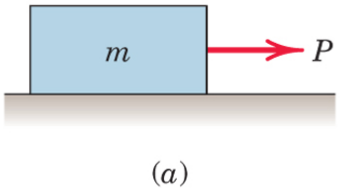
ENGG 202
April 3 Week 12

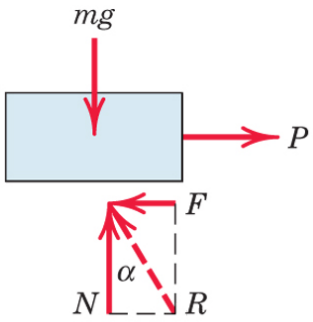
Problems

6/3 Dry Friction

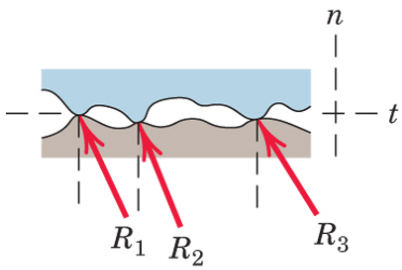
Dry friction occurs when the unlubricated surfaces of two solids are in contact under a condition of sliding or a tendency to slide. A friction force tangent to the surfaces of contact occurs both during the interval leading up to impending slippage and while slippage takes place.



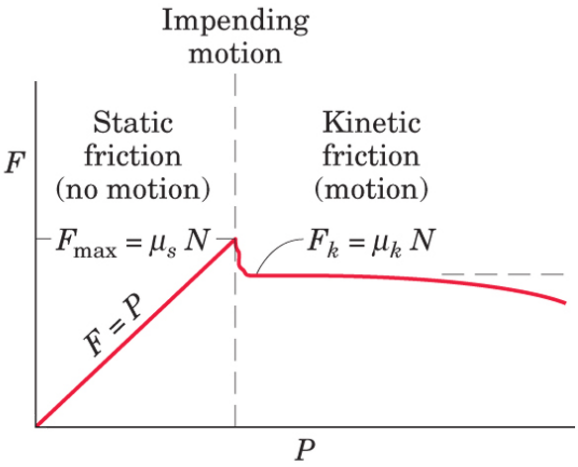
(a)



(b)



(c)



(d)

$$F_{\max} = \mu_s N \qquad \textbf{(6/1)}$$

$$F_k = \mu_k N \qquad \textbf{(6/2)}$$

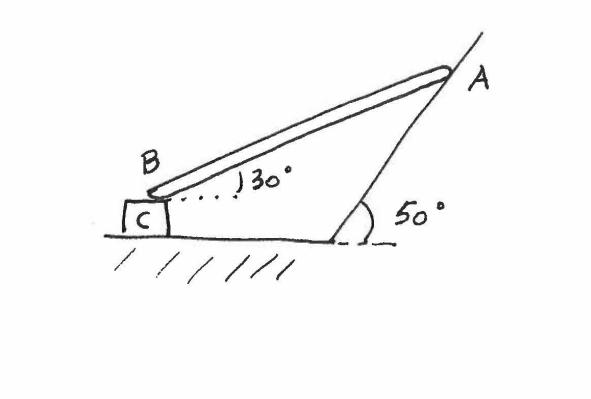
FRICTION PROBLEMS

1) Problem statement DOES NOT specify impending motion:
    a. Assume equilibrium, include the friction force F_s opposing movement
    b. Solve for equilibrium
    c. Check assumptions: if $F_S \leq \mu_S N$ at each friction surface then slipping does not occur

2) Problem statement states impending motion:
    a. Set $F = F_{MAX} = \mu_S N$
    b. Solve for the unknowns

