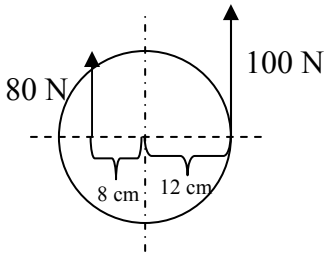
AP Physics C
Review Chapter 9 Rotational Motion II

1. Given the drawing



   a. What is the net torque on the cylinder shown?

   b. Assume the mass of the cylinder is 50 kg. What is the rotational acceleration produced by the two forces shown?

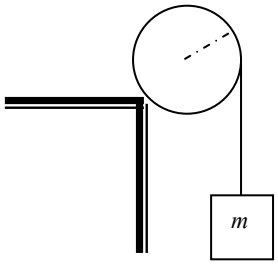
2. A block of mass m is hung from a pulley of radius R and mass M and allowed to fall.

   a. What is the acceleration of the block?

   b. What speed does the block strike the floor if it starts from rest?

   c. What is the rotational kinetic energy of the pulley just before the block strikes the floor?

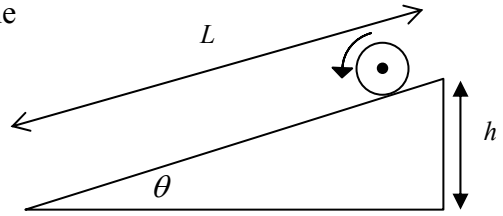
   d. At what rate was work done on the pulley?



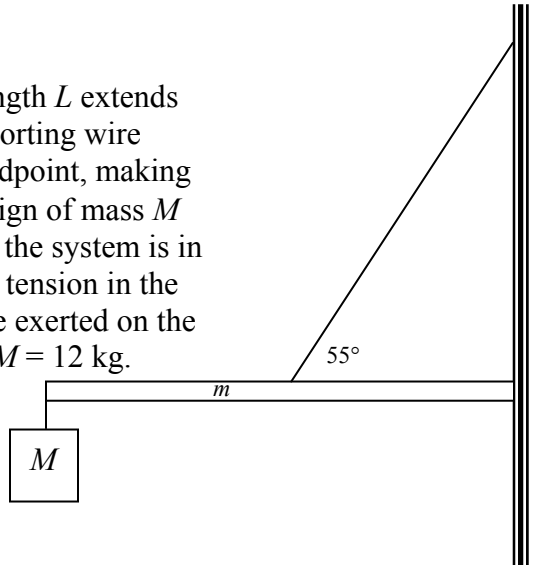
3. A cylinder of mass M and radius R rolls (without slipping) down an inclined plane (height h and length L) whose incline angle with the horizontal is θ.

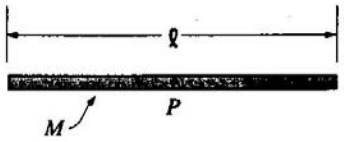
   a. Determine the acceleration of the cylinder's center of mass.

   b. Determine the linear speed of the center of mass when it reaches the bottom if it started from rest.



4. A uniform bar of mass m and length L extends horizontally from a wall. A supporting wire connects the wall to the bar's midpoint, making an angle of 55° with the bar. A sign of mass M hangs from the end of the bar. If the system is in static equilibrium, determine the tension in the wire and the strength of the force exerted on the bar by the wall of m = 8 kg and M = 12 kg.

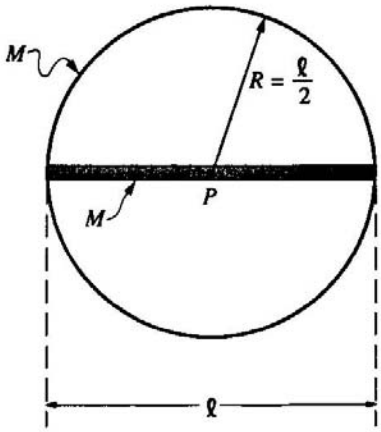




5.

Consider a thin uniform rod of mass M and length ℓ, as shown above.

(a) Show that the rotational inertia of the rod about an axis through its center and perpendicular to its length is $M\ell^2/12$.



The rod is now glued to a thin hoop of mass M and radius $R = \ell/2$ to form a rigid assembly, as shown above. The centers of the rod and the hoop coincide at point P. The assembly is mounted on a horizontal axle through point P and perpendicular to the page.

(b) What is the rotational inertia of the rod-hoop assembly about the axle?

Several turns of string are wrapped tightly around the circumference of the hoop. The system is at rest when a cat, also of mass M, grabs the free end of the string and hangs vertically from it without swinging as it unwinds, causing the rod-hoop assembly to rotate. Neglect friction and the mass of the string.

(c) Determine the tension T in the string.

(d) Determine the angular acceleration α of the rod-hoop assembly.

(e) Determine the linear acceleration of the cat.

(f) After descending a distance $H = 5\ell/3$, the cat lets go of the string. At that instant, what is the angular momentum of the cat about point P?