

Practice Problem Set 2: Engineering Mechanics (NMEC101)
Equilibrium of Rigid Bodies

Instruction:

Figure numbers correspond to the problem numbers.

1. A load of lumber weighing $W = 25$ kN is being raised by a mobile crane. The weight of the boom ABC and the combined weight of the truck and driver are as shown. Determine the reaction at each of the two (a) front wheels H , (b) rear wheels K .
2. A hand truck is used to move two barrels, each weighing 160 N. Neglecting the weight of the hand truck, determine (a) the vertical force \mathbf{P} which should be applied to the handle to maintain equilibrium when $\alpha = 35^\circ$, (b) the corresponding reaction at each of the two wheels.
3. When cars C and D stop on a two-lane bridge, the forces exerted by their tires on the bridge are as shown. When both cars are on the bridge, determine (a) the value of a for which the total reaction at A is maximum, (b) the corresponding total reactions at A and B .
4. Three loads are applied as shown to a light beam supported by cables attached at B and D . Knowing that the maximum allowable tension in each cable is 12 kN and neglecting the weight of the beam, determine the range of values of Q for which the loading is safe when $P = 5$ kN.
5. For the given loading of the beam AB , determine the range of values of the mass of the crate for which the system will be in equilibrium, knowing that the maximum allowable value of the reactions at each support is 2.5 kN and that the reaction at E must be directed downward.
6. A follower $ABCD$ is held against a circular cam by a stretched spring which exerts a force of 12 N for the position shown. Knowing that the tension in rod BE is 8 N, determine (a) the force exerted on the roller at A , (b) the reaction at bearing C .
7. Neglecting friction and the radius of the pulley, determine the tension in cable BCD and the reaction at support A when $d = 10$ cm.
8. Rod ABC is bent in the shape of a circular arc of radius R . Determine (a) the value of θ so that the magnitudes of the reactions at B and C are equal, (b) the corresponding reactions at B and C .
9. Rod $ABCD$ is bent in the shape of a circular arc of radius 4 in. and rests against frictionless surfaces at A and D . Knowing that the collar at B can move freely on the rod and that $\theta = 45^\circ$, determine (a) the tension in cord OB , (b) the reactions at A and D .
10. A movable bracket is held at rest by a cable attached at E and by frictionless rollers. Knowing that the width of post FG is slightly less than the distance between the rollers, determine the force exerted on the post by each roller when $\alpha = 20^\circ$.
11. A belt passes over two 5 cm diameter pulleys which are mounted on a bracket as shown. Knowing that $M = 16$ N.m, and that T_i and T_o are equal to 32 N and 16 N, respectively, determine the reaction at C .
12. A vertical load \mathbf{P} is applied at end B of rod BC . The constant of the spring is k , and the spring is unstretched when $\theta = 90^\circ$. (a) Neglecting the weight of the rod, express the angle θ corresponding to equilibrium in terms of P , k , and l . (b) Determine the value of θ corresponding to equilibrium when $P = \frac{1}{4}kl$

