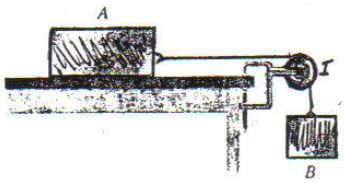
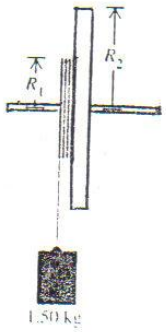
Homework #7 – Additional Problems

1) Find the moment of inertia of the uniform solid region (total mass M) bounded by the paraboloid $cz = x^2 + y^2$ and the plane $z = h$ about the z-axis.

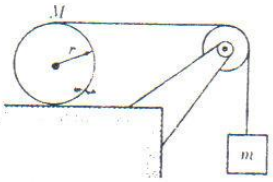
2) The pulley has radius R and moment of inertia I. The rope does not slip over the pulley. The coefficient of friction between block A and the tabletop is μ_k. the system is released from rest, and block B descends.
a) Use energy methods to calculate the speed of block B as a function of the distance d that it has descended.
b) Use forces and torques to calculate the speed of block B as a function of the distance d that it has descended.



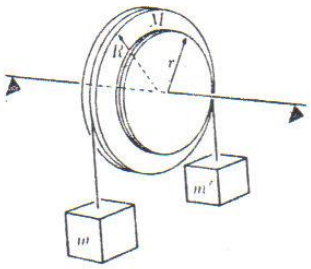
3) Two metal disks, one with radius $R_1 = 4$ cm and mass $M_1 = 0.8$ kg and the other with radius $R_2 = 8$ cm and mass $M_2 = 1.60$ kg, are welded together and mounted on a frictionless axis through their common center. a) What is the total moment of inertia of the two disks? b) A light string is wrapped around the edge of the smaller disk, and a 1.50 kg block is suspended from the end of the string. If the block is released from rest a distance of 2.00 m above the floor, what is its speed just before it hits the ground? c) Repeat the calculation of part (b), this time with the string wrapped around the edge of the larger disk. In which case is the final speed of the block the greatest? Does your answer make sense? Why?



4) In the following system, $M = 1$ kg, $m = 0.2$ kg, r = 0.2 m. Calculate the linear acceleration of m, the angular acceleration of the cylinder M, and the tension in the rope. Neglect the effect of the small pulley.



5) Determine the angular velocity of the disk and the linear velocity of m and m' (this mass is connected to the smaller radius disk). Calculate the tension in each rope. Assume that $m = 600$ grams, $m' = 500$ grams, $M = 800$ grams, R = 8 cm, and r= 6 cm. (Both disks have the same density and thickness)



6) A system of double stars under the action of their mutual attraction describes circular orbits around each other with a time period T. If suddenly they are deprived of their velocities, show that they collide after a time interval of $T/(4(2)^{1/2})$