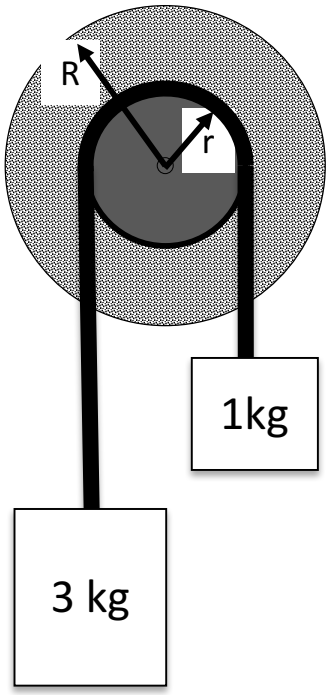
You will be graded on your *COMMUNICATION* of physics understanding

#1 The two masses at right are connected by a thin string over a light plastic pulley of radius r. The pulley is connected to a concrete flywheel of radius R and mass ***M***. The pulley/flywheel is free to turn on a smooth axel and moves along with the string. I would like to know the tension in the string connected to the 3 kg mass as I release it from rest.

a) What do you expect to see when the system is released from rest?
b) Can you tell me anything about the tension in the string? How does it compare to 30 N? 10 N? to the tension in the string above the 1 kg mass? Please explain why.
c) Please conceptually describe a plan to find the acceleration of this system by any means you like. But carefully explain your lens(es) and method.
d) Clarify your method above with the necessary equations.

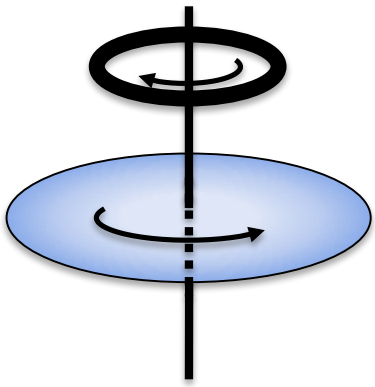


#2 Two identical planets, planet A and planet B orbit the same sun. The mass of the planets is much less than the mass of the sun: $m_A = m_B << m_S$. However, planet B is twice as far from the sun as planet A. ***You must explain your answers to receive credit.***

a) How do the planets' attractions to the sun compare? $F_B =$ __F_A.
b) How do the accelerations of two planets compare? $a_B =$ __a_A.
c) How do the speeds of the two planets compare? $v_B =$ __v_A.
d) What difference (if any) would there be if the masses of the planets were not the same? Explain.
e) Would it be different if the mass of the planets were *not* much less than that of the sun? Explain.

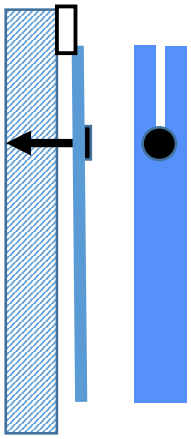
#3 There is a solid, uniform disk ("B" for "bottom") rotating at ω_o on a low friction bearing. I drop a ring ("T" for "top") on it that is rotating in the opposite direction at the same angular velocity. The ring stays centered on the rotating axis. The ring and the disk have the same mass, but the ring has ½ the diameter of the disk. After a while, the ring is connected to the disk and still centered about the axis of rotation. I want to know if they're still turning:

a) Please set this problem up.
b) Are they still turning? If not, how do you know? If so, please find the final rotational velocity and direction.
c) Is any heat given off in the process? Please prove why this should be so.

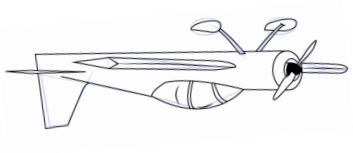


#4 I have a nail stuck in a vertical wall. I need to pull it with 1000 N to get it to come out but I can't pull 1000 N. I get a 50 cm slotted pry bar and slide the nail all the way down the 10 cm slot. I put a small white block under the slotted end of the pry bar. I've included two depictions of this. At left, you are looking at the arrangement from the side. At right, you see it as if you are looking at the wall. To pull out the nail, find the force I have to put on the pry bar (include direction and where I put the force), and what force does the white block put on the pry bar (include direction). *You will be graded by your process and explanation. The correct answer helps.*

a) Please set up the problem with good reasoning.
b) Please solve the problem.



#5 This is the problem that I should have put on your test, but I didn't think you'd have enough time if I did:



I perform a loop the loop in my airplane. You see me at the top of a (r = 200 m) loop moving at 40 m/s. I'm strapped into the plan so I can't fall out; allowing the plane to push me up as well as pull me down into my seat.

a) What is the direction of the force the plane applies to my body?
b) What is the magnitude of the force of the plane on my body?

Name _____