Slide 1 - Title

Physics 121

Class 19

Slide 2 - Schedule

Reminders

• The test ends at 4:00 pm tomorrow!!
• No homework due tomorrow - but HW is due on Friday
• There's a Quiz due Saturday

Slide 3 - Today

Last Time

• Several examples with torque, angular momentum, and rotational kinetic energy
• How torque changes angular momentum - qualitative

Slide 4 - Today

Today

• Statics
  \[ \sum \vec{F} = 0 \]
  \[ \sum \vec{r} = 0 \]
Slide 5 - Torque and Angular Momentum

Torque and Angular Momentum

Slide 6 - Bicycle

Bicycle

You are riding your bike down the road and turn your handlebars to the right. What happens?

Slide 7 - Bicycle

Bicycle

You are riding your bike down the road and lean to the right. What happens?

Slide 8 - Gyroscope

Top

A top can precess at a constant angle (though it usually doesn’t do that). Don’t worry about calculating the precession rate - but qualitatively understand this motion.
**Rod in an Aquarium**

\[ x: \ H_1 - H_2 = 0 \]
\[ y: \ N - W = 0 \]
\[ \tau_\theta: \ H_2 L \sin \theta - W \frac{L}{2} \cos \theta = 0 \]

\[ H_2 = \frac{W}{2} \cot \theta \]

**Balls in an Aquarium**

The balls are the same distance from the front wall and don’t touch the front or back. Find all the forces and torques.

\[ H_1 - F \cos \theta = 0 \]
\[ N - W - F \sin \theta = 0 \]
\[ F \cos \theta - H_1 = 0 \]
\[ F \sin \theta - W = 0 \]
\[ F = \frac{W}{\sin \theta} \]
\[ H_1 = H_2 = F \cos \theta = W \cot \theta \]
\[ N = 2W \]
**Balls in an Aquarium**

\[ H_i - F \cos \theta = 0 \]
\[ N - W - F \sin \theta = 0 \]
\[ F \cos \theta - H_i = 0 \]
\[ F \sin \theta - W = 0 \]

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**Tetrapod**

Four rods touch at the top and have ropes connecting adjacent rods to keep them from falling. Ignore friction with the ground below.

Top view:

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**Tetrapod**

\[ H - \sqrt{2} T = 0 \]
\[ N - W = 0 \]
\[ N \frac{L}{2} \cos \theta - H \frac{L}{2} \sin \theta = 0 \]
A platform extends horizontally from a wall to view the area below.

How does the tension in the ropes change as the man walks out on the platform?

Platform

\[ H - 2T \cos \theta = 0 \]
\[ N + 2T \sin \theta - W - w = 0 \]
\[ 2T \sin \theta \cdot L - W \frac{L}{2} - wx = 0 \]