



KEEPING MOBILE PHONE/SMART WATCH, EVEN IN 'OFF' POSITION, IS TREATED AS EXAM MALPRACTICE
General instructions: Make suitable assumption wherever required and draw neat sketches

Answer any TEN Questions

(10 X 10 = 100 Marks)

- Three forces are applied to a bracket as shown in figure 1. The directions of the two 150-N forces may vary, but the angle between these forces is always 50° . Determine the range of values of ' α ' for which the magnitude of the resultant of the forces acting at A is less than 600 N.

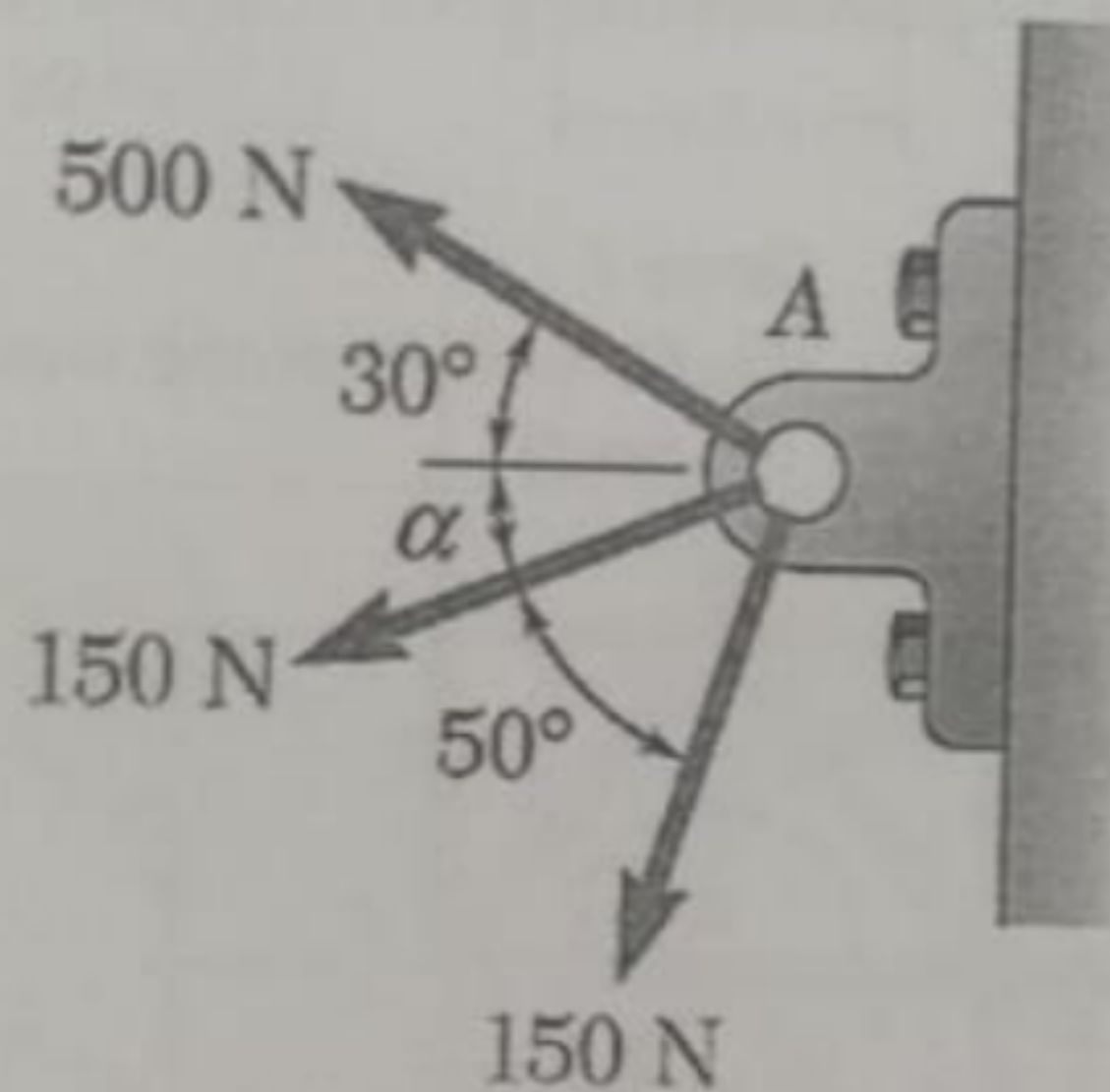


Figure 1

- Three cables are used to tether a balloon as shown in figure 2. Determine the vertical force P exerted by the balloon at A knowing that the tension in cable AD is 481 N.

