

**Part B: Rotational Inertia****Rotational Inertia**

Rotational inertia is specifically, resistance to any change in rotational motion

- something that is not rotating resists beginning to rotate.
- Something that is already rotating resists stopping, or any change in its rotational velocity

**Rotational Inertia of Point Masses****Point Mass**

One mass, located at one single point.

As long as you are dealing only with point masses, you don't need to use calculus to do physics.

The formula for rotational inertia of a point mass:

$$I = mr^2$$

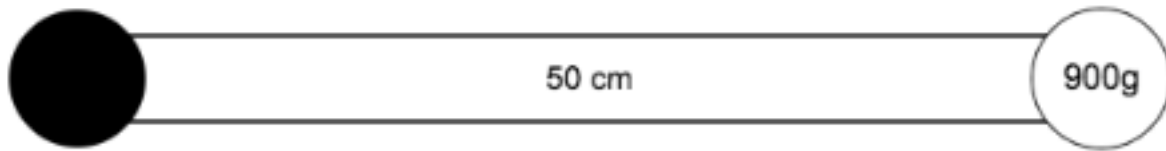
Symbol	Quantity	SI Unit
$I$	Rotational inertia	Kg-m <sup>2</sup>
$m$	Mass	Kilograms
$r$	Distance from the pivot point	Meters

The following diagrams show rods designed to spin around. The black dot represents the pivot point, and all masses are labeled. In each case, the mass of the rod itself is negligible.

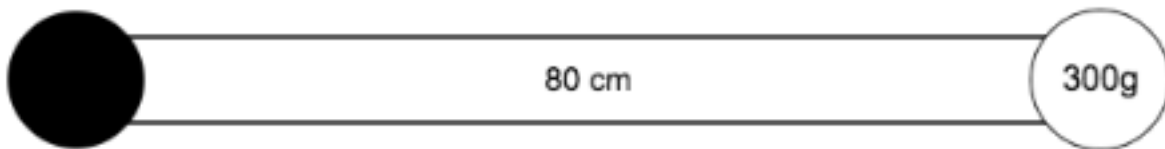
Use the formula above to calculate the rotational inertia of each rod.

Make sure that in each calculation you use proper SI units! (meters and kilograms)

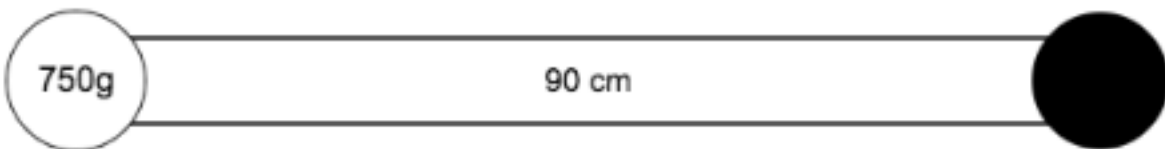
**B.1**



B.2



B.3

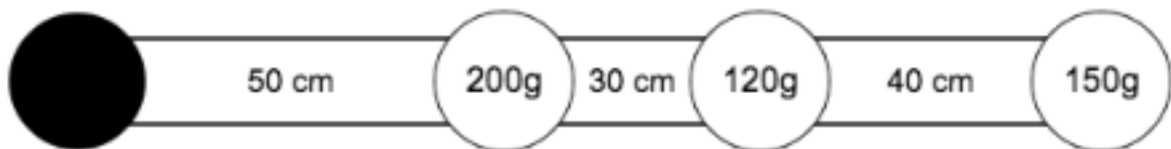
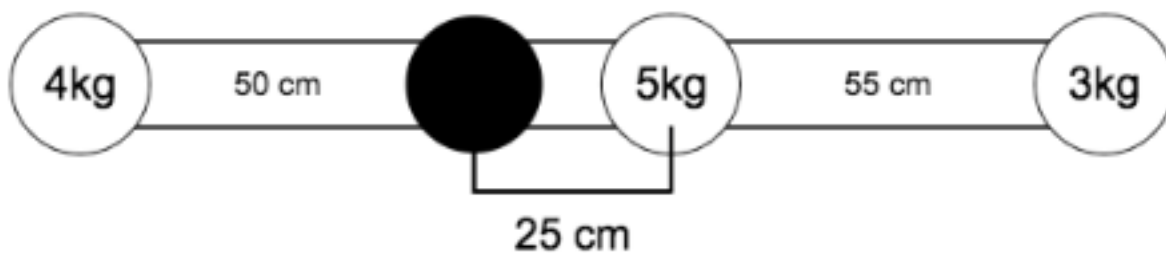
**Rotational Inertia of a collection of point masses:**

$$I = \sum_i m_i r_i^2$$

This is called *sigma notation* in mathematics. It means that you need to calculate the contribution for each point mass and add them all up:

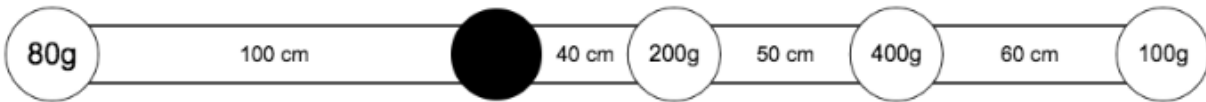
Calculate the rotational inertia of each of the following rods. Remember that the pivot is the block dot, and often masses are on both sides of it.

B.4

**B.5****B.6****B.7****B.8****B.9**



**B.10**



**B.11**

Rotational inertia conceptual question:

If mass A = 200 g and mass B = 100 g, which mass provides a larger contribution to the overall rotational inertia?



Rotational inertia of continuous masses.

Determining the rotational inertia for a continuous mass (such as a rod, hoop, disc, or sphere) requires using a calculus method called an *integral*.