General Physics I Laboratory, Section 7 Due November 13, 2024
Dr. Pogo

Quiz #10

Name:_____ **Use a pencil, not a pen.**

Rotational Inertia

1. A rectangular "brick" of steel has dimensions 6 cm × 5 cm × 12 cm. Determine its volume.

V_{brick} = cm^3

2. The mass of this brick is m = 2850 g. Determine the density "ρ"of this steel brick, in g/cm^3.

ρ_{steel} = g/cm^3

3. For fun, convert this density into "regular" units of kg/m^3. To see whether you did it right, Google the correct answer before submitting!

ρ_{steel} = kg/m^3

4. A certain steel cylinder has a diameter of 18 cm, and a thickness of 3 cm. Determine its volume. Note that diameter is not the same as radius. Feel free to Google the area of a circle…

$V_{cylinder}$ = cm^3

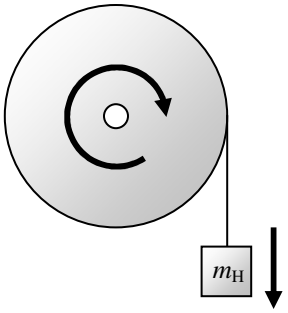
5. The cylinder and the brick are made from the same kind of steel. Use two of your prior answers to determine the mass of the cylinder

$m_{cylinder}$ = g

6. The cylinder is made to rotate about its own axis. Determine the rotational inertia I of the cylinder. Again, note that diameter is not the same as radius!

$I_{cylinder}$ = g·cm^2

A string is wrapped around the cylinder and tied to a small mass having m_H = 100 g. As m_H falls, it causes the cylinder to rotate. A free body diagram of m_H reveals that the tension in the string is $T = m_H g - m_H a$. Also, $a = R\alpha_{cylinder}$, so $T = m_H g - m_H R\alpha_{cylinder}$. The torque that makes the cylinder rotate is obviously just $R \cdot T$.



7. Use $\Sigma\tau = I\alpha$ to get an expression (i.e., all symbols, no numbers) for α. Be careful… α is also hiding in the torque, so α appears twice in this equation. You'll have to group them. Your symbolic answer should not use any numbers yet. Your expression for α should have only the following symbols in it: R, m_H, g, and $I_{cylinder}$.

α = _____

8. You already have numbers for those 4 things! So, use your formula to get a number for α.

α = rad/s^2