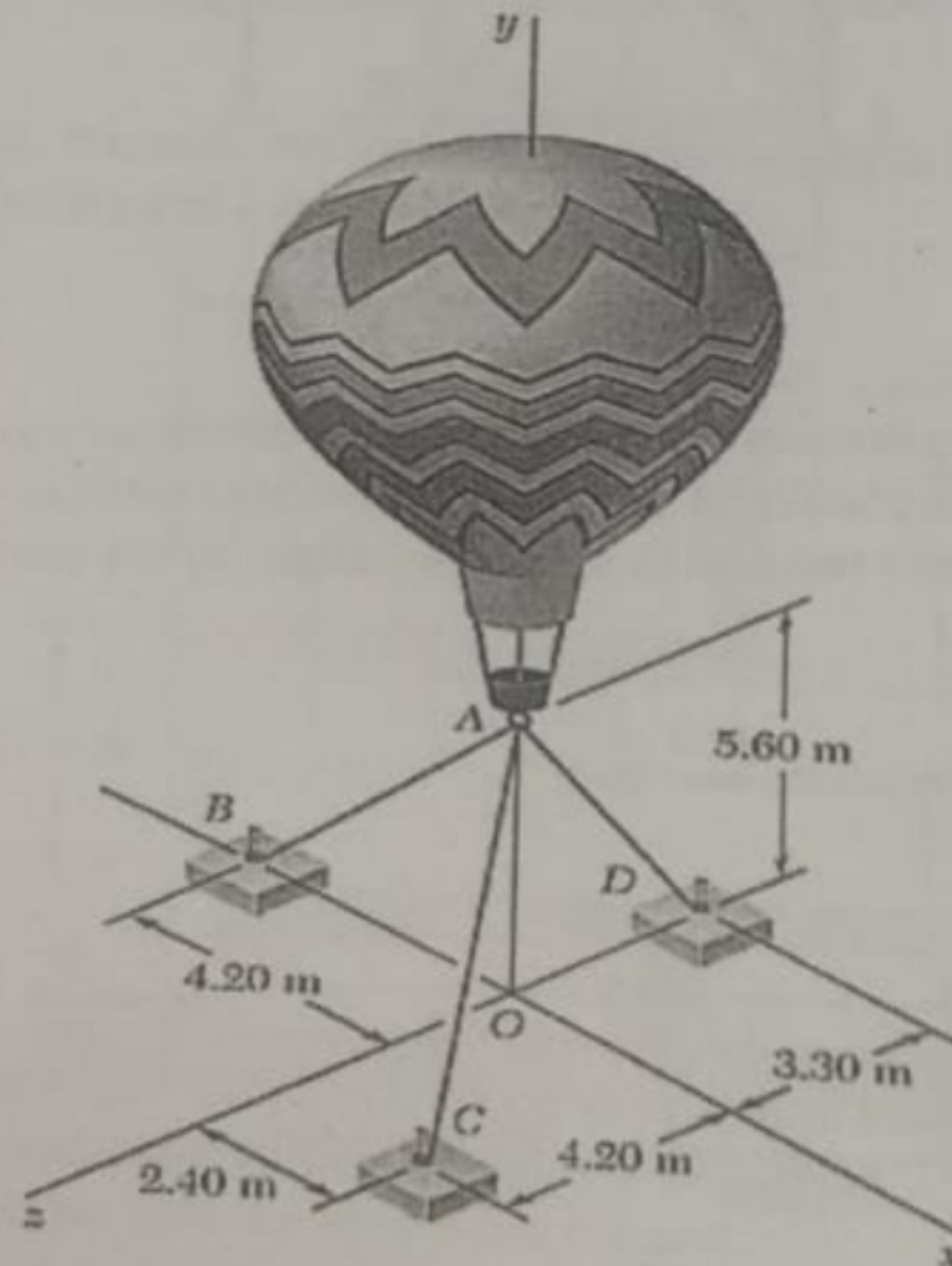


Figure 2

3. A hexagonal plate is acted upon by the force P and the couple as shown in figure 3. Determine the magnitude and the direction of the smallest force P for which this system can be replaced with a single force at E .

