MASSACHUSETTS INSTITUTE OF TECHNOLOGY
Department of Physics

Physics 8.01 TEAL **Fall Term 2004**

In-Class Problems 30-32: Moment of Inertia, Torque, and Pendulum

Section_____Table and Group Number _____

Names _____

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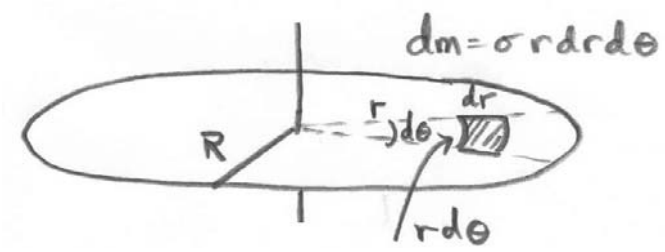
Hand in one solution per group.

Problem 30 Moment of Inertia of a Uniform disc.

A uniform disc of mass m and radius R is mounted on an axis passing through the center of the disc, perpendicular to the plane of the disc. In this problem, you will calculate the moment of inertia about two different axes that pass perpendicular to the disc. One passes through the center of mass of the disc and the second passes through a point on the rim of the disc a distance R from the center. As a starting point, consider the contribution to the moment of inertia from the mass element dm show in the figure below.

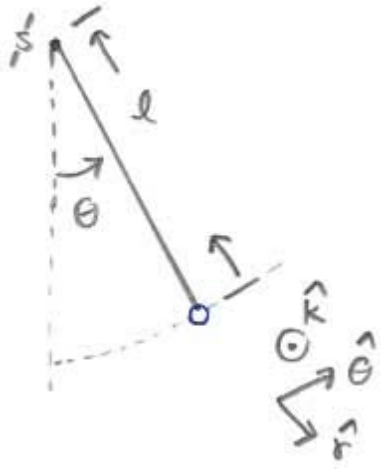


Problem 30 Turntable

A turntable is a uniform disc of mass 1.2 kg and radius $1.3\times10^{-1}m$. The turntable is spinning at an initial constant frequency of $f_0 = 33$ *cycles/min*. The motor is turned off and the turntable slows to a stop in 8.0 s due to frictional torque. Assume that the angular acceleration is constant. What is the magnitude of the frictional torque acting on the disc?

Problem 31: Simple Pendulum

A pendulum consists of an object hanging from the end of a string. The object is pulled to one side and allowed to oscillate. If the object has negligible size and the string is massless, then the pendulum is called a simple pendulum.



a) Find the equation of motion for the object.

b) Show that the object undergoes simple harmonic motion when the initial angle is small and you can approximate $\sin\theta \cong \theta$.

c) For small angles, what is the period of oscillation?

d) Is the angular velocity the same as the angular frequency for the object?