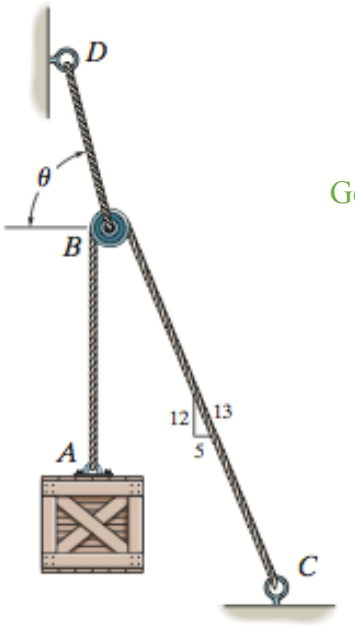
TAM 211 Written Assignment 6 (due Wednesday, May 2nd)

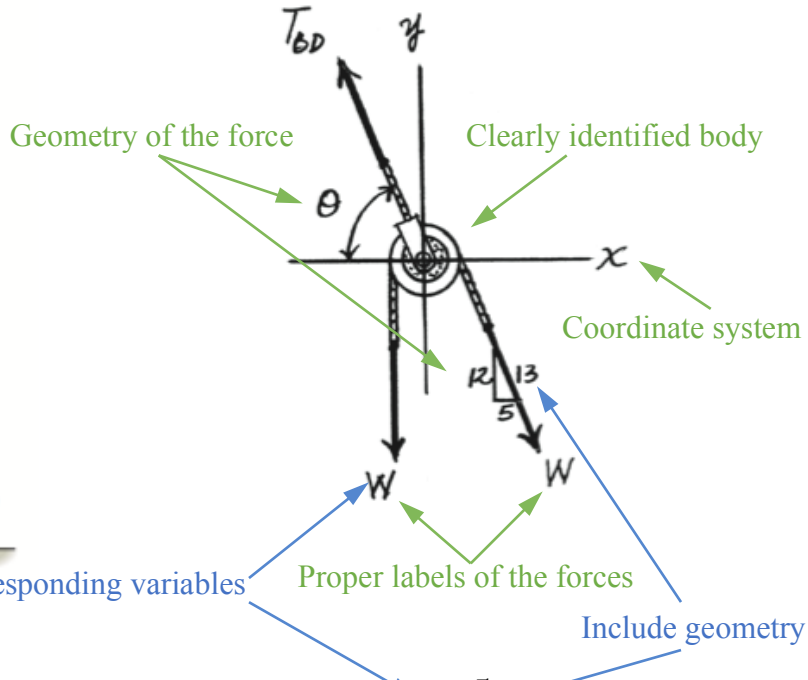
DIRECTION: On each problem solution page, use the top half to clearly draw out a large FBD of the specified body/bodies, and the bottom half to write the corresponding equations for solving the problem with given geometry for the diagram. DO NOT SOLVE THE PROBLEM.

General "Written Assignment Instructions" applies. Additional grading criteria includes: 1) proper use of page space for FBD and equations; 2) properly labeled external forces on the body; 3) properly labeled geometry of the forces; 4) coordinate system; 5) variables and geometry in solution equations correspond to FBD.

Sample Problem: The cord *BD* can support a maximum load of *T*. Perform equilibrium analysis on pulley *B* for determining the maximum weight of the crate, and the angle θ for equilibrium. Assume the mass of the pulley is negligible.



Sample FBD Solution



Sample EoE Solution

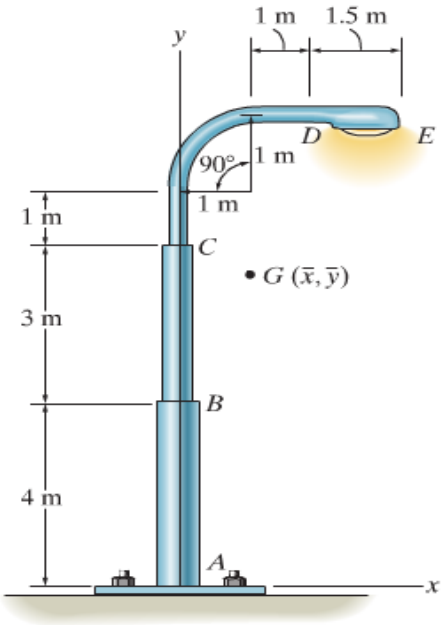
$$\sum F_x = 0 = -T_{BDx} + W_x = -T_{BD}(\cos\theta) + W\left(\frac{5}{13}\right) = 0$$

$$\sum F_y = 0 = T_{BDy} - W - W_y = T_{BD}(\sin\theta) - W - W\left(\frac{12}{13}\right) = 0$$