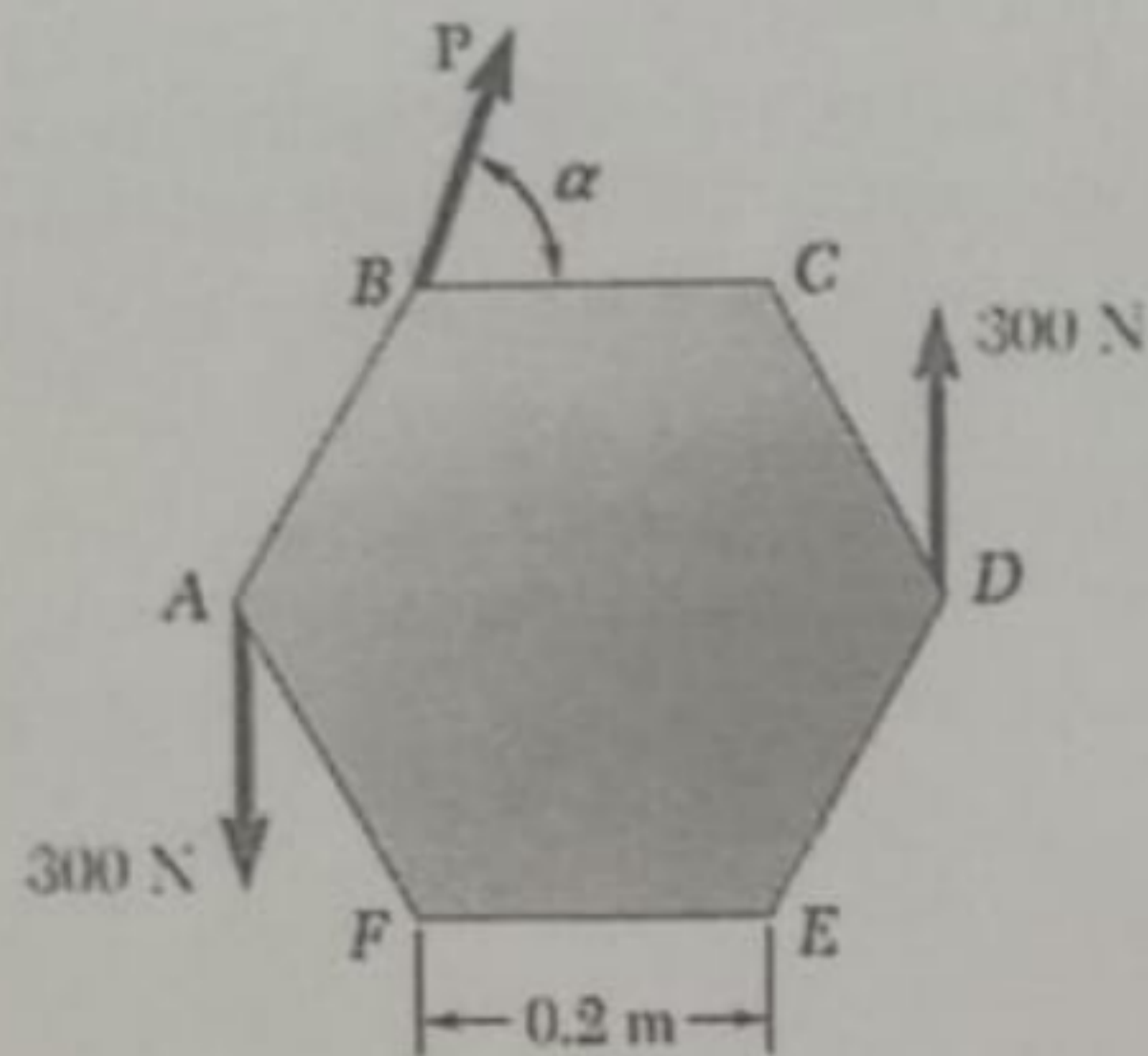


Figure 3

4. Determine the forces in the members DG , FI , GJ & IK of the truss shown in figure 4. (Hint: use the section 'aa' and 'bb' as per the need)

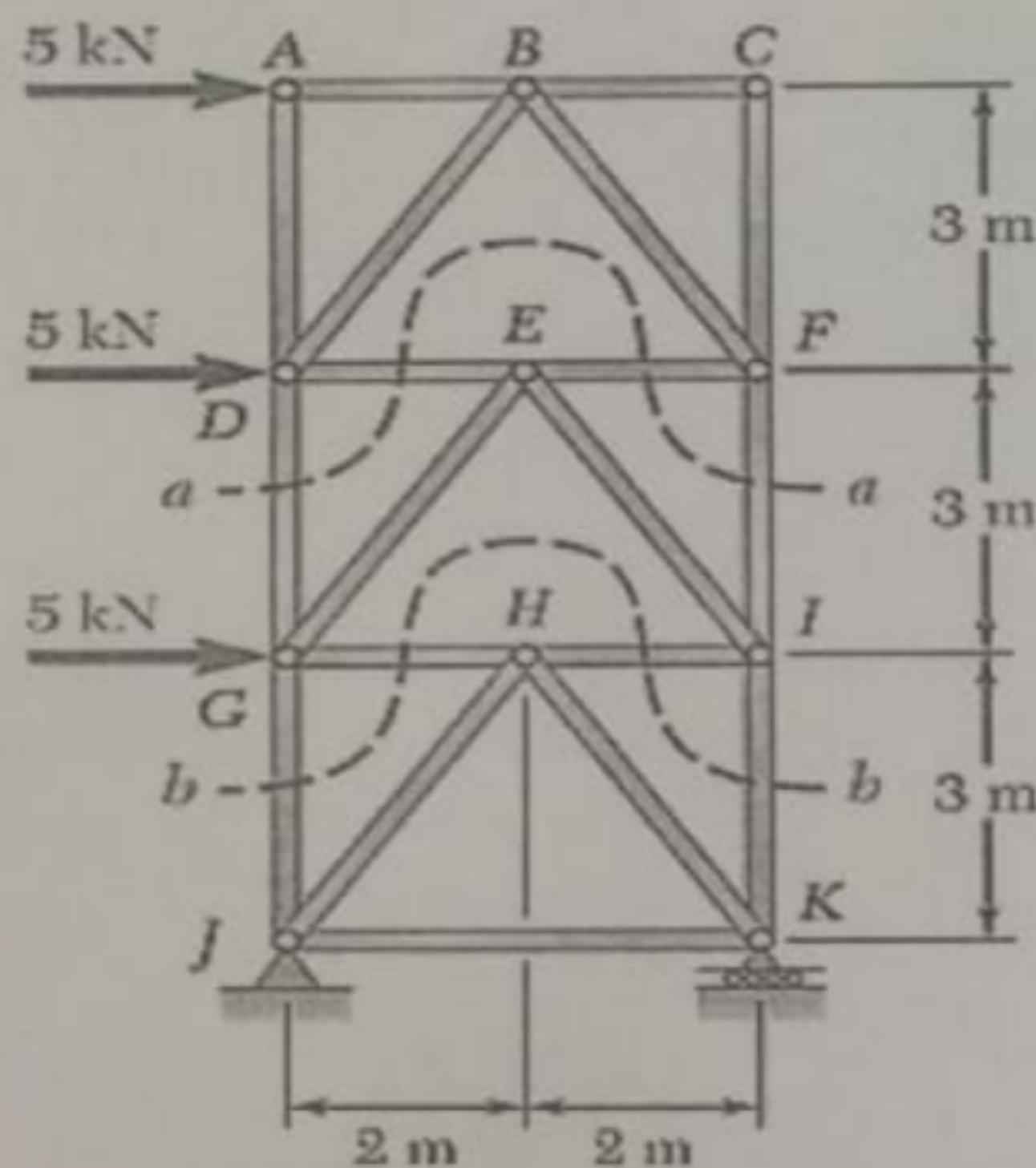


Figure 4

5. The machine part ABC shown in figure 5 is supported by a frictionless hinge at B and a 10° wedge at C. Knowing that the coefficient of static friction at both surfaces of the wedge is 0.20, determine (a) the force P required to move the wedge, (b) the components of the corresponding reaction at B.

