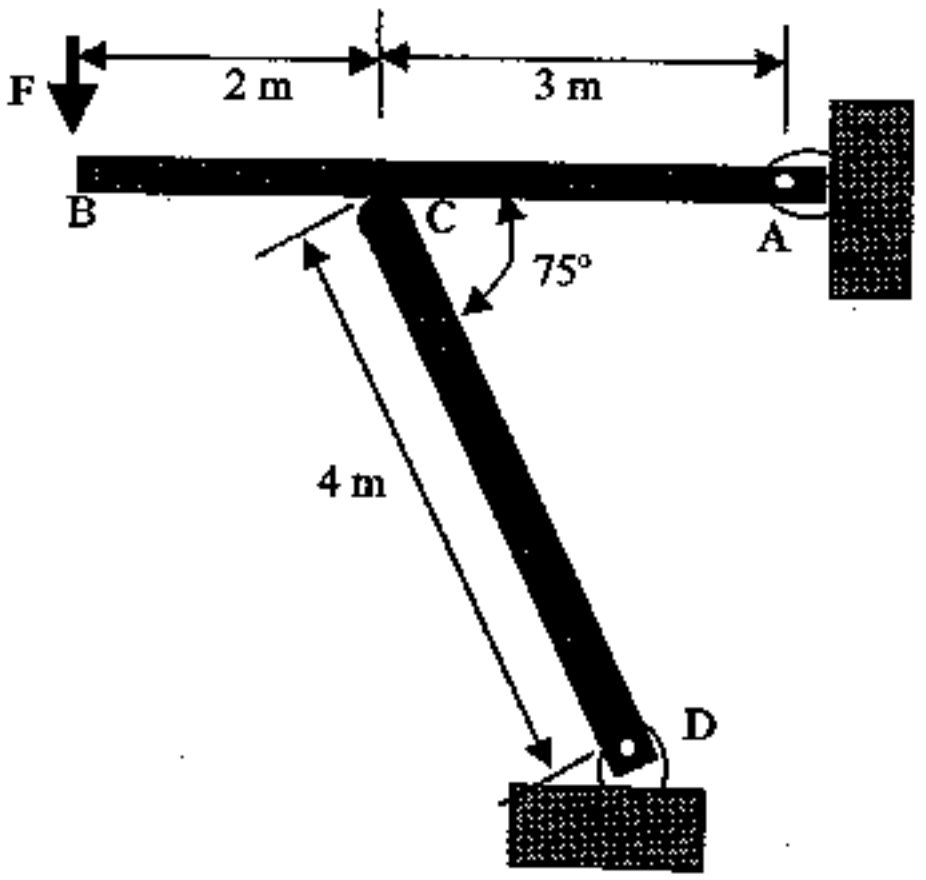
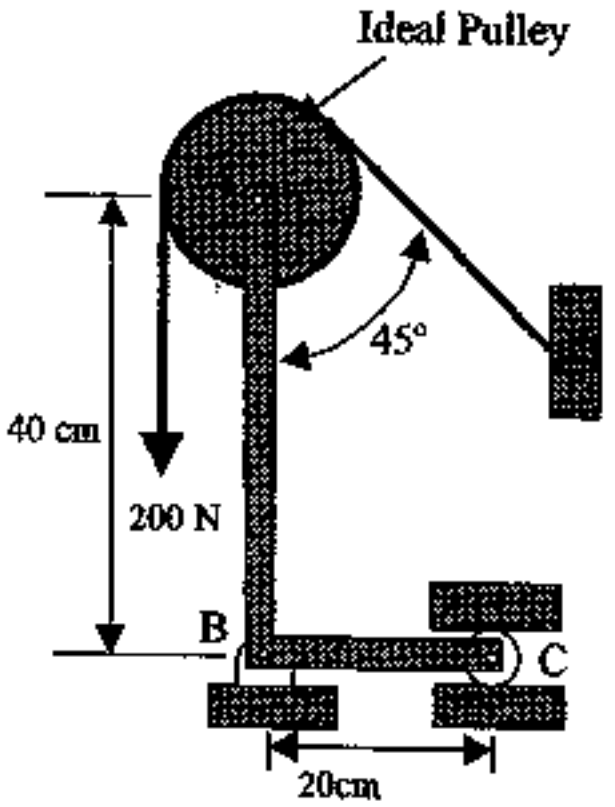
(1) The system of bars supports a vertical force F at end B. Each bar weights 0.204 kg/m. Determine (a) the friction and normal forces acting on bar CD at end C, (b) the minimum value of the coefficient of static friction between the bars required for the system to be in static equilibrium. (20%)



