

國立清華大學 100 學年度碩士班入學考試試題

系所班組別：動力機械工程學系丙組(固體與奈微米力學組)、
丁組(設計、製造組)

考試科目 (代碼)：應用力學(含靜力學、動力學)(1202、1302)

共 3 頁，第 1 頁 *請在【答案卷、卡】作答

1. A 6-meter uniform rod AB of weight 100 N leans against a wall as shown in Fig. 1. Assuming that the coefficient of static friction μ is the same at both surfaces of contact, determine the smallest value of μ for which equilibrium can be maintained. (15%)

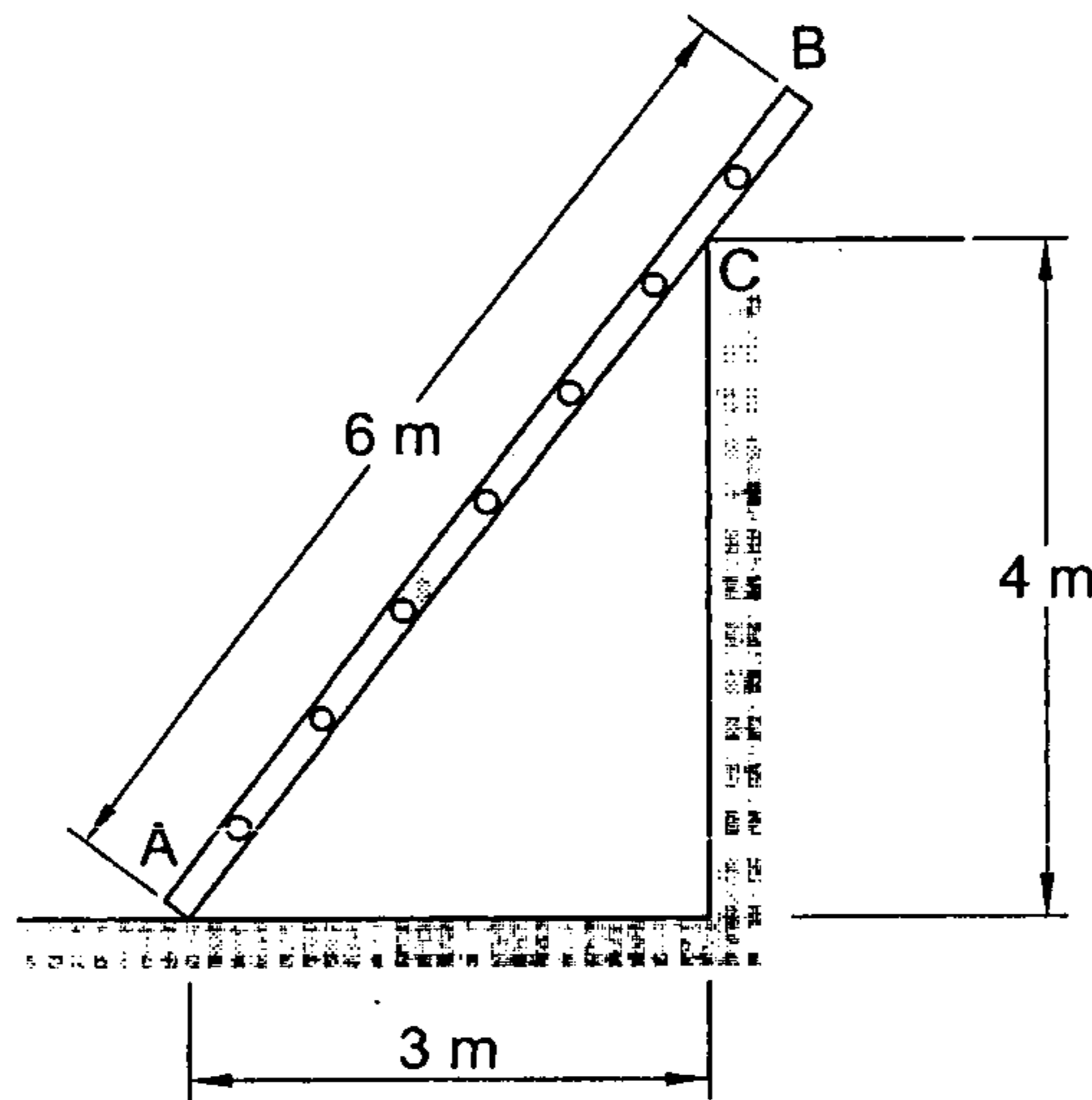


Fig. 1

2. The axis of the three-hinge arch ABC is a parabola with vertex at B as shown in Fig. 2. Knowing that $P = 112\text{ kN}$ and $Q = 140\text{ kN}$, determine (a) the components of the reaction at A , (b) the components of the force exerted at B on segment AB . (15%)

