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Answers (9.02 - Rotational Inertia)

1	A By grabbing the stick from its edge (0 cm), the axis of rotation is set at that point. The opposite end of the meter stick is then a full meter away from the axis and hardest to rotate. By grabbing any other point, the maximum distance from the axis would be less than 1 meter, and therefore, would be easier to rotate.

2 **Scenario**	**Where is the axis?**	**Inertia Formula**
A bowling ball rolls without slipping across a horizontal bowling lane	Center of bowling ball	Solid Sphere $I = \frac{2}{5} MR^2$
The minute hand of a clock rotating once every hour.	Center of clock	Rod (about end) $I = \frac{1}{3} ML^2$
A hamster wheel spins as a hamster runs on its inside	Center of hamster wheel	Hoop/Ring $I = MR^2$
The Earth while rotating around the Sun once every year.	Center of the Sun	Point Mass $I = MR^2$
A soccer ball rolls along a level, grassy surface.	Center of soccer ball	Hollow Sphere $I = \frac{2}{5} MR^2$
A tennis ball is tied to the end of a massless string and spun in a vertically-aligned circle.	End of the string connected to the person's hand	Point Mass $I = MR^2$
A seesaw oscillates up and down on top of a triangular pivot at its center.	Center of seesaw (triangular pivot)	Rod (about center) $I = 1/12\ ML^2$
A frisbee spins as it flies through the air	Center of frisbee	Solid Cylinder/Disk $I = \frac{1}{2} MR^2$

3	Hollow Wheel Rotational inertia is defined as 'an object's tendency to resist changes in rotational motion.' Since we are changing the rotational motion of each object from resting to rotating, we should be analyzing the rotational inertia of each object when considering which is harder to set into motion. According to the rotational inertia equation ($I = mr^2$), as radius increases, rotational inertia increases.Whichever object's mass is further from its center is the one with the larger rotational inertia. The hollow wheel has ALL of its 2kg mass located the full distance *r* from center, whereas the solid disc has its 2kg mass distributed throughout its shape. This means that some of the disc's mass is located closer to center than the distance *r*.

4	a) Position D (center of mass has shifted towards largess 2 kg mass) b) Position A (this puts the largest mass the furthest away: $I = mr^2$)