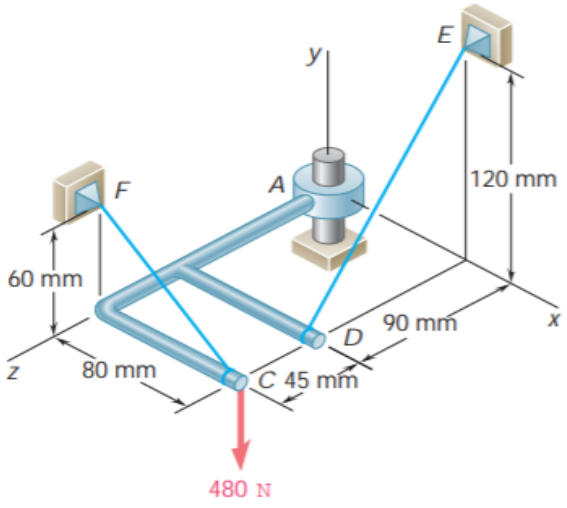
Problems 1: Locate the center of gravity $G\ (\bar{x}, \bar{y})$ of the streetlight, then draw the free body diagram using G and write the equations of equilibrium to find the support reactions at A. The mass per unit length of each segment is as follows:

$$\rho_{AB} = 12\frac{kg}{m}, \rho_{BC} = 8\frac{kg}{m}, \rho_{CD} = 5\frac{kg}{m}\ and\ \rho_{DE} = 2\frac{kg}{m}.$$

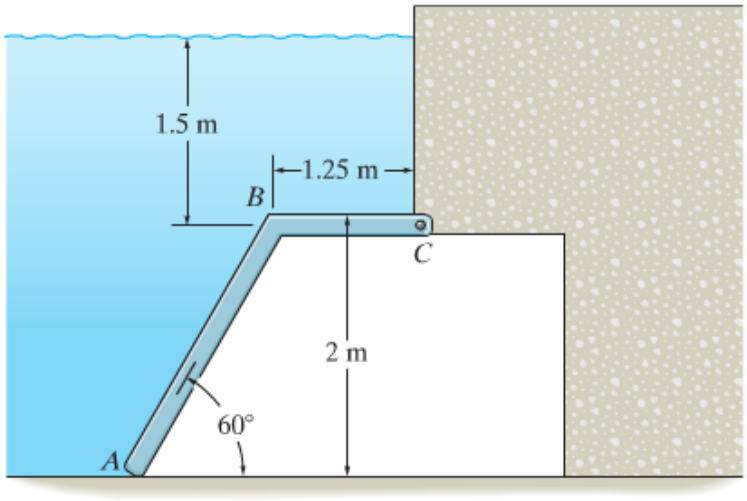
Neglect the thickness of each segment.



Problem 2: The assembly shown has collar A that fits on the vertical pin shown. The pin can exert moments about the x- and z-axes but does not prevent motion about or along the y-axis. For the loading shown, draw the free body diagram and write the equations of equilibrium to determine the tension in each cable and the support reactions at A.



Problem 3: Determine the magnitude of the resultant force acting on the gate ABC due to hydrostatic pressure. Draw the free body diagram of gate *ABC* and write the corresponding equations of equilibrium to determine the reactions at *A* and *C*. The gate has a width of 1.5m. $\rho_w = 1000\,\frac{kg}{m^3}$.



Problem 4: The mechanism shown is acted upon by the force *P*. Derive an expression for the magnitude of the force *Q* required to maintain equilibrium by

A) Draw the free body diagram of the whole mechanism and write out the equations using principle of virtual work.
B) Draw the free body diagram of members *AE*, *BD*, *DF* and *EF* and write the corresponding equations of equilibrium necessary to relate *P* to *Q*.