

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.

$V_{\text{brick}} =$	cm^3
----------------------	---------------

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

$\rho_{\text{steel}} =$	g/cm^3
-------------------------	-----------------

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

$\rho_{\text{steel}} =$	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...

$V_{\text{cylinder}} =$	cm^3
-------------------------	---------------

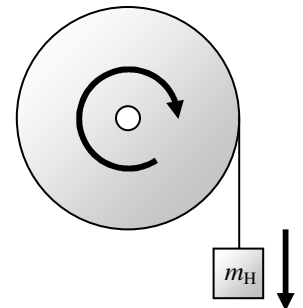
5. The cylinder and the brick are made from the same kind of steel. Use two of your prior answers to determine the mass of the cylinder

$m_{\text{cylinder}} =$	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!

$I_{\text{cylinder}} =$	$\text{g} \cdot \text{cm}^2$
-------------------------	------------------------------

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, $a = R \alpha_{\text{cylinder}}$, so $T = m_H g - m_H R \alpha_{\text{cylinder}}$. 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, so 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} .

$\alpha =$ _____

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

$\alpha =$	rad/s^2
------------	------------------