PH202 Recitation 2

Torque, Statics, Dynamics

Warm-Up 1

- Say the equation in words

$$|\vec{\tau}| = |\vec{r}||\vec{F}|sin\theta$$

Warm-Up 1 Solution

Torque

Torque

Position vector

Force vector

$$|\vec{\tau}| = |\vec{r}||\vec{F}|sin\theta$$

Smallest angle between the position vector and force vector when they are placed tail-to-tail

In words: The magnitude of the **torque** is equal to the magnitude of the **position vector** multiplied by the magnitude of the applied **force vector** multiplied by the sin of the **smallest angle** between the **position vector** and the **force vector.**

Warm-Up 2

- Say this equation in words

$$\sum \vec{\tau}_{ext,o} = I_o \, \vec{\alpha}_o$$

Warm-Up 2 Solution

Newton's Second Law

Summation or addition

Torque external to the system

Moment of inertia

Angular Acceleration

$$\sum \vec{\tau}_{ext,o} = I_o \vec{\alpha}_o$$

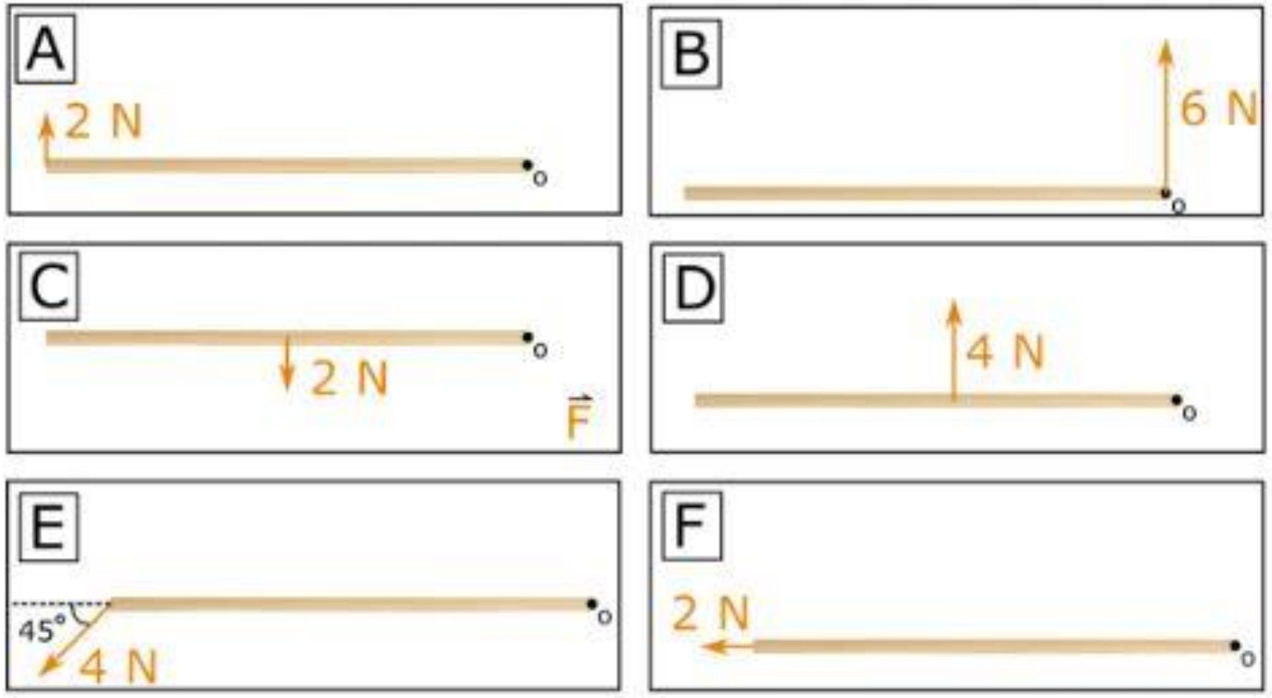
In words: The **net torque** from forces external to the system acting about axis o, is equal to the product of the **moment of inertia** about axis o, and the **angular acceleration** about axis o.