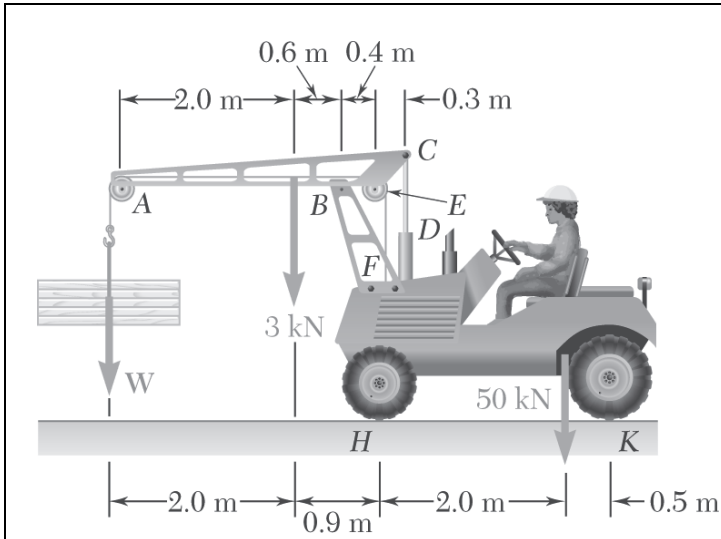


Fig. 1

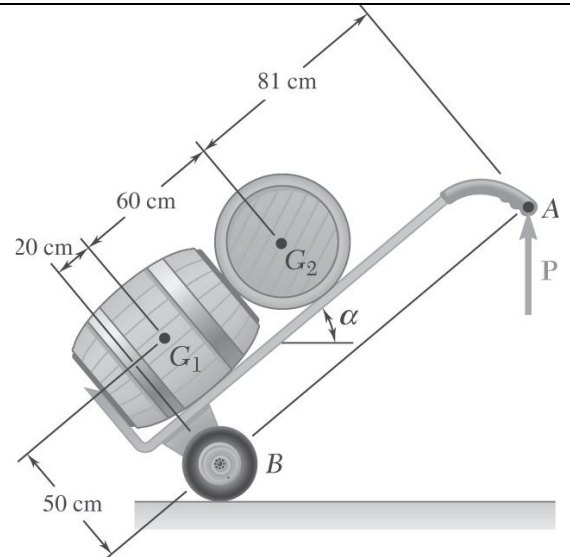


Fig. 2

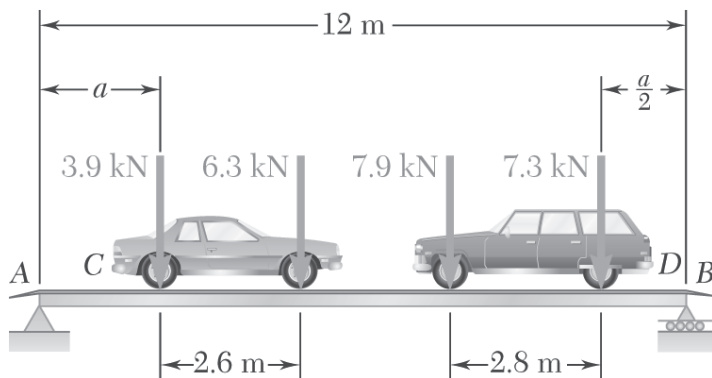


Fig. 3

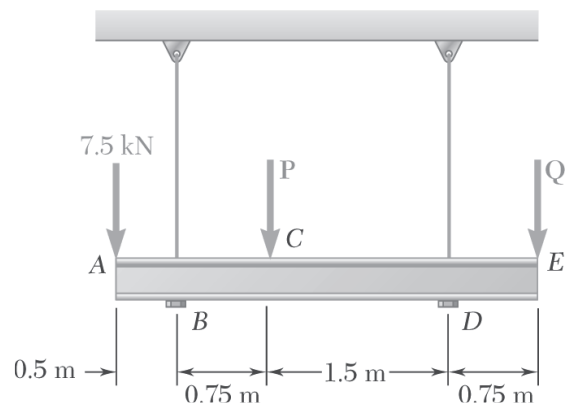


Fig. 4

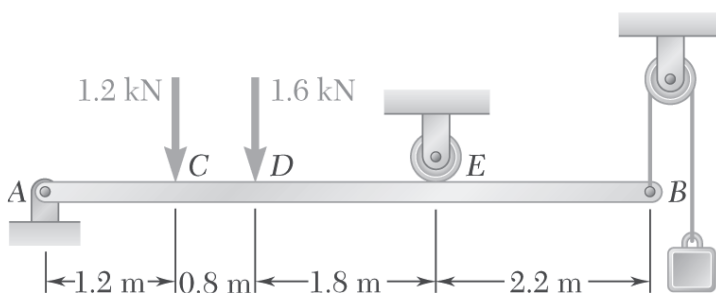


Fig. 5

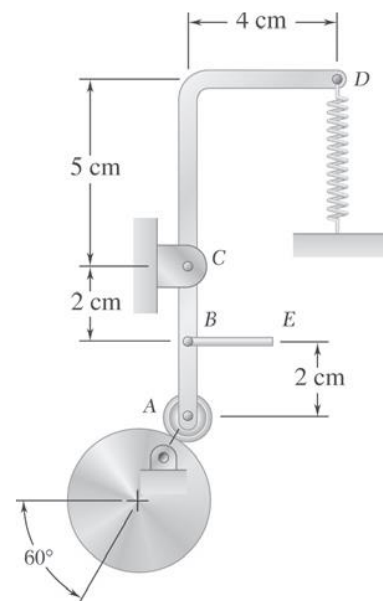


Fig. 6

