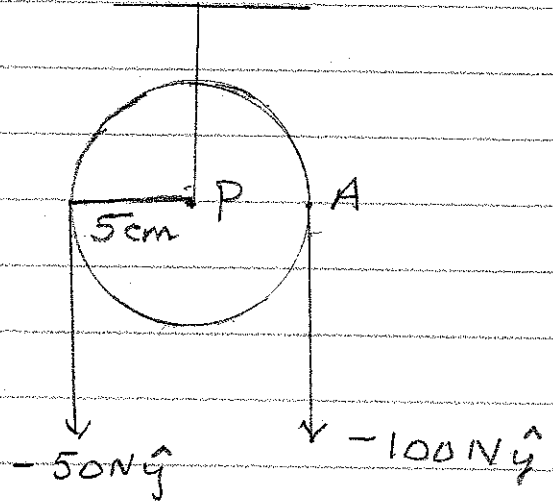


Test QUESTIONS - PART II

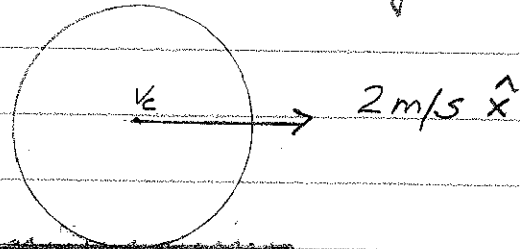
1. How do you distinguish between Force and TORQUE? Support your answers with examples.

2. Shown is a pulley of moment of Inertia 0.01 kg-m^2 and radius 5 cm , a) what is the mass of the pulley? ($I = \frac{M R^2}{2}$) b) What is the torque about P?



- c) What is the angular acceleration?
 d) What is the tangential acceleration at A if there is no slip in the string?

3. A disk of radius 0.5 m is rolling without slipping on a horizontal table which is 1.5 m high.



- If $v_c = 2 \text{ m/s} \hat{x}$ what is its angular velocity? As it rolls off the table how long before it hits ground? What is its velocity just before it hits ground? What is the angle through which it turned during the fall?

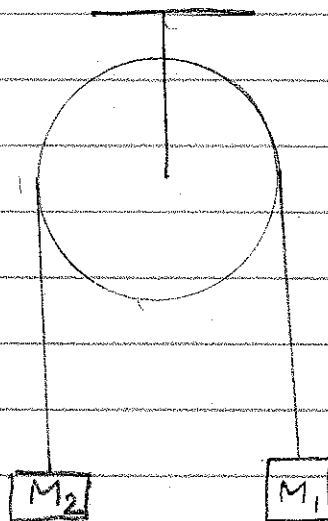
4 In an Atwood Machine

$M_1 > M_2$ and the pulley has a mass M_p and radius R_p . There is a frictional force f opposing the motion.

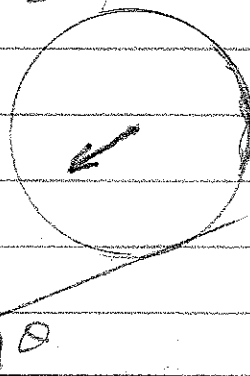
Show that if the string does not slip on the

pulley [$I_p = \frac{M_p R_p^2}{2}$] the masses accelerate at

$$\underline{a} = \pm \frac{(M_1 - M_2)g - f}{M_1 + M_2 + \frac{M_p}{2}} \hat{g}$$



5 A disk, a ring and a sphere roll down an inclined plane without slipping.



$$I_{\text{disk}} = \frac{MR^2}{2}$$

$$I_{\text{ring}} = MR^2$$

$$I_{\text{sphere}} = \frac{2}{5}MR^2$$

a) Do you need

friction for this to happen? Why?

b) Show that the accelerations are independent of the mass and radius of the objects.

c) If you increase θ eventually slip will begin. If the coefficient of friction is μ_s at what value of θ would slip start? Why?

6 Compare the motion of the ring in problem 5 with the motion of the tire in a car when you first engage the engine to move forward on a flat road with a frictional coefficient of μ_s .

Test Questions

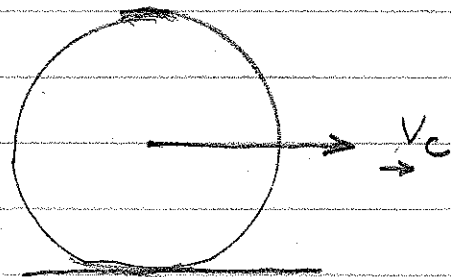
7 A drill is rotating clockwise at 20 revs. per sec when you turn on the reversing switch and keep it on till it rotates at 20 revs. per second counter clockwise. What is the total angle turned by it during this operation? Why?

8 You are stopped at a red light on a horizontal road. When the light turns green what is the maximum acceleration with which you can take off? Why?

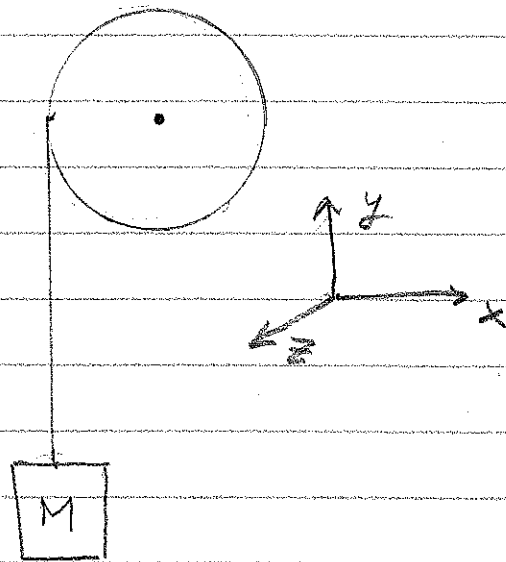
9 A disk of radius 1m and mass 1kg is rolling without slipping on a horizontal table. a) Does this motion require friction between the disk and the table? Why? b) If so, how much work is done by friction as the disk's center moves by 3m? Why?

10 In prob. 3 the velocity at the center of the disk is 10 m/s .

What must be the angular velocity to roll without slipping? Why?

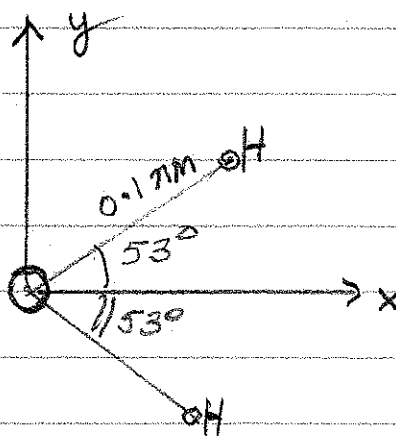


11 A cylinder of radius 10cm and mass 0.2kg is mounted so as to rotate freely about the z-axis. A string is wound around it and carries a mass M of 0.5kg. If you let M go, what is its acceleration? Assume



that the string does not slip. If the string on the pulley is 2m long, how long before it is totally unwound? $[I = \frac{MR^2}{2}]$

12 A water molecule consists of an oxygen atom and two hydrogen atoms as shown. The OH bond is 0.1nm long and the angles are 53° as shown.



Assuming that $m_O = 16m_H$ calculate the position of the center of gravity of H_2O .