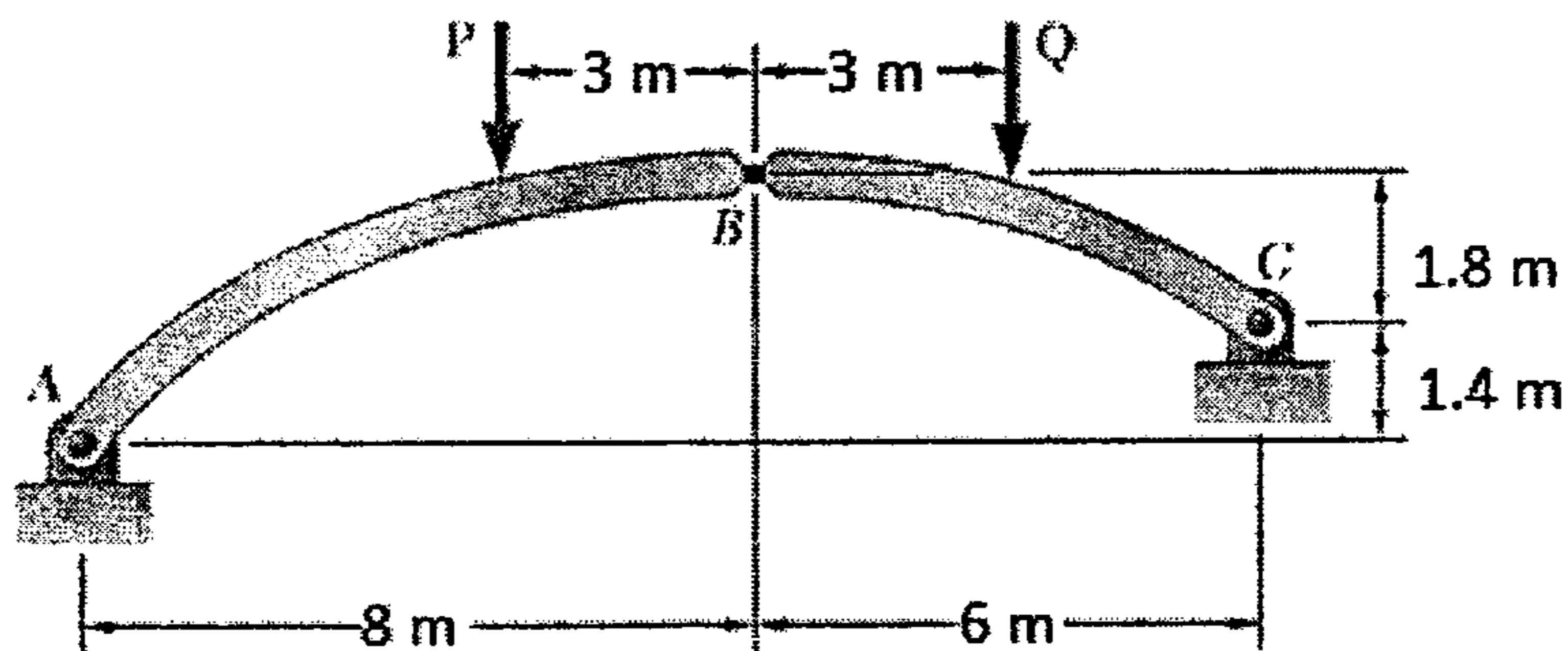


Fig. 2

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3. As shown in Fig. 3, pin B weighs 110 g and is free to slide in a horizontal plane along the rotating arm OC and along the circular slot DE of radius $b = 500$ mm. Neglecting friction and assuming that $\dot{\theta} = 15$ rad/s and $\ddot{\theta} = 250$ rad/s² for the position $\theta = 20^\circ$, determine for that position (a) the radial and transverse components of the resultant force exerted on pin B , (b) the forces P and Q exerted on pin B , respectively, by rod OC and the wall of slot DE . (15%)