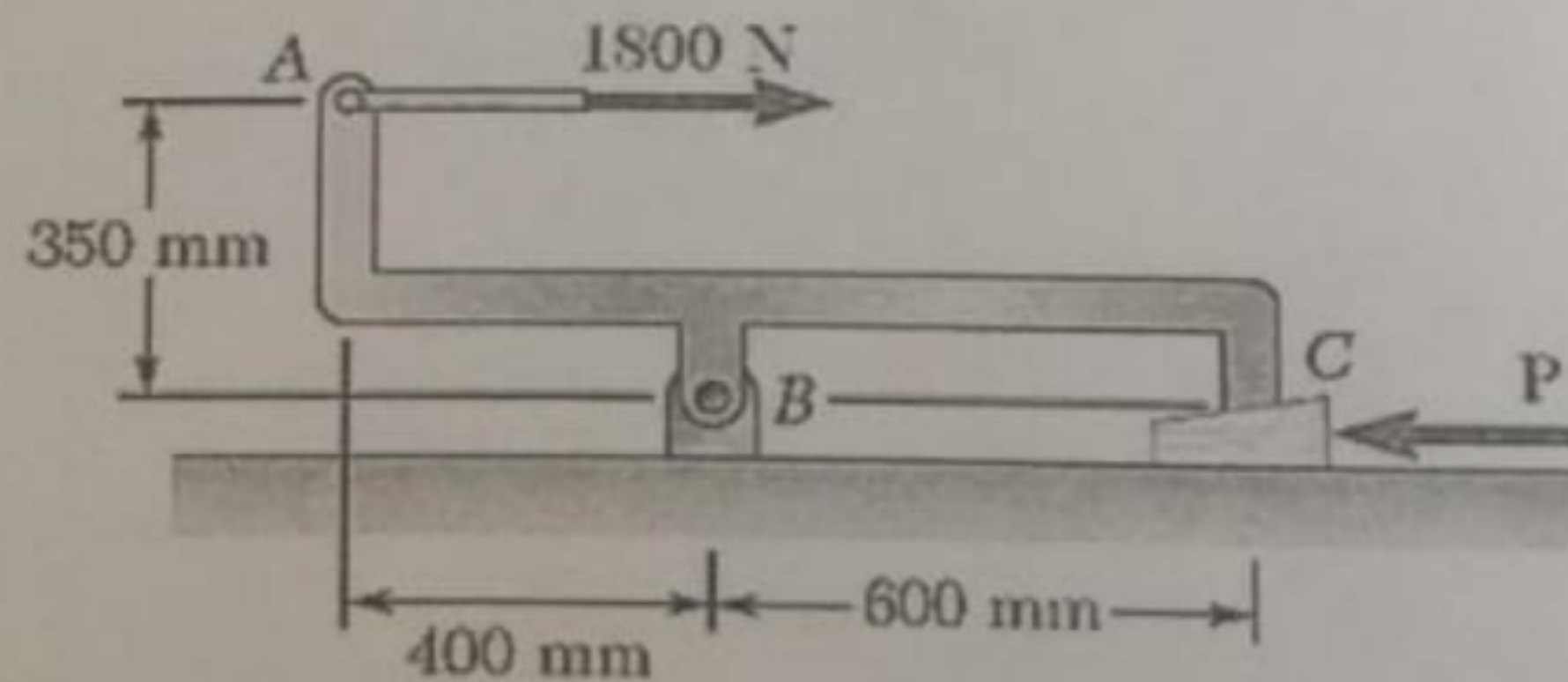


Figure 5

6. Locate the centroid of the shaded area shown in figure 6 and hence determine the volume of revolution about x axis using Pappus-Guldinus Theorem.

