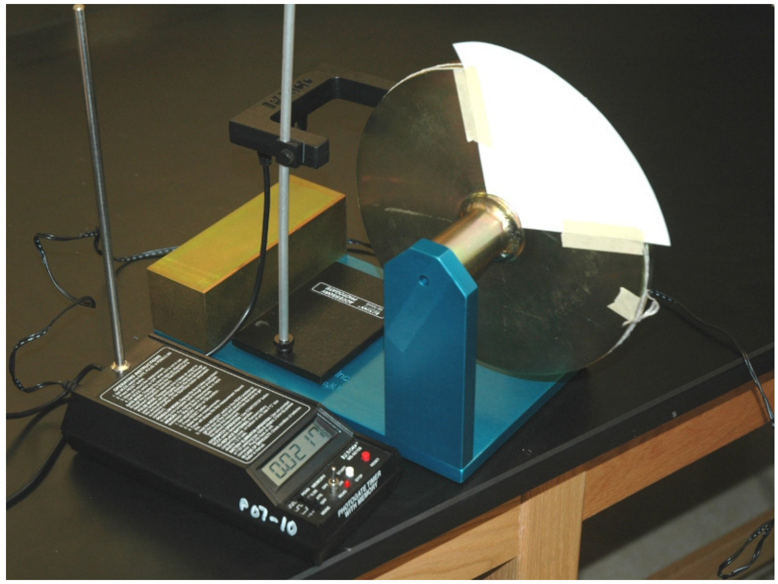
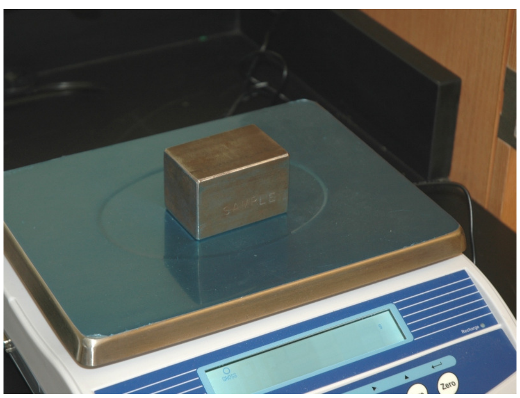
Rotational Inertia

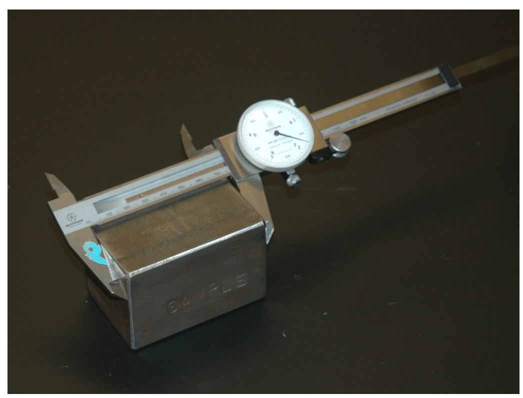
In this lab, we will determine the rotational inertia of the flywheel seen here using two methods.



For the first method, we will use the fact that $I = ½mR^2$ for a cylinder. Measuring the radius is not as easy as it sounds. For the largest wheel, you'll need to measure the circumference of the wheel using some string. You can use calipers for the smaller cylinders.

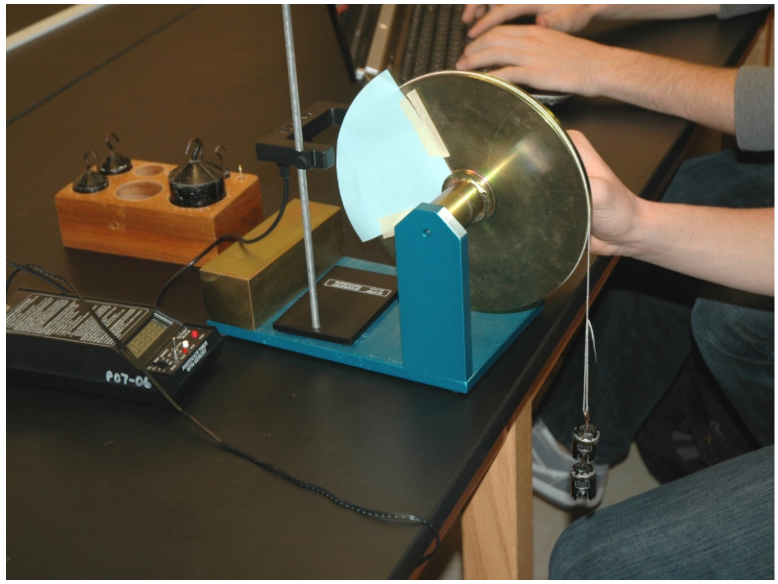
To measure m, we will first determine the density ρ of this material (steel) using a reference brick as seen here. You will need to weigh the brick, and also you'll need to determine its dimensions.





The second method is dynamic: we'll attach a string to the outer edge of the largest part of the wheel, and tie the free end to a small mass. As the mass falls, the wheel will angularly accelerate. If we can measure both the torque exerted on the wheel by the string for each small mass, and the angular acceleration of the wheel, then we should be able to determine the rotational inertia.

To determine α, we'll use a single photogate timer that is configured to measure multiple times. We'll add a paper fin to the wheel to trigger the photogate.



The paper fin will pass through the photogate twice, and the time of each passage will be used to compute an average ω for each of those two passes. Those two angular velocities will then be used to compute α.

A free body diagram of the small mass will be used, along with α, to determine the torque exerted on the wheel.