Discussion Question 1: 3 minutes

- If you wish to stop a door from closing using a door stop that wedges between the floor and the bottom of the door, where should you place the door stop and why?

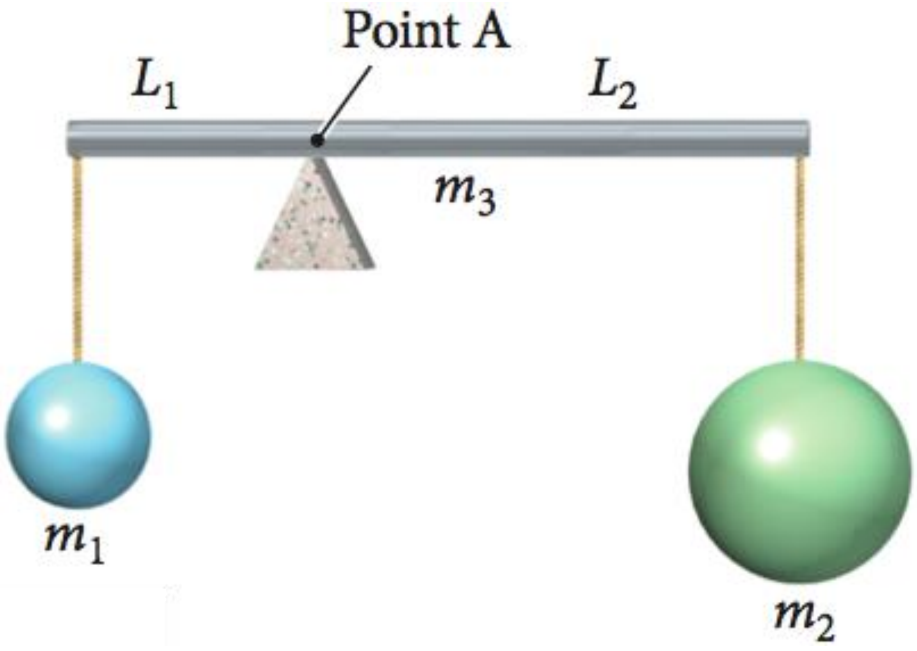
Discussion Question 2: 3 minutes

- Consider a block of wood being pushed/pulled on by a force as shown in the images below. The images are drawn to scale. Rank the torques in each situation from most negative to most positive.



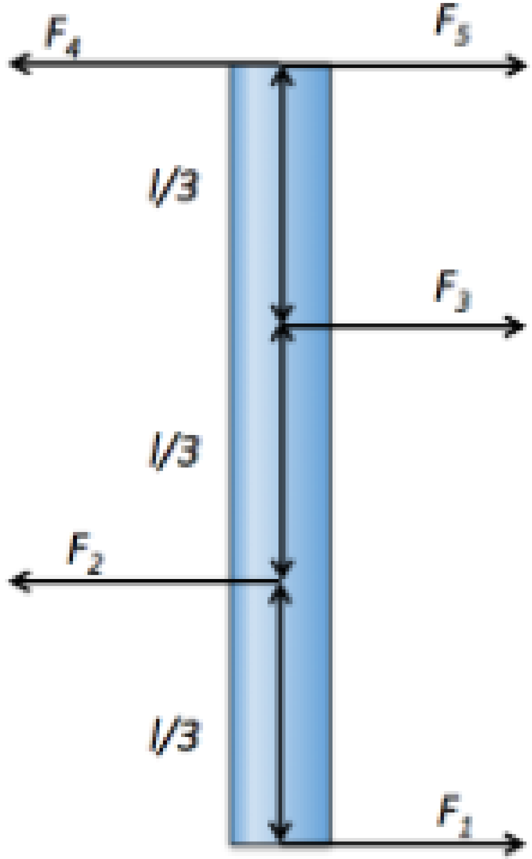
Discussion Question 3: 3 minutes

- The rod below m_3 is balancing at rest on a pivot at point A, while holding up 2 masses m_1 and m_2 located lengths L_1 and L_2 away from point A respectively. If m_1= 8kg, L_1= 2m, and L_2= 4m, what is m_2? May not be drawn to scale.