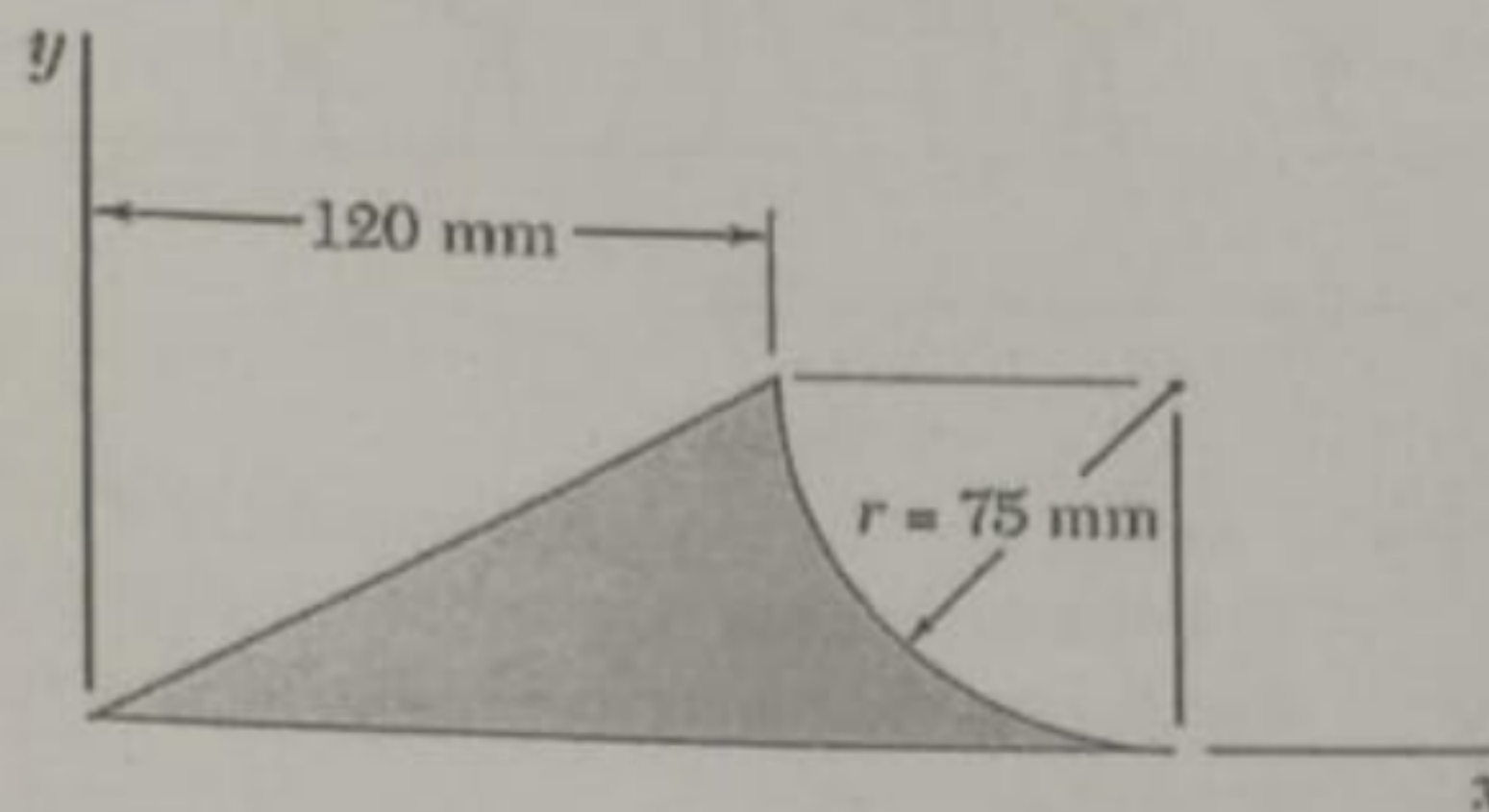


Figure 6

7. Determine the moments of inertia of the shaded area shown with respect to the x and y axes in figure 7, when $a = 20$ mm.

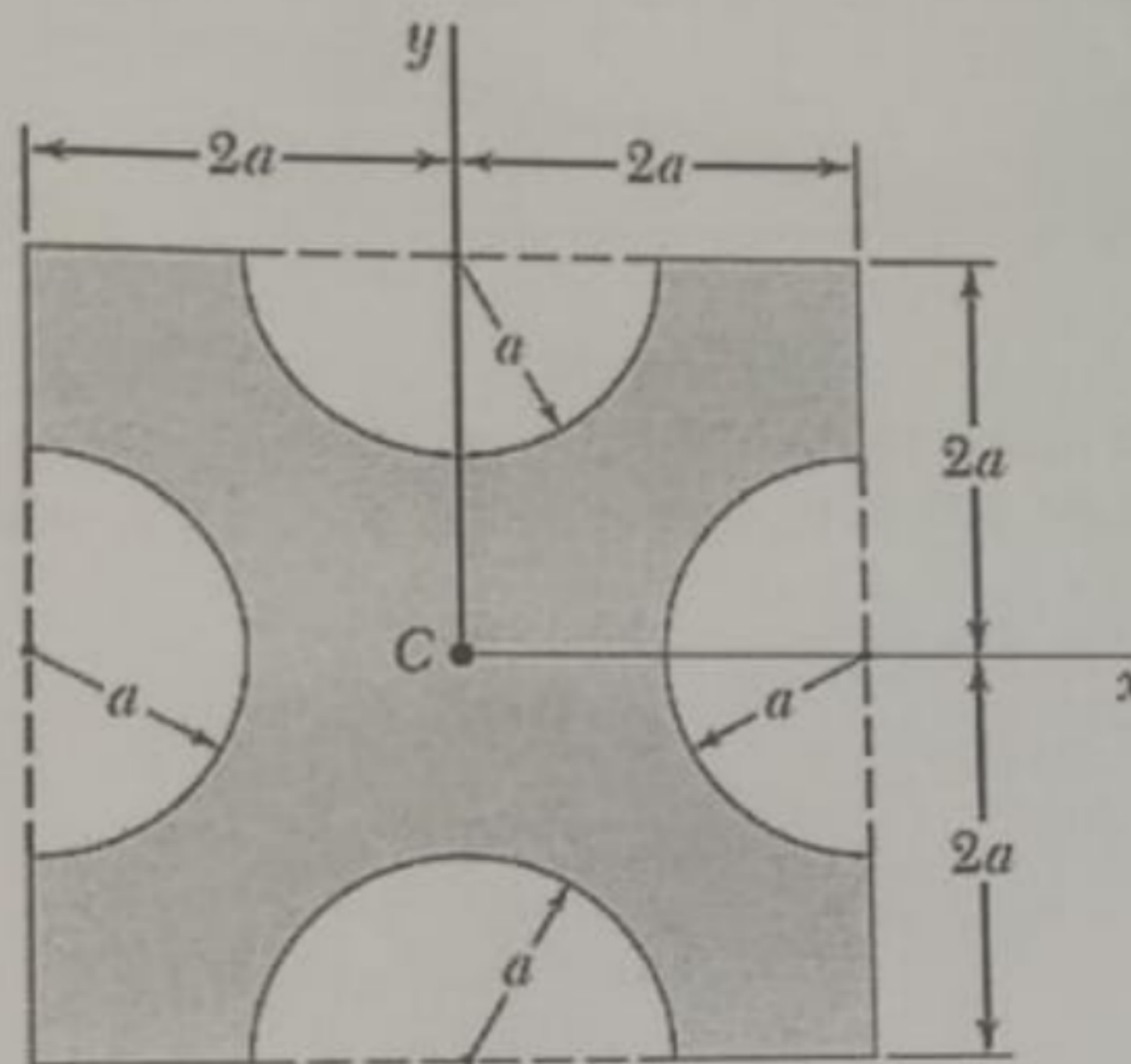


Figure 7

8. Using the parallel-axis theorem, determine the product of inertia of the area shown with respect to the centroidal x and y axes in figure 8.

