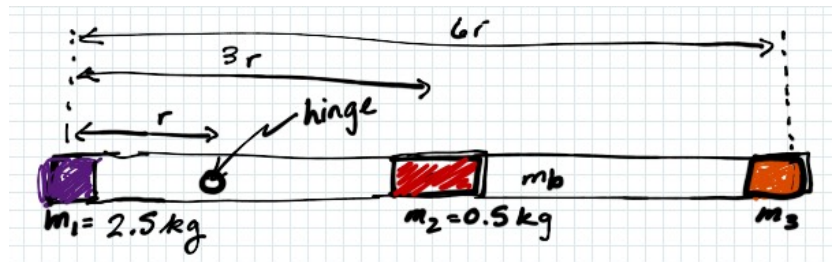


PS Week 12  
 Physics 215 Fall 2019

Open Stax Ch 10: 59, 117  
 Ch 11: 28, 36, 44, 58, 71

and the following problem:

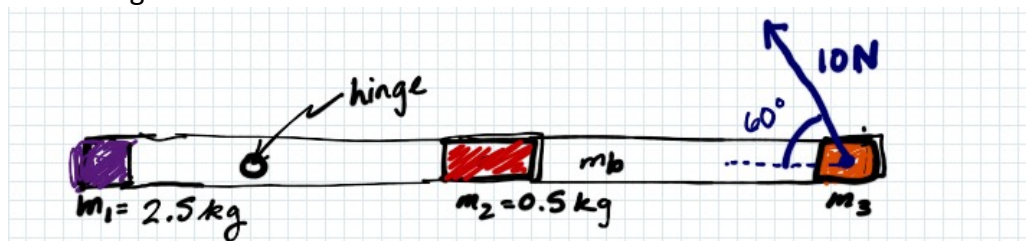
A schematic diagram of an outdoor modern art installation is shown in below. It consists of a solid aluminum beam on a frictionless hinge with several pieces of heavy stained glass attached directly to the beam.



The artist has designed the beam so that it is in mechanical equilibrium. Distances and masses are labeled on the diagram. Assume the stained glass pieces can be treated as point masses. The beam has a mass of  $0.5 \text{ kg}$ .

- What is the horizontal distance of the center of mass of the beam/stained glass system from the hinge? Is it to the right or left of the hinge?
- Draw an extended free body diagram for the beam, labeling all the forces.
- What is the mass of  $m_3$ ?
- What is the normal force exerted by the hinge on the beam?

A bystander pushes on the end of the beam (in the plane of the diagram) with a force indicated in the diagram below.



- What is the net torque on the beam?
- What is the moment of inertia of the beam?
- What is the angular acceleration of the beam?
- Assuming the beam starts from rest and the angular acceleration remains constant and equal to the value you calculated in part g over a period of  $0.5 \text{ s}$  while the bystander is pushing, what is the final angular velocity of the beam?
- Through what angle does the beam rotate in  $0.5 \text{ s}$ ?