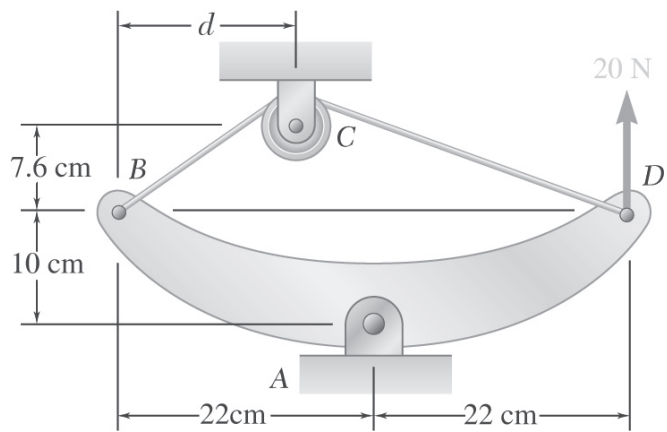


Fig. 7

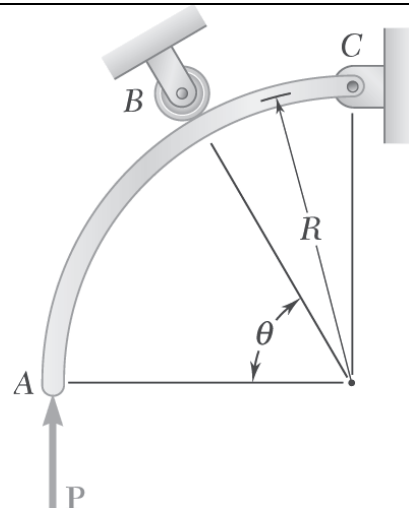


Fig. 8

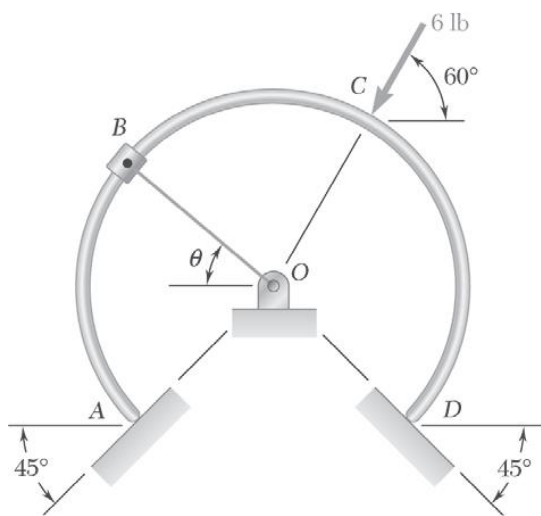


Fig. 9

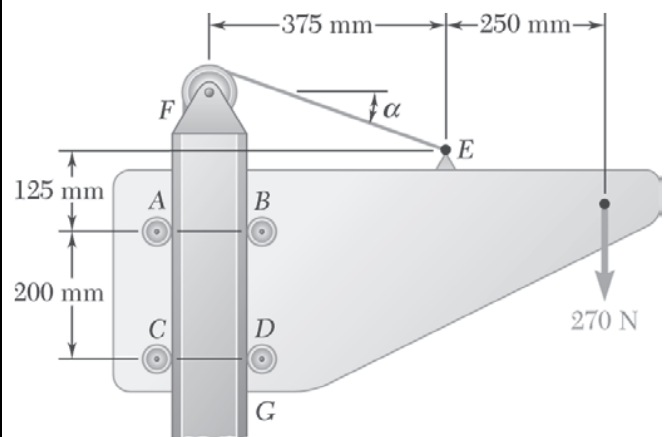


Fig. 10

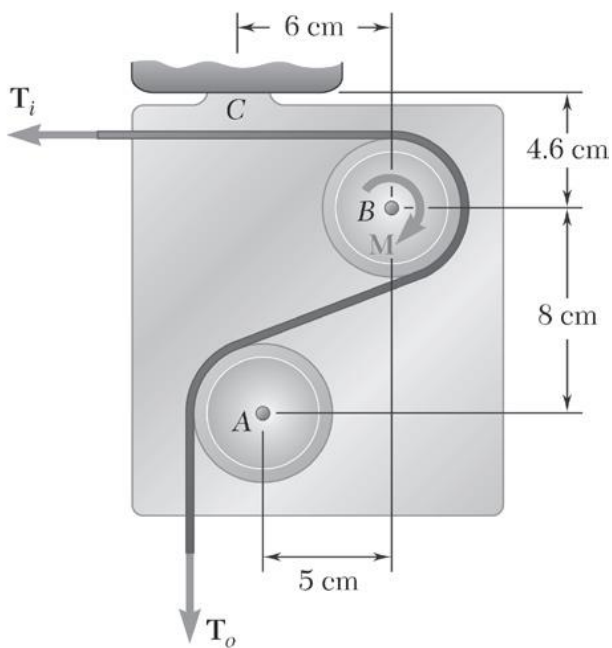


Fig. 11

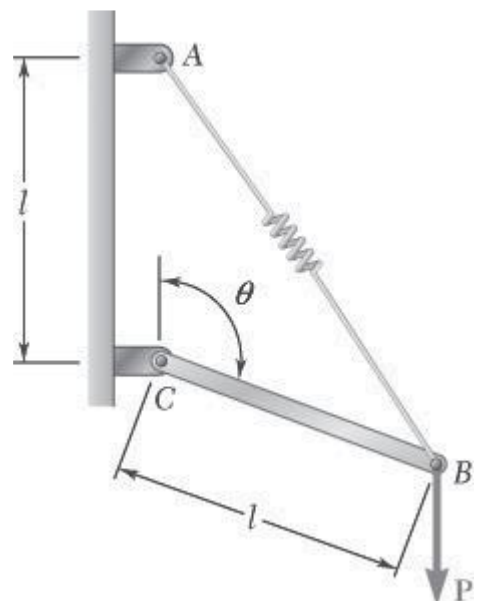


Fig. 12