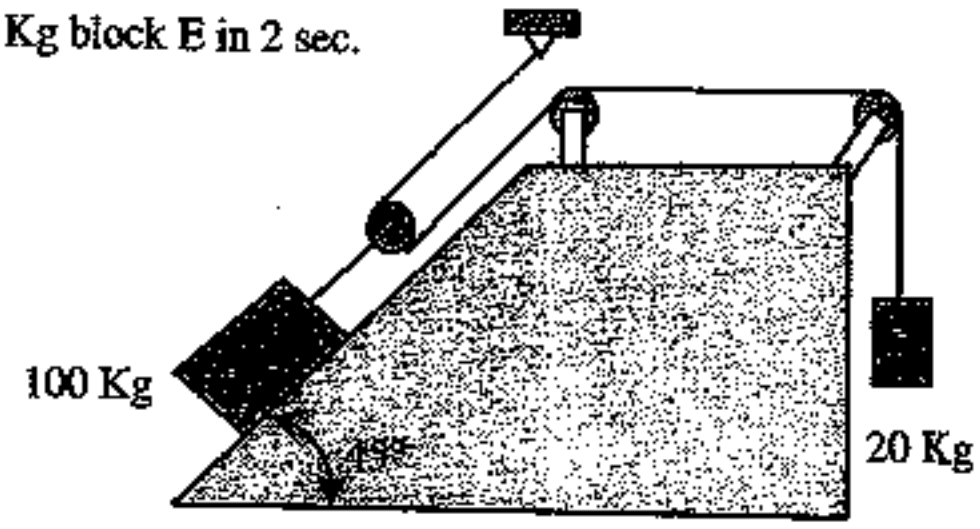
(2) An ideal pulley is pinned to end A of the bent bar ABC and a cable is wrapped around the pulley as shown. A tensile force of 200 N is applied to the free end of the cable. Determine the reactions at pin B and roller C. (15%)