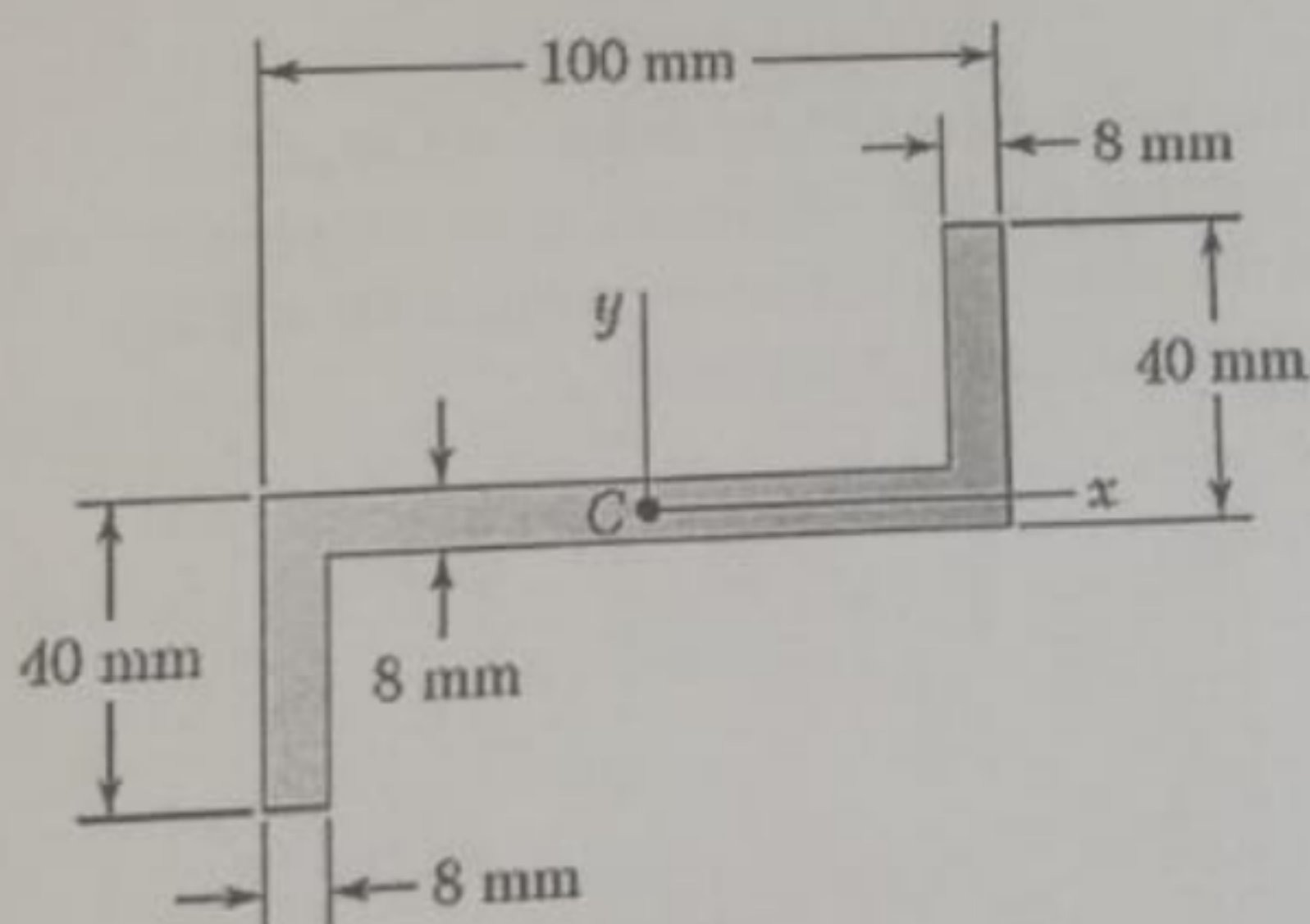


Figure 8

9. A volleyball player serves the ball with an initial velocity v_0 of magnitude 13.40 m/s at an angle of 20° with the horizontal as shown in figure 9. Determine (a) if the ball will clear the top of the net, (b) how far from the net the ball will land.

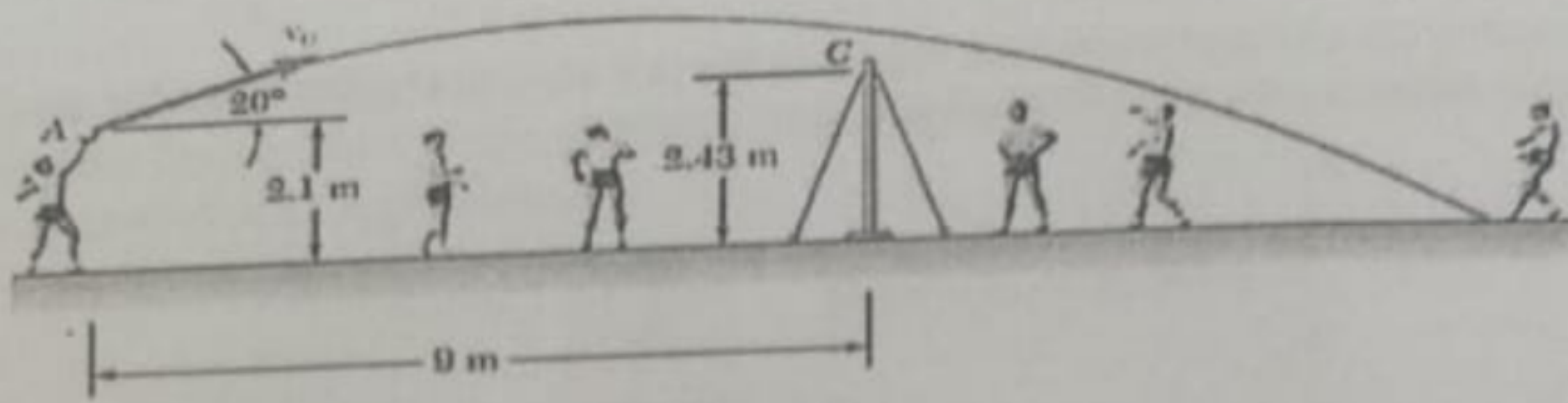


Figure 9

10. A package is projected up a 15° incline at A with an initial velocity of 8 m/s. Knowing that the coefficient of kinetic friction between the package and the incline is 0.12, determine (a) the maximum distance 'd' that the package will move up the incline, (b) the velocity of the package as it returns to its original position.

