CONSERVATION OF ANGULAR MOMENTUM

● Remember: The most important part about LINEAR Momentum was that it is _____.

- The same is true for ANGULAR Momentum. Most Angular Momentum problems are about _____.

LINEAR MOMENTUM (p = _____)	ANGULAR MOMENTUM (L = _____)
- Conserved if no external _____.	- Conserved if no external _____.
- Or better yet, if **Σ**_____.	- Or better yet, if **Σ**_____.
- MOST problems involve TWO objects.	- MANY problems involve just ONE object.
- Conservation: _____.	- Conservation: _____.
_____	_____
- TWO Objects: Push-Away; Collision	- ONE Object: _____.
- Add/remove mass (collision/push-away)	- **2+** Objects: _____.

EXAMPLE: For each of the following, indicate whether the angular speed will increase or decrease:

(a) An ice skater spins on frictionless ice. What happens to her angular speed if she closes her arm**?**	**(b)** A large horizontal disc spins around itself. What happens to the disc's angular speed if you land on it**?**
(c) An object tied to a point via a string spins horizontally around it. What happens if you shorten the string**?**	**(d)** A star (like the Sun) spins around itself. What happens if it collapses and loses half its mass and half its radius**?**

EXAMPLE: ICE SKATER CLOSES HER ARMS

EXAMPLE**:** Suppose an ice skater has moment of inertia of 6 kg m² while spinning with arms wide open, and 4 kg m² if she closes her arms. If she spins at 120 RPM with arms open, what RPM will she have as a result of closing her arms**?**

PRACTICE: DIVER CHANGING ANGULAR SPEED

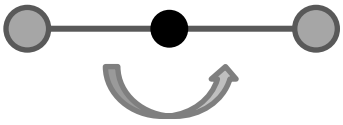
PRACTICE**:** Suppose a diver spins at 8 rad/s while falling with a moment of inertia about an axis through himself of 3 kg m^2**.** What moment of inertia would the diver need to have to spin at 4 rad/s**?** → BONUS**:** How could he accomplish this**?**

EXAMPLE: ANGULAR SPEED OF STAR AFTER COLLAPSE

EXAMPLE**:** When a star exhausts all its stellar energy, it **"**dies**"**, at which point a gravitational collapse happens, causing its radius and mass to decrease substantially. Our Sun spins around itself, at its equator, every 24.5 days. If our Sun were to collapse and shrink 90% in mass and 90% in radius, how long would its new period of rotation take, in days**?**

PRACTICE: TWO ASTRONAUTS SPINNING IN SPACE

PRACTICE**:** Two astronauts, both 80 kg, are connected in space by a light cable. When they are 10 m apart, they spin about their center of mass with 6 rad/s. Calculate the new angular speed they'll have if they pull on the rope to reduce their distance to 5 m. You may treat them as point masses, and assume they continue to spin around their center of mass**.**



EXAMPLE: MOVING ON A ROTATING DISC

EXAMPLE: A 200 kg disc 4 m in radius spins around a perpendicular axis through its center at 2 rad/s. An 80 kg person falls into the disc, with no horizontal speed, at a point 3 m away from the disc's center. Treating the person as a point mass:

(a) Calculate the disc's new angular speed.

(b) Calculate the person's new tangential speed.

(c) The person starts walking towards the disc's center.
Calculate the disc's speed once the person reaches it.