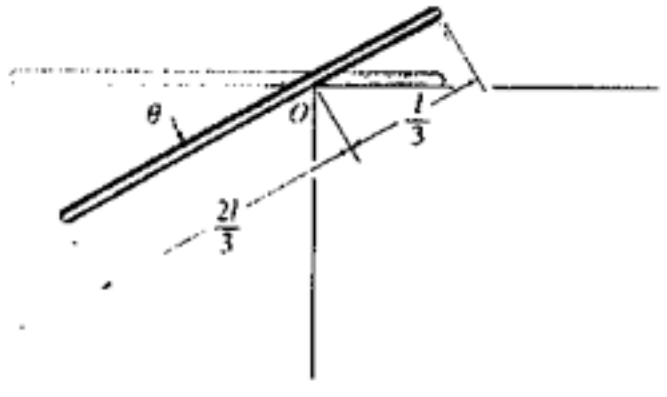
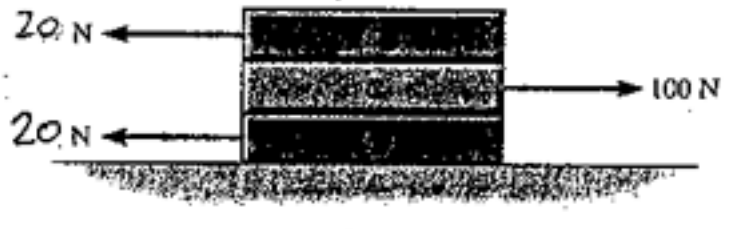
1. The uniform bar has a mass **m** and length *l*. If it is released from rest when $\theta=0^{\circ}$, determine the angle θ at which it first begins to slip. The coefficient of static friction at O is $\mu_s=0.3$. (25%)

Fig. 1



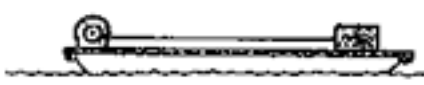
2. Each of the three plates has a mass of 10kg. If the coefficients of static and kinetic friction at each surface of contact are $\mu_s=0.3$ and $\mu_k=0.2$, respectively, determine the acceleration of each plate when the three horizontal forces are applied. (25%)

Fig. 2



3. A 3-Mg barge is initially at rest and carries a 500-kg crate. The barge is equipped with a winch which exerts a constant 1200-N force on the crate for 6 seconds. The crate then slides along the deck until it comes to rest. ($\mu_k=0.2$) (a) Draw the *v-t* curve for the barge. (b) Determine the final position of the barge. (c) Determine the final position of the crate on the deck of the barge. Hint: Neglecting the water resistance. (25%)

Fig. 3



4. A uniform rod AB, of weight 30kg and length 1 meter, is attached to the 40-kg cart C. Knowing that the system is released from rest in the position shown and neglecting friction, determine (a) the velocity of point B as rod AB passes through a vertical position, (b) the corresponding velocity of cart C. (b) the angular acceleration of the rod. (25%)

Fig. 4