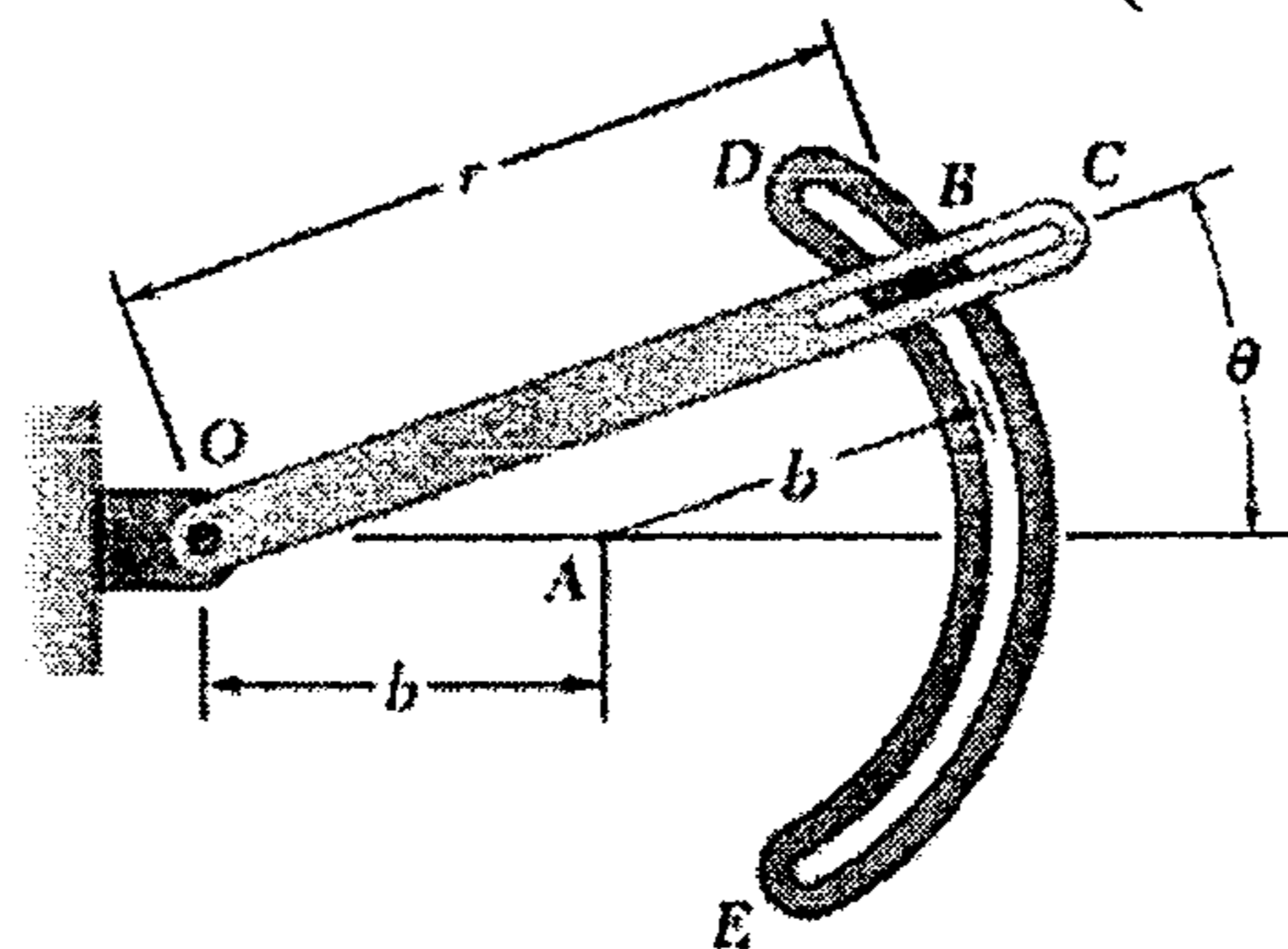


Fig. 3

4. As shown in Fig. 4, point P is the center of the pin guided by two slots cut in rods AE and BD . Knowing that the rods rotate with constant angular velocities $\omega_A = 1$ rad/s and $\omega_B = 2$ rad/s, both counterclockwise, determine the velocity and acceleration of point P for the position shown. (20%)

