Conservation of Angular Momentum

Pre-Class Questions

Problem Set (due next time)
Ch 10 - 22, 24, 31, 33

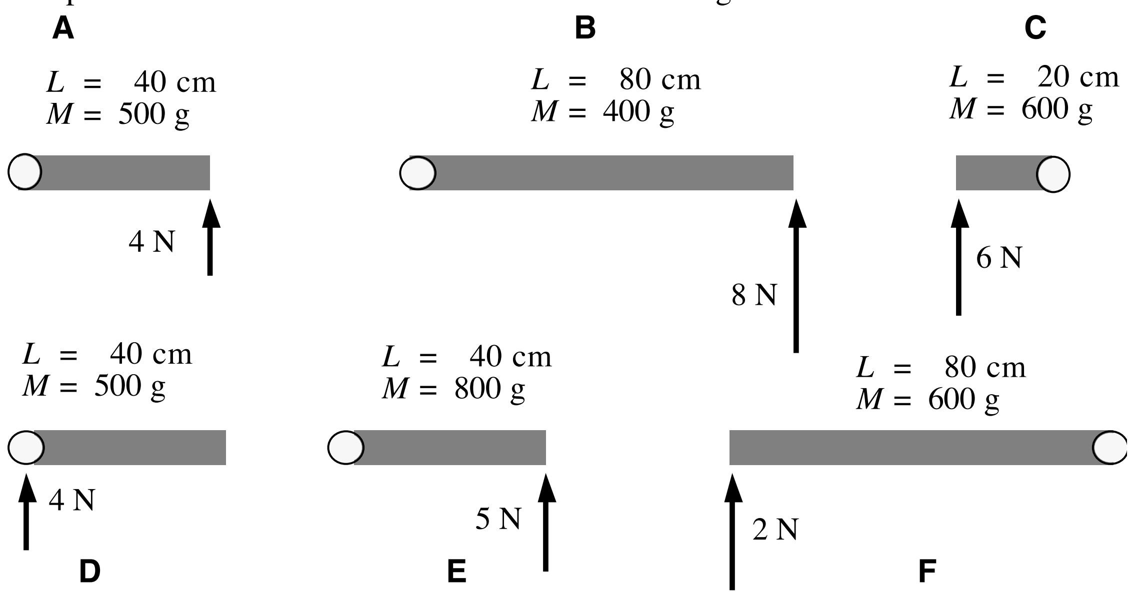
Lecture Outline

1. Torque and Angular Momentum
2. Angular Momentum of a Point Particle
3. The Law of Conservation of Angular Momentum

Example 1: A 2.00kg grinding wheel has a radius of 10.0cm. It accelerates from rest to 300rpm in 4.00s. Find (a)the final angular momentum and (b)the net torque required.

Shown below in a top view are six uniform rods that vary in mass (M) and length (L). Also shown are circles representing a vertical axis around which the rods are going to be rotated in a horizontal plane and arrows representing forces acting to rotate the rods. The forces change direction in order to always act perpendicular to the rods. Specific values for the lengths and masses of the rods and the magnitudes of the forces are given in each figure.

Rank these rods, from greatest to least, on the basis of their change in the magnitude of angular momentum for the same time period. That is, put first the rod that has the largest change in angular momentum and put last the one that will have the smallest change.



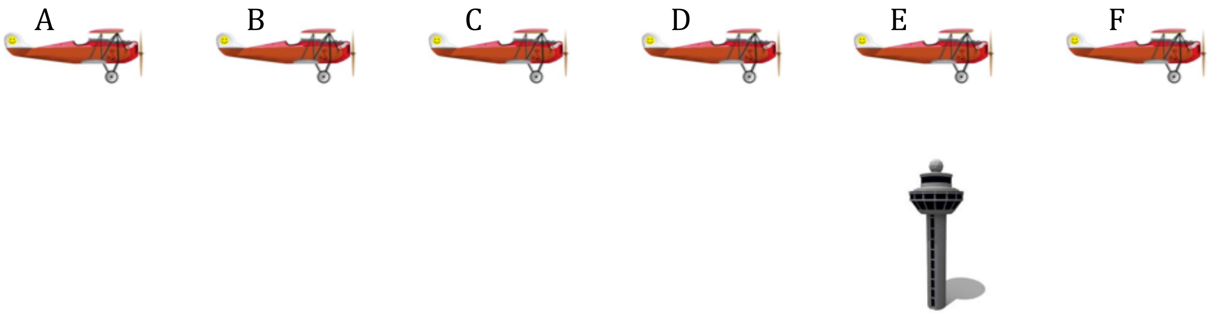
Greatest 1________ 2________ 3________ 4________ 5________ 6_______ Least

Or, all six of these rods will have the same change in magnitude of angular momentum. _____

Please carefully explain your reasoning.

Example 2: Find the angular momentum of the moon about Earth.

The airplane below travels horizontally staying at the same altitude and speed as if flies by the tower. The plane is shown at six different positions. Rank these based upon the angular momentum of the plane about the base of the tower.



Example 3: As a student pulls their arms in on the turntable, their angular speed changes from 10rpm to 15rpm. Assuming their rotational inertia was 1.8kg·m$^{@}$/s, find their rotational inertia afterward.

Example 4: A potter's wheel with a rotational inertia of $0.400 kg \cdot m^2$ rotates at 100rpm when a 4.00kg cylindrical hunk of clay 20.0cm in diameter is thrown directly down on the center. Find the rotation rate just after this collision.

Lecture 25 - Summary

Newton's Second Law for Rotation $\Sigma\tau = \frac{dL}{dt}$

The Angular Momentum of a Rigid Body $L = I\omega$

Angular Momentum of a Point Particle $L = r_{\perp} p$

The Law of Conservation of Angular Momentum

"The total angular momentum of an isolated system of bodies remains constant."