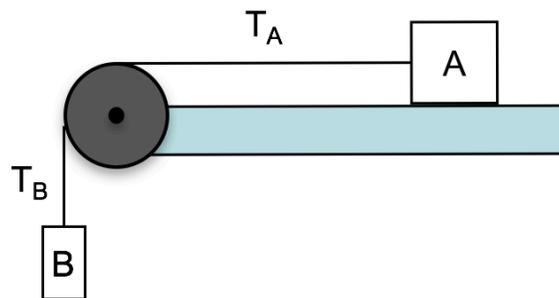


You will be graded on your COMMUNICATION of physics understanding

#1 A system of masses has a pulley wheel with considerable mass that turns freely on the axel with the rope stretched over it. That is, the rope does not slip on the wheel's surface. There is a coefficient of friction, μ_A between block A and the surface. I release the system from rest and it moves until mass B hits the floor 4 m below.



- In order for the system to move and not just sit there after I let it go, what must be true? Explain why you know this, briefly and clearly.
- As mass B falls (and mass A slides), is T_A greater than, less than or equal to T_B ? Briefly and clearly explain how you know this to be true.
- You need to calculate everything about the system: the final speed when it hits the ground, the acceleration, the angular acceleration of the wheel, and T_A . Explain how you would go about this. Be brief but clear, and a diagram is always good.
- $m_A = 2\text{ kg}$, $m_B = 1\text{ kg}$, The wheel is a uniform solid disk of radius 20 cm and mass 2 kg , and the coefficient of friction is 0.1 . Please find T_A , the torque on the wheel, the speed of block B when it hits the ground and anything else you want to find. (extra for Problem Set)
- Do a very thorough analysis and ask yourself if all of your answers for d) above make sense.

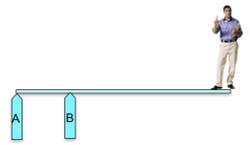
#2 I hold a spinning wheel over my head with a vertical axis of rotation. I step onto a rotating table so I am free to rotate. With my body motionless and the wheel spinning, I grab the rim of the wheel and hold it tightly, only hurting my hand slightly. Model my body as a solid cylinder of radius 10 cm and mass 70 kg. The wheel has a radius of 30 cm and mass of 3 kg and it originally spins around 3 times per second.

- a) After I grab the wheel, find my angular velocity in radians per second. Clearly explain your thought process.
- b) Is kinetic energy conserved in this process? If so, please explain how you know this to be true. If not, please calculate how much kinetic energy is lost (extra for problem set), and explain where it went.

#3 You are riding your bike with a scale between you and your bicycle seat at a speed of 10 m/s and you have a mass of 50 kg and you have standard 700 mm wheels (diameter = 700 mm). You ride through a dip approximated by a circular arc of radius 50 m. Briefly and clearly explain your reasoning with a drawing.

- a) What is the rotational velocity of your bicycle wheels?
- b) How do you feel when you are at the bottom of the dip? Why?
- c) What does the scale read as you are at the bottom of the dip? Assume you bear no weight on your hands and feet.

#4 I stand at the end of an 8 m diving board with 2 m between pylons A and B. I have a mass of 70 kg and the board is a uniform plank of mass 30 kg. Find the force provided by Pylon A and Pylon B (including direction) while explaining your reasoning with a drawing *of your own*.



Name _____