

PHY115: Homework 4

Spring 2021

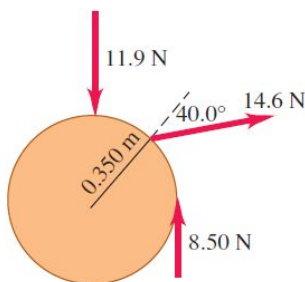
Deadline: March 29th

1 Discussion Questions: 30 p

1. What is the difference between tangential and radial acceleration for a point on a rotating body?
2. A flywheel rotates with constant angular velocity. Does a point on its rim have a tangential acceleration? A radial acceleration? Are these accelerations constant in magnitude? In direction? In each case give the reasoning behind your answer.
3. To maximize the moment of inertia of a flywheel while minimizing its weight, what shape and distribution of mass should it have? Explain.
4. How might you determine experimentally the moment of inertia of an irregularly shaped body about a given axis?

Exercise 1: 30 p

Three forces are applied to a wheel of radius 0.350 m , as shown in the figure. One force is perpendicular to the rim, one is tangent to it, and the other one makes a 40.0° angle with the radius. What is the net torque on the wheel due to these three forces for an axis perpendicular to the wheel and passing through its center?



Exercise 2: 30 p

Consider a solid sphere and a cylinder rolling without slipping in an inclined plane of angle β with an static friction coefficient μ_s .

1. Make free body diagrams for both bodies
2. What is the acceleration of their center of mass?
3. Which body roll down the incline the fastest?

Exercise 2: 30 p

Make a simulation of a cylinder rolling without slipping in 3dsMax.

1. Consider a cylinder of radius 10 px
2. An angular velocity $\omega = 1.5 \text{ rad}$
3. You must submit the *.max* file and the math expressions that you used in a *.tex* file.

Extra credit: 10 p

Explain qualitatively, the motion of a top.

1. Sketch the top and make a free body diagram
2. In the same sketch, show with a different color, the angular momentum and the torque.
3. Explain why the top does not fall when it is spinning?