

Rolling PreLab

Name: _____ Lab Section: _____

Date: _____

PreLab Activity (10 points) – Complete prior to your lab session & hand in at the START of lab.

Listen to the YouTube video: https://www.youtube.com/watch?v=a-QG_-P3x_E

(a) What is the acceleration of a sphere, solid cylinder, or a hollow cylinder in terms of g , θ , m , r , and I ? Just write one single equation for all three objects (*Hint*: look for the 3 dot triangle)

(b) Substitute LeiAcademy's expression for f_s (look for the other 3 dot triangle) and N into the expression for the static friction force: $f_s \leq \mu_s N$

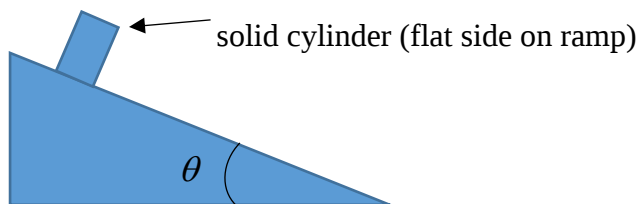
put in the expression
for f_s in terms of I ,
 a , and r

put in the expression
for N in terms of
 m , g , and θ

Show that for rolling to occur without sliding (or slipping), then: $\mu_s \geq \frac{\tan \theta}{1 + \frac{mR^2}{I}}$

That is, if the coefficient of static friction is less than the expression above, sliding (and rolling) can occur making all the equations in your Rolling Lab invalid. The objects in your lab must only roll. No sliding can occur.

You can find μ_s by placing the solid cylinder with its flat side on the ramp (shown below)



and using the relation for no sliding: $\mu_s \geq \tan \theta$.

When you get to lab, measure the coefficient of static friction, and determine whether the angle of your ramp will produce rolling without sliding.

END OF PRELAB – HAND IN AT THE BEGINNING OF YOUR LAB SESSION TO GET CREDIT