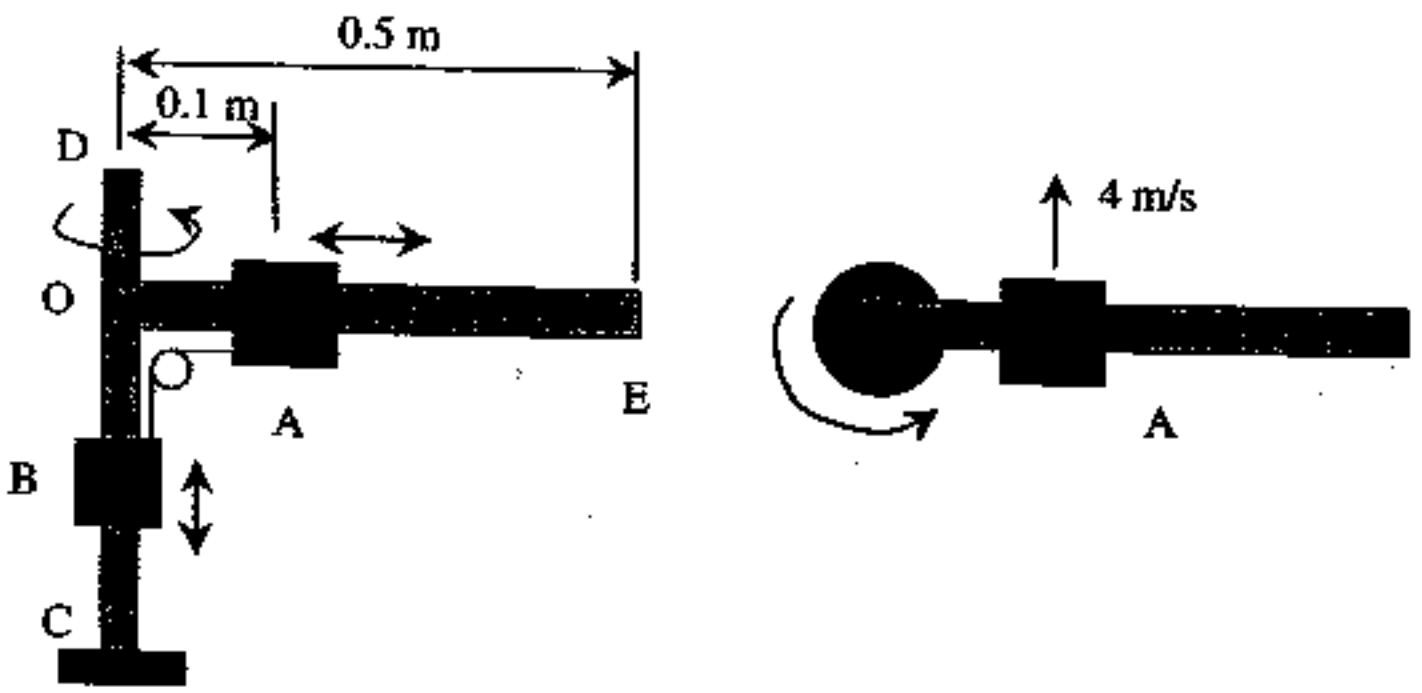
(3) The 100 Kg block H shown in Figure below is released from rest and travels down along the inclined plane. If the mass of the pulleys and the cord is neglected and the pulleys are frictionless, (15%)

(a) Draw the free body diagram of block H.

(b) Determine the speed of the 20 Kg block E in 2 sec.



(4) Block A shown in figure below has a mass of 2 Kg and is free to slide along the smooth horizontal rod OE. This block is connected to the 1 Kg block B, which slides freely along rod CD. Holding B so that it cannot travel up rod CD, a moment is applied to CD until the velocity of A reaches 4 m/s, as shown. When the moment is removed and B is released, determine the upward speed of B when A slides outward until it is 0.3m from the axis of rotation, CD. Neglect the mass of the rod. (18%)

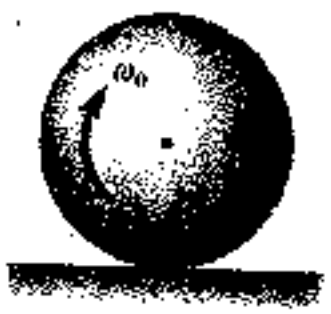


Side view Top view

(5) A sphere of radius r and mass m is placed on a horizontal floor with no linear velocity but with a clockwise angular velocity ω_o. Denoting by μ the coefficient of kinetic friction between the sphere and the floor, determine

(a) the time t_1 at which the sphere will start rolling without sliding,

(b) the linear and angular velocities of the sphere at time t_1. (15%)



(6) The bent rod OAB rotates about the vertical OB. At the instant considered, its angular velocity and angular acceleration are, respectively, 15 rad/s and 200 rad/s^2, both clockwise when viewed from the positive Y axis. The collar D moves along the rod, and at the instant considered, OD = 200 mm. The velocity and acceleration of the collar relative to the rod are, respectively, 2 m/s and 15 m/s^2, both upward. Determine (a) the velocity of the collar, (b) the acceleration of the collar. (17%)