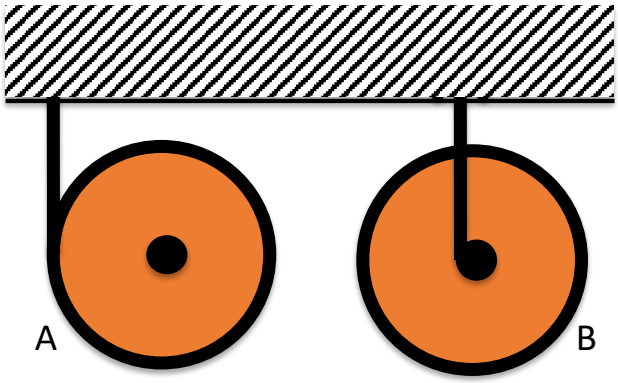
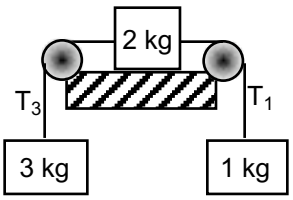
MT#2 121, W2019, Schwartz **HEY! Only do 3 of the 4 problems!!!**
You will be graded on your *communication* of physics understanding.

#1 At right you see two identical wheels that are simultaneously let go. They are both connected to the same length of string, but the string is wrapped around the rim of wheel A, and the string is wrapped about the small center hub of wheel B.



a) Which wheel is spinning the fastest (highest rotational velocity) when it comes to the end of the string, or are they the same? Please outline your argument very clearly.
b) The string connected to which wheel has greater tension, or do they have the same tension? Please be very clear in supporting your answer. *Almost everyone made arguments based on the fact that B had a much lower moment of inertia… Are the moments of inertia different for two identical wheels?*

#2 Check out the system at right. The two hanging masses are 1 m from the floor. The force of friction between the 2 kg mass and the surface is 2 N. The string slides with almost no friction over the two wheels shown.

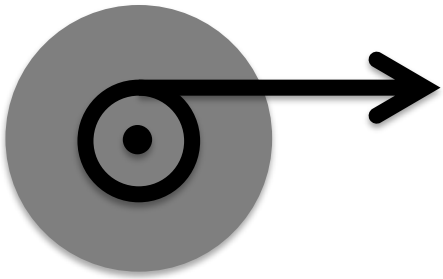


a) Make a physically-correct statement about what will happen when I let this system go from rest. Include relevant direction.

b) Compare T_3 to T_1. Provide good reasoning for your answer. *Most folks inadvertently assumed that the force of gravity on the 3 kg mass was the same as the force of gravity on the 1 kg mass. Please see if you did this too, how you made that assumption, and what mistake it caused you. Please consider what his happening with the 2 kg mass.*

c) Find either the acceleration of the system after I let it go, or find the speed of the system just before one of the masses hits the ground.

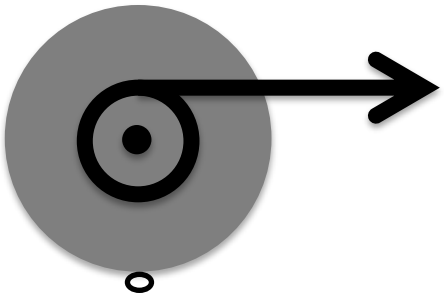
#3 At right, you see a 15 kg wheel of radius 2 m. It has a central round hub of radius 60 cm. I wrap a string around the central hub and pull with a tension of 100 N.



a) What is the angular acceleration of the wheel? *Many folks mix up Tension and Torque. Are these the same things? What are the units? How do we use them? Folks are also mixing up acceleration and angular acceleration.*

b) How long does it take for the wheel to be spinning at 3 radians/s?

#4 In the last problem, A large tarantula of mass 40 g is tightly clutching the outside of the rim as shown at the bottom of the (r = 2m, 15 kg) wheel. What is the force that the legs provide to keep the bug on the rim at the rotational velocity of 3/s when in the position shown at right? Clearly explain your answer. *Again, many people use rotational and linear mechanics (especially dynamics) interchangeably. They are not the same… they even have different units. If you recognize that forces cause acceleration, do you identify which mass is being accelerated and what forces are acting on it? do you make a FBD? Do you make a vector sum of the forces diagram?*



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