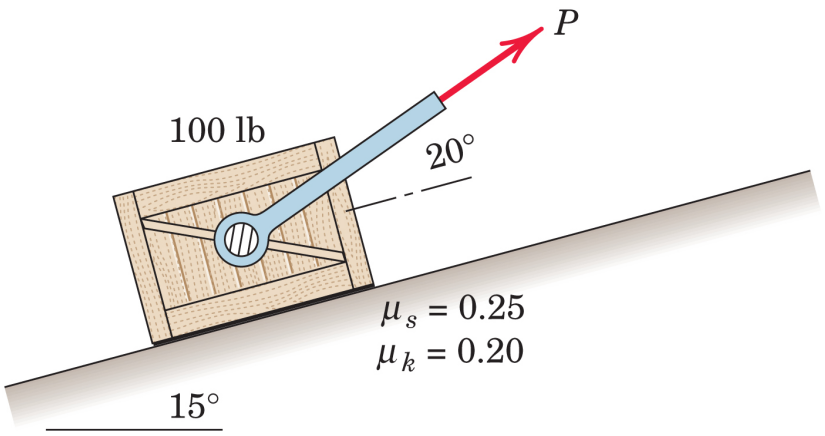
Problem

Can the system below be in static equilibrium?
Mass of the bar AB: 500 kg
Mass of block C: 300 kg
Friction between B and C and between C and ground: $\mu_S = 0.4$
Friction at A is negligible



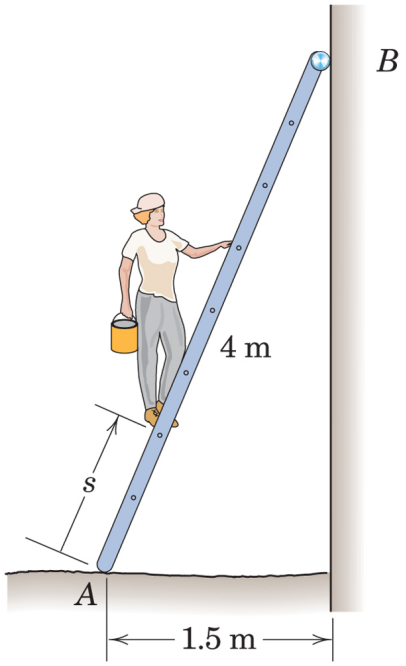
Problem 6/3

The force P is applied to the 100 lb block when it is at rest. Determine the magnitude and direction of the friction force exerted by the surface on the block if (a) P=0, (b) P=40 lb, (c)P=60 lb, (d) What is the value of P required to initiate motion of the crate up the incline?



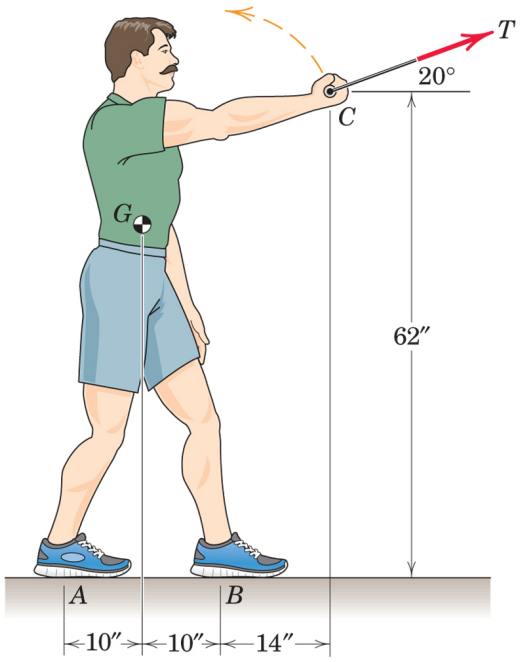
Problem 6/33

Determine the distance s to which the 90 kg painter can climb without causing the 4 m ladder to slip at its lower end. The top of the 15 kg ladder has a small roller and at the ground the coefficient of friction is 0.25. The mass centre of the painter is directly above her feet.



Problem 6/5

The 180-lb exerciser is repeated from Prob. 3/23. The tension T = 15 lb is developed against an exercise machine (not shown) as he is about to begin a biceps curl. Determine the minimum coefficient of static friction which must exist between his shoes and the floor if he is not to slip.



Problem 6/16

The homogeneous rectangular block of mass m rests on the inclined plane which is hinged about a horizontal axis through O. If the coefficient of static friction between the block and the plane is μ, specify the conditions which determine whether the block tips before it slips or slips before it tips as the angle θ is gradually increased.