Homework Chapter 7

Problem 7-1: The horizontal force is **P**. Determine the normal and frictional forces acting on the crate of weight *W*. The friction coefficients are μ_k and μ_S.

Given:

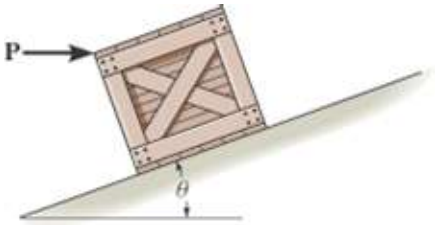
$W = 1500\ \text{N}$

$P = 400\ \text{N}$

$\mu_s = 0.3$

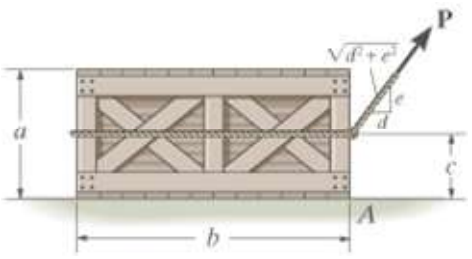
$\mu_k = 0.2$

$\theta = 20\ \text{deg}$



Problem 7-2: Determine the friction force on the crate of mass *M*, and the resultant normal force and its position *x*, measured from point *A*, if the is force **P**.

Given:



$M = 40\ \text{kg}$

$a = 400\ \text{mm}$

$b = 800\ \text{mm}$

$c = 200\ \text{mm}$

$P = 300\ \text{N}$

$\mu_s = 0.5$

$\mu_k = 0.2$

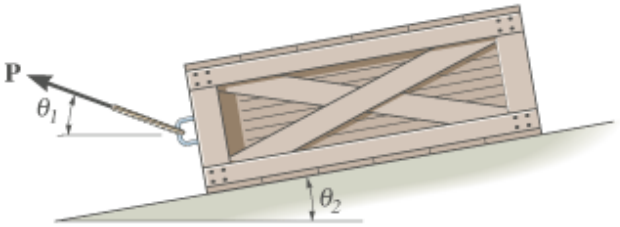
$d = 3$

$e = 4$

Problem 7-3: The crate has a mass *M* and is subjected to a towing force **P** acting at a θ_1 angle with the horizontal. If the coefficient of static friction is μ_s, determine the magnitude of **P** to just start the crate moving down the plane.

Given:

$M = 350\ \text{kg}$
$\theta_1 = 20°$
$\theta_2 = 10°$
$\mu_s = 0.5$
$g = 9.81\text{m/s}^2$



Problem 7-4: The motorcyclist travels with constant velocity along a straight, horizontal, banked road. If he aligns his bike so that the tires are perpendicular to the road at *A*, determine the frictional force at *A*. The man has a mass of M_C and a mass center at G_C, and the motorcycle has a mass of M_m and a mass center at G_m. If the coefficient of static friction at *A* is μ_A, will the bike slip?

Given:

$M_m = 120\ \text{kg}$
$M_C = 60\ \text{kg}$
$\mu_A = 0.4$
$\theta = 20°$
$g = 9.81\text{m/s}^2$

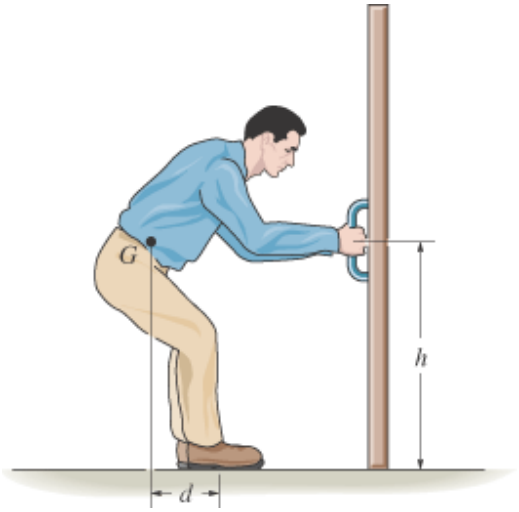
Problem 7-5: The man has a weight *W*, and the coefficient of static friction between his shoes and the floor is μ_s. Determine where he should position his center of gravity *G* at *d* in order to exert the maximum horizontal force on the door. What is this force?

Given:

$W = 200$ N

$\mu_s = 0.5$

$h = 0.9$ m



Problem 7-6: The crate has a weight W and a center of gravity at *G*. Determine the horizontal force **P** required to tow it. Also, determine the location of the resultant normal force measured from *A.*

Given:

$a = 1$ m

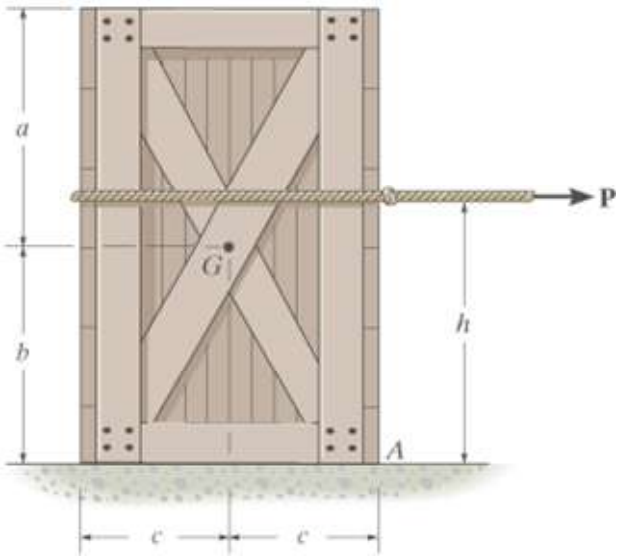
$b = 0.9$ m

$c = 0.6$ m

$W = 1000$ N

$h = 1.2$ m

$\mu_s = 0.4$



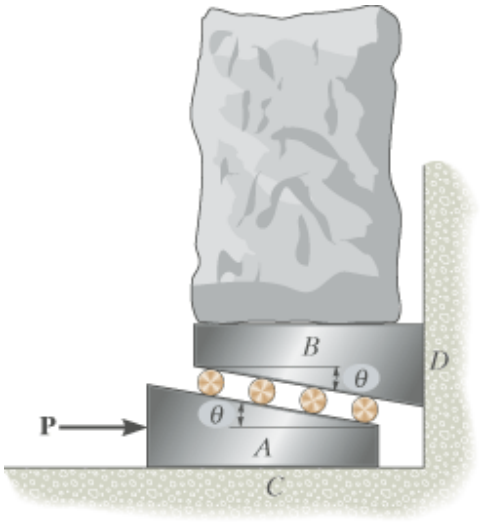
Problem 7-7: Determine the force **P** needed to lift the load of weight *W*. Smooth rollers are placed between the wedges. The coefficient of static friction between *A* and *C* and between *B* and *D* is μ_S . Neglect the weight of each wedge.

Given:

$\theta = 10$ deg

$W = 500$ N

$\mu_s = 0.3$



Problem 7-8: The wedge is used to level the member. Determine the reversed horizontal force $-\mathbf{P}$ that must be applied to pull the wedge out to the left. The coefficient of static friction between the wedge and the two surfaces of contact is μ_S . Neglect the weight of the wedge.

Given:

$\mu_s = 0.15$

$\theta = 5°$

$a = 600$ mm

$b = 500$ mm

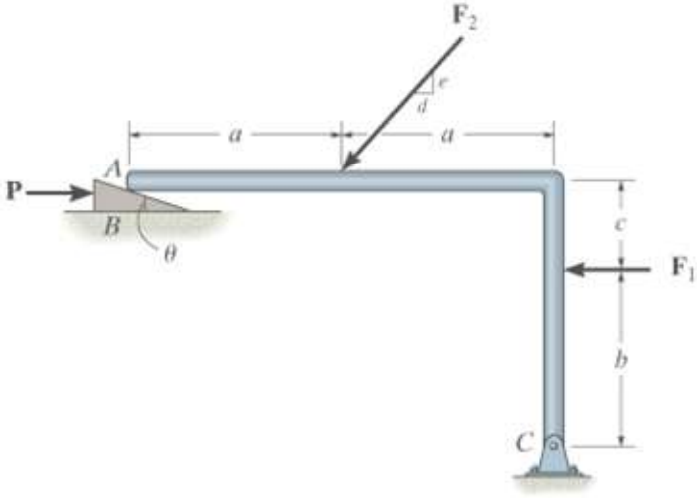
$c = 250$ mm

$d = 3$

$e = 4$

$F_1 = 8$ kN

$F_2 = 15$ kN



Problem 7-9: Determine the smallest couple moment, which can be applied to the wheel of weight W_1 that will cause impending motion. The cord is attached to the block of weight W_2, and the coefficients of static friction are μ_B and μ_D.

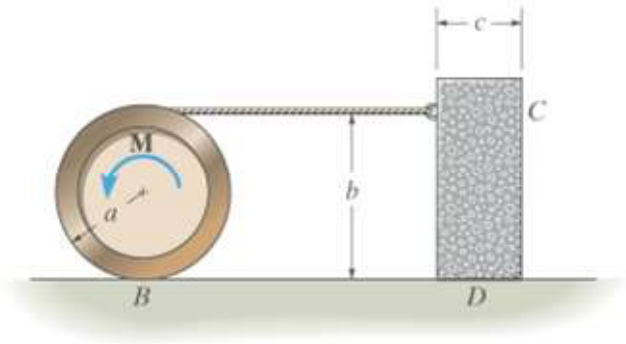
Given:

$W_1 = 100$ N $a = 0.5$ m

$W_2 = 150$ N $b = 1$ m

$\mu_B = 0.2$ $c = 0.5$ m

$\mu_D = 0.3$



Problem 7-10: If the spring is compressed a distance δ and the coefficient of static friction between the tapered stub *S* and the slider *A* is μ_{SA}, determine the horizontal force **P** needed to move the slider forward. The stub is free to move without friction within the fixed collar *C*. The coefficient of static friction between *A* and surface *B* is μ_{AB}. Neglect the weights of the slider and stub.

Given:

$\delta = 60$ mm

$\mu_{SA} = 0.5$

$\mu_{AB} = 0.4$

$k = 300$ N/m

$\theta = 30°$