POTD: Read the Problem/Visualize: 2 minutes

- Tuesday Statics: The massless rod pictured is in static equilibrium. The length of the rod is L and is divided into L/3 segments with forces acting perpendicular to the rod. If F_2= 6N, F_3= 3N, and F_4= 6N, what are F_1 and F_5?
- Thursday Dynamics: Now have the same rod but the top of the rod is now bolted so that the rod rotates about the top. If all forces stay the same but F_2= 10N now, find the angular acceleration of the rod. Moment of Inertia for a rod about its end is $I = 1/3\ ML^2$



POTD: Picture, Knowns/Uknowns: 2 minutes

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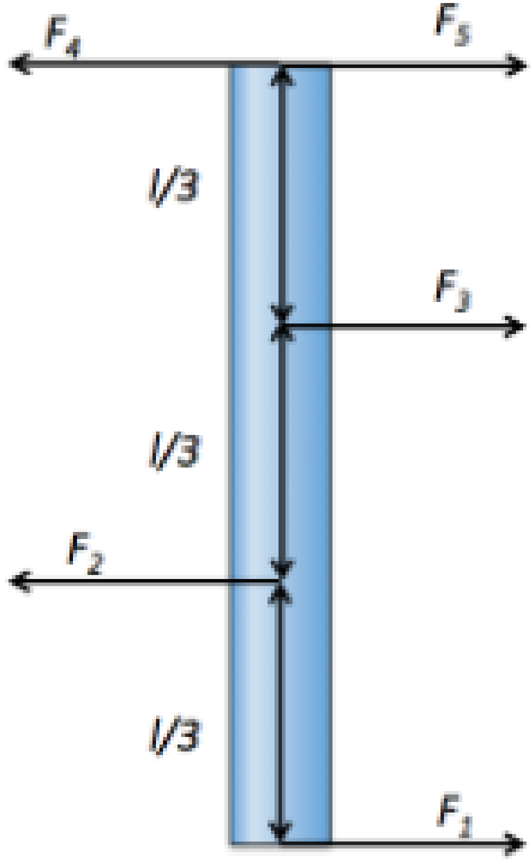

POTD: Solve the Problem: 2 minutes

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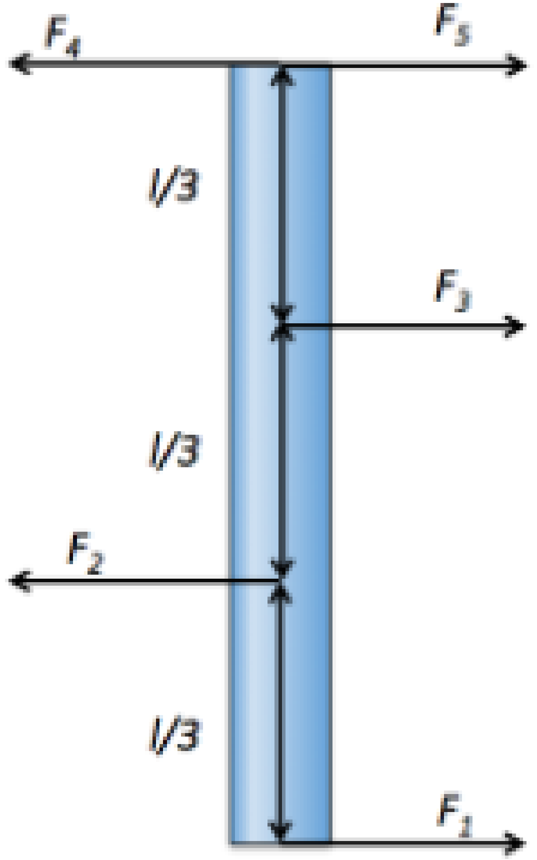

Challenge Homework Orientation

- A 4kg disk lies in static equilibrium on an incline that makes an angle of 40 degrees up from the horizontal. A rope, parallel to the incline, connects the disk to an immovable wall. Through experiment it is found that the static friction between the disk and the incline is maximum. What is (a) the tension in the rope and (b) the coefficient of static friction between the disk and the incline?