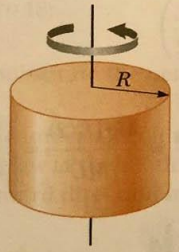
Long, thin rod with rotation axis through center
$I_{CM} = \frac{1}{12}ML^2$



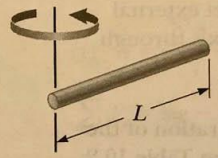
Solid sphere
$I_{CM} = \frac{2}{5}MR^2$



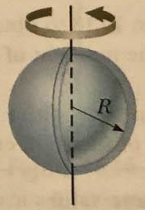
Solid cylinder or disk
$I_{CM} = \frac{1}{2}MR^2$



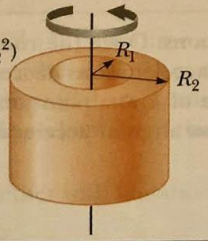
Long, thin rod with rotation axis through end
$I = \frac{1}{3}ML^2$



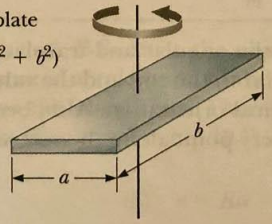
Thin spherical shell
$I_{CM} = \frac{2}{3}MR^2$



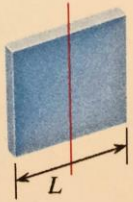
Hollow cylinder
$I_{CM} = \frac{1}{2}M(R_1^2 + R_2^2)$



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



Thin rectangular sheet, axis parallel to one edge and passing through center of other edge



$I = \frac{1}{12}ML^2$

Thin rectangular sheet, axis along one edge

$I = \frac{1}{3}ML^2$

Moment of Inertia for Different Shapes

This video gives two examples of calculating Moment of Inertia for objects rotating about their own axis.

https://youtu.be/idB-oSjcOBU

Videos: Moment of Inertia 2 - Examples

1. Find the moment of inertia of a 16.0 lb bowling ball of diameter 8.50 in.
2. A 0.0500-kg pizza cutter of radius 0.0500 m has a 0.0150-kg perfume bottle stuck to it 0.0400 m from the central axis. What is the moment of inertia of the system?

Examples from the Videos

Homework 1

Find the moment of inertia of a jar of peanut butter, of radius 0.034 m and mass 0.454 kg. Treat the jar as a uniform cylinder.

- Try to solve the problem yourself, then watch the first part of the solution video:
- https://youtu.be/-Q5S4sA-51o

Homework 2

A 0.015 kg ruler that is 0.31 m long has a 0.0454 kg mass attached at the 12 cm mark, and another 0.0397 kg mass attached at the 18 cm mark. The ruler is rotated about the center at the 15 cm mark. What is the moment of inertia of the entire system?

- Try to solve the problem yourself, then watch the second part of the solution video:
- https://youtu.be/-Q5S4sA-51o

That’s it!