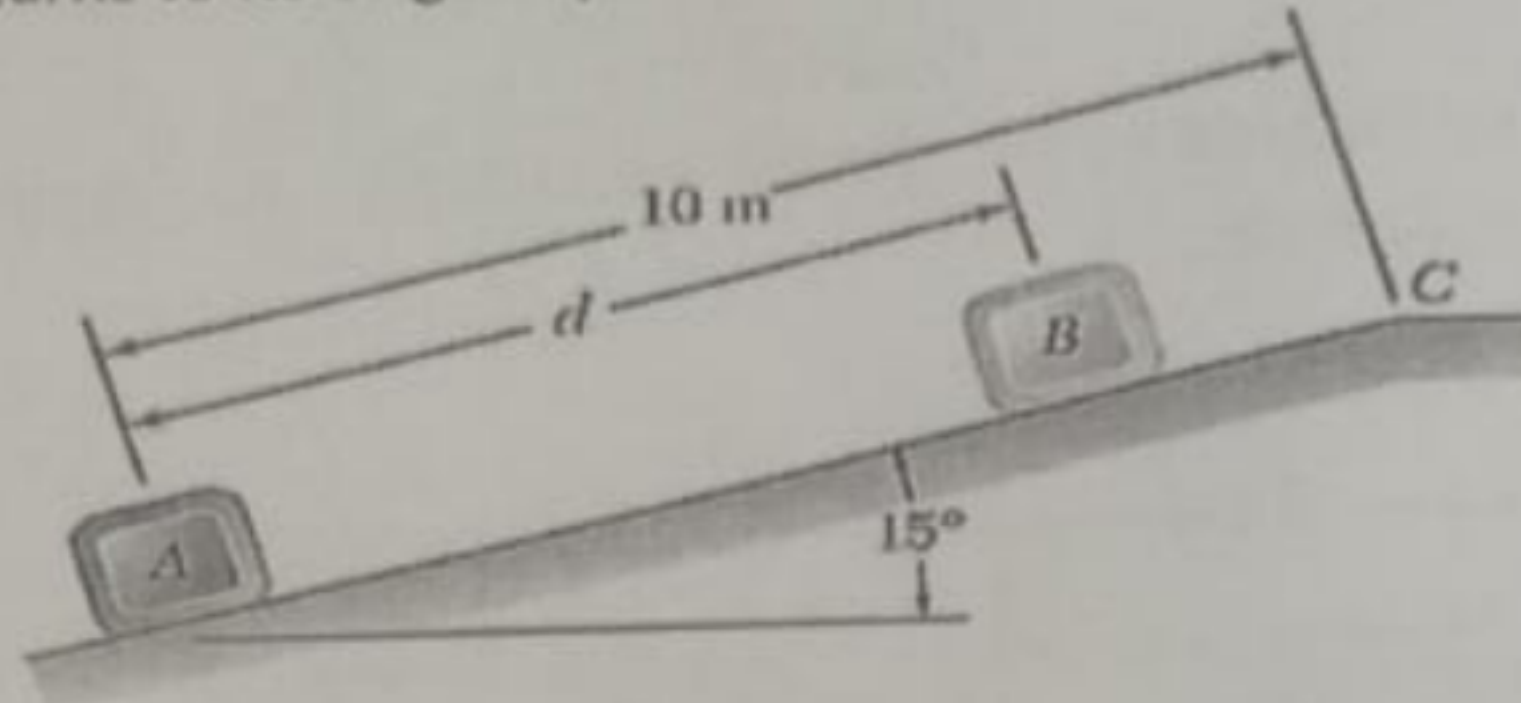


Figure 10

11. In the position shown in figure 11, bar DE has a constant angular velocity of 10 rad/s clockwise. Knowing that $h = 500$ mm, determine (a) the angular velocity of bar FBD, (b) the velocity of Point F.

