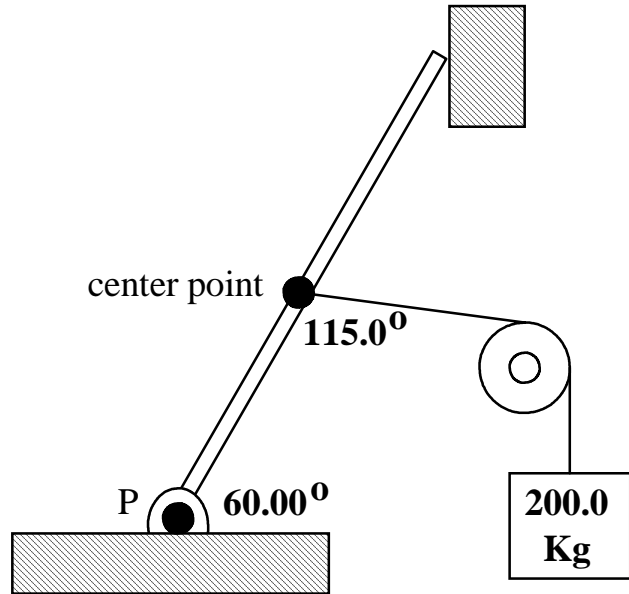


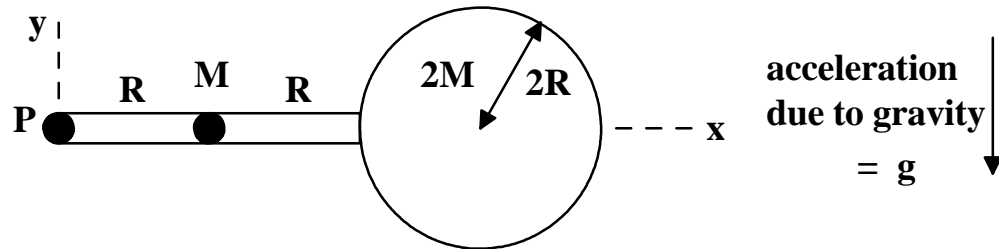
PHY 1350 EXAM 3

1. The beam shown below has negligible weight and is in static equilibrium. There is NO friction between the beam and the vertical support. Neither is there any friction in the axel at point P.



- (a.) Draw a free body diagram of the beam. Use the space to the left of the diagram above.
- (b.) Write down the equations of equilibrium.
- (c.) Solve the equilibrium equations for the force at the vertical wall and at the axel.

2. A pendulum is fashioned from a rod of length $2R$ and negligible mass. A point mass of mass M is located at the rod's center. At the end away from the frictionless pivot point, P , a uniform disk of mass $2M$ and radius $2R$ is connected to the rod. The system is shown below.



For the following, leave answers in terms of M , R , and g , as appropriate.

- (a.) Measuring from point P , where is the center of mass of the pendulum system.

- (b.) The moment of inertia of a uniform disk about an axis through its center and perpendicular to the plane of the disk is $\frac{1}{2}M_d R_d^2$. What is the moment of inertia of the pendulum about an axis through P and perpendicular to the plane of the paper?

- (c.) What torque is exerted about axis P by the force of gravity at the instant shown?

- (d.) Determine the angular acceleration of the pendulum at the instant shown.

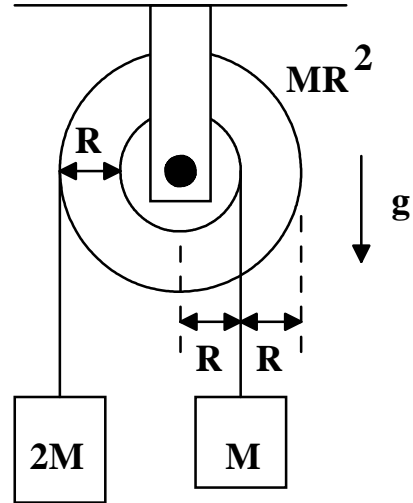
- (e.) Determine the force that the axle must exert on the pendulum at the instant shown.

3. Two pucks move without friction on a horizontal air table. One puck has a mass of 200.0 grams and moves due East with a speed of 9.00 cm/s. The second puck has a mass of 100.0 grams and moves due West with a speed of 3.00 cm/s. The two pucks experience a head-on collision, and because of velcro, stick and move off together after the collision.

(a.) What is the final speed and direction of motion of the two pucks as they move off together?

(b.) How much heat energy is developed in the collision?

4. The Atwood's machine shown to the right consists of a pulley of radius $2R$ which turns on a frictionless axel. The pulley's moment of inertia is MR^2 and its mass is $4M$. Two blocks are hung from the pulley via massless, inextensible strings which do NOT slip on the pulley. One block has mass $2M$ and pulls on the pulley at a radius of $2R$. The other block has mass M and pulls on a radius of R . The acceleration due to gravity is g .



(a.) Draw a free body diagram for each object.

(b.) Write down three force equations and one torque equation. Note that the linear accelerations of the two blocks are different.

(c.) Determine the acceleration of the $2M$ block by solving the set of equations from part (b.).