Conservation of Angular Momentum

Pre-Lecture Questions

Problem Set #30 (due next time)

Lecture Outline
1. Changing Rotational Inertia
2. Changing the Angular Momentum Vector
3. Rotational Collisions

Pre-Class Summary:

Using the connection between the Second Law and the Law of Conservation of Linear Momentum as a model, we went from the Second Law for Rotation to establish our third conservation law,

The Law of Conservation of Angular Momentum
"The total angular momentum of an isolated system of bodies remains constant."

Turn table demonstration
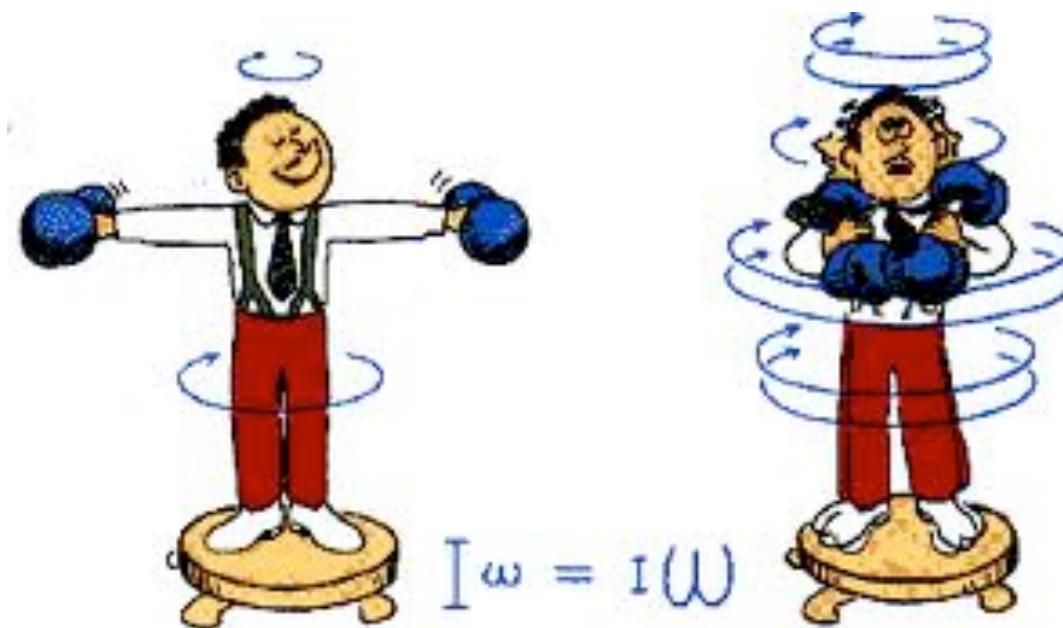
$$I\omega = I\omega$$

A remarkable ice skater does the four different spin moves shown all beginning with a single spin. Assume there are no external torques on her as she goes through each move. Rank them from greatest to least based upon her angular momentum.

A   B   C   D

A remarkable ice skater does the four different spin moves shown all beginning with a single spin. Assume there are no external torques on her as she goes through each move. Rank them from greatest to least based upon her angular speed.
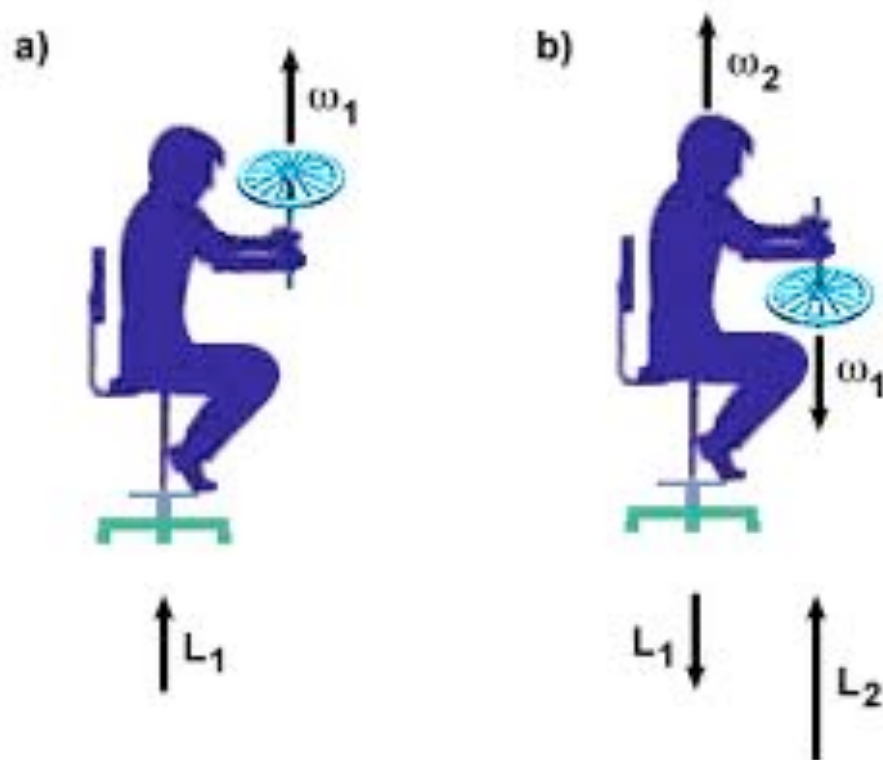
A   B   C   D

Example 1: A high diver is in a tuck position rotating at 50rpm when he switches to a kick out position just before hitting the water. Given that his rotational inertia grew by a factor of 6.2, find his rotation rate as he enters the water.

Turn table demonstration

Example 2: At the right is a brochure photo from a company that needs a loan to produce a personal helicopter hat. The propeller can be considered a stick of mass 400g and length 40cm. They say it will need to spin at 1000rpm. Estimate the spin rate of a 30kg boy cause by starting the propeller. Treat the boy as a cylinder of radius 20cm.

Example 3: The merry-go-round has a mass of 100kg and a radius of 1.50m. It can be treated as a disk spinning at 5.00rpm. The shooter has a mass of 75.0kg. He leaps tangentially off the merry-go-round in the same direction it is spinning with a speed of 3.20m/s. Find the rotation rate of the merry-go-round just after the shot.

Lecture 30 - Summary

The Law of Conservation of Angular Momentum
"The total angular momentum of an isolated system of bodies remains constant."

We looked at three different types of interactions:
- •Changing rotational inertia resulting in changing angular speed.
- •Changing the direction of the angular momentum vector.
- •Collisions that result in changing angular speeds.