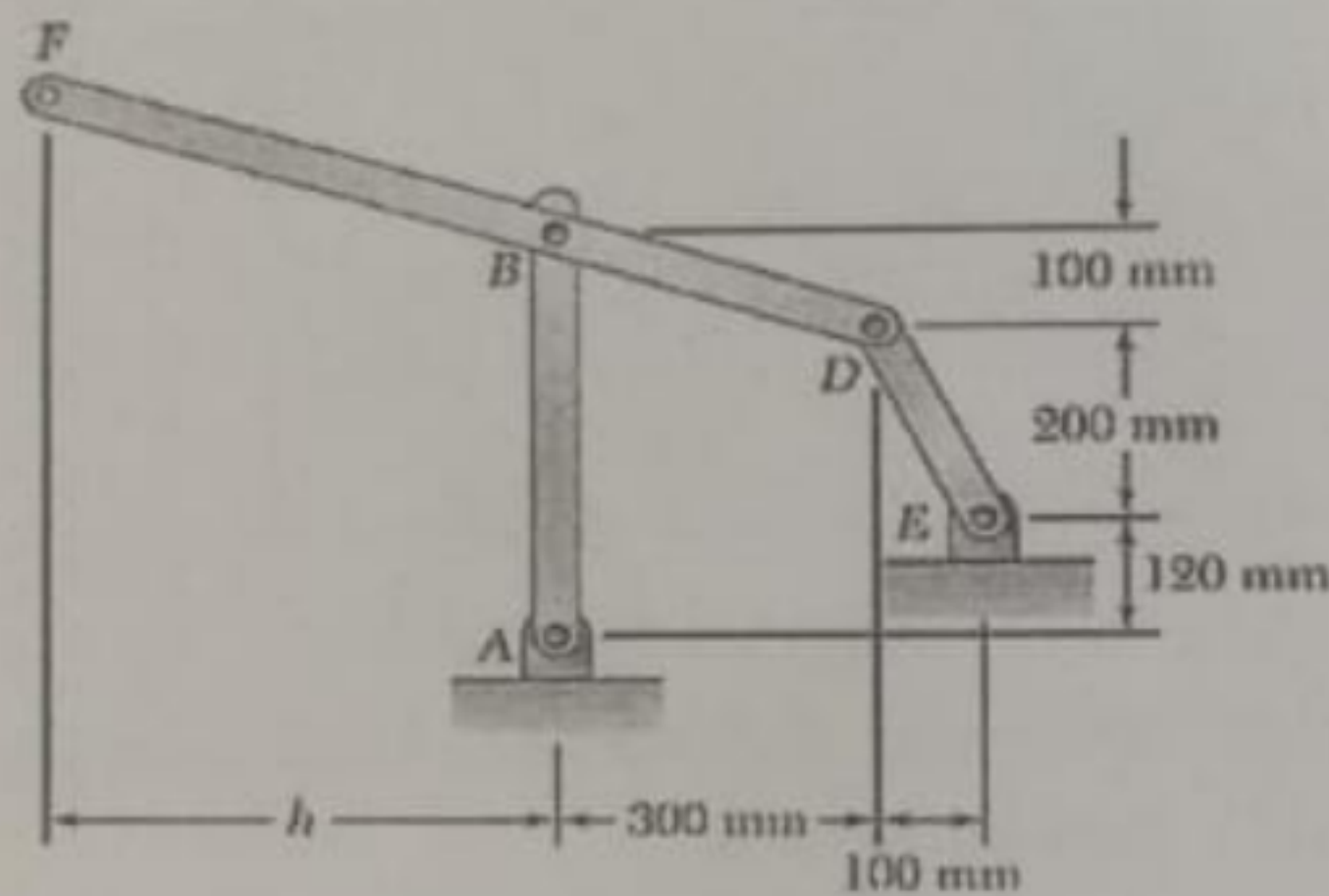


Figure 11

12. A uniform rectangular plate has a mass of 5 kg and is held in position by three ropes as shown in figure 12. Knowing that $\theta = 30^\circ$, determine, immediately after rope CF has been cut, (i) the acceleration of the plate, (ii) the tension in ropes AD and BE.

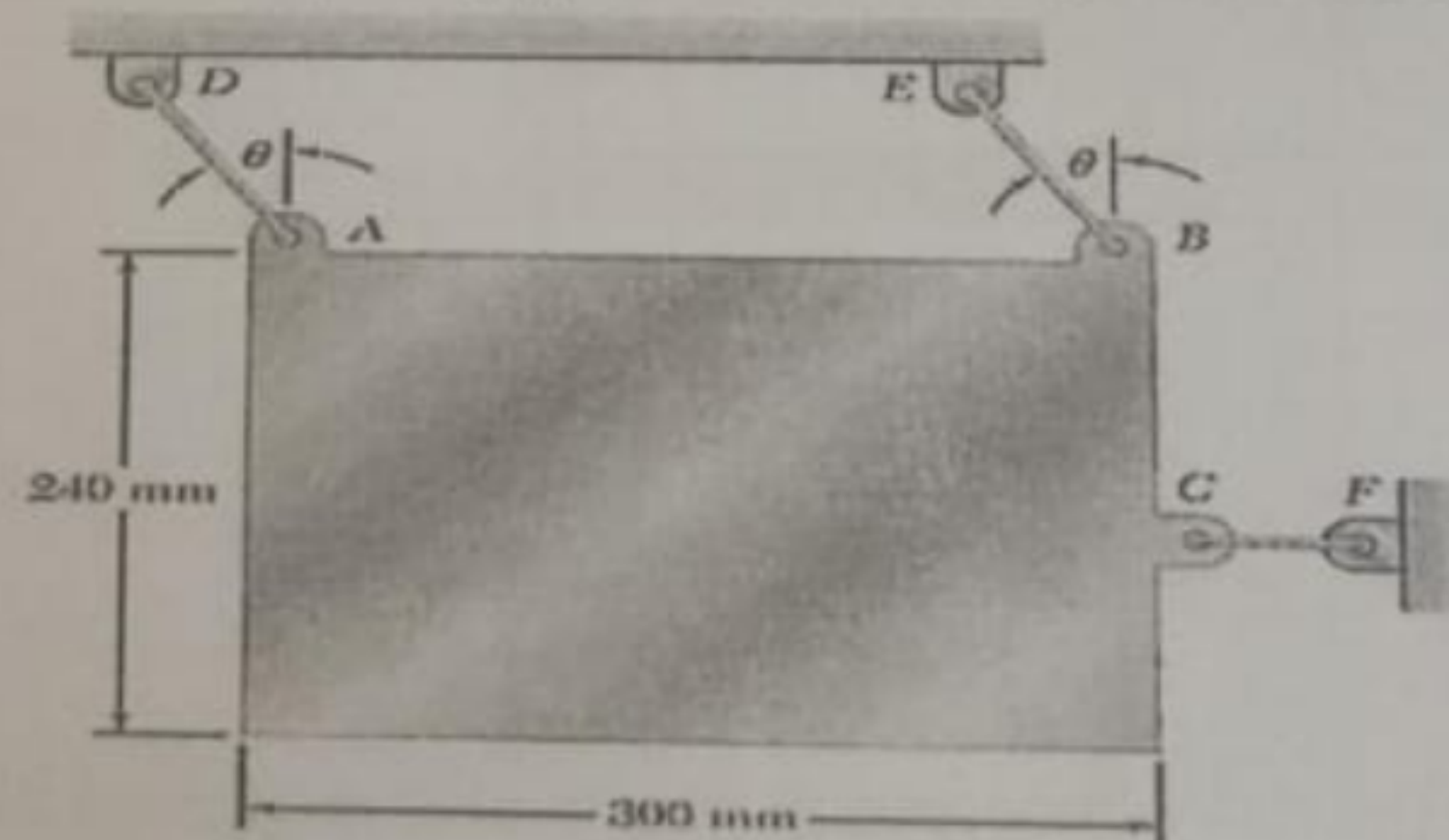


Figure 12