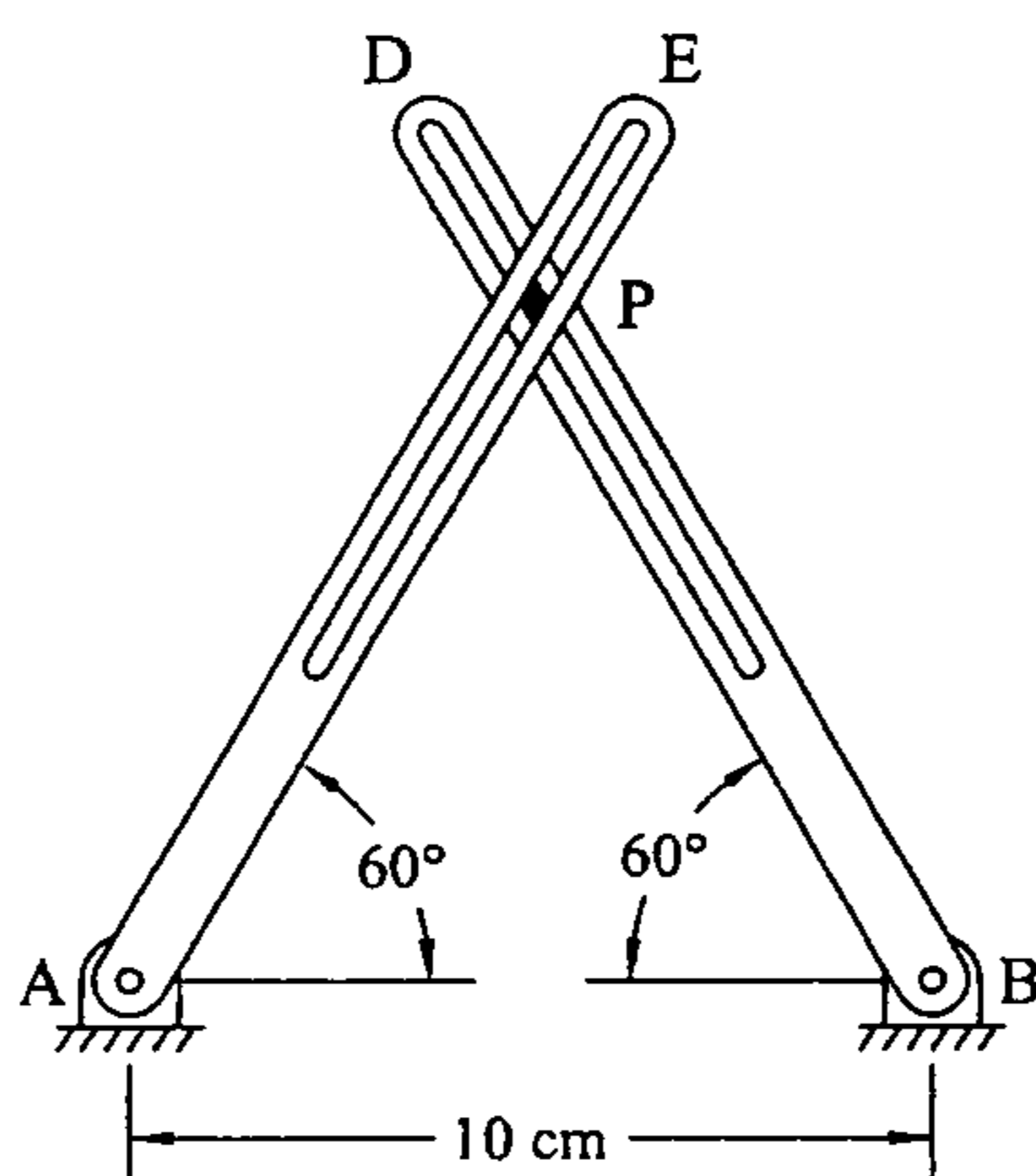


Fig. 4

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5. Ball B is hanging from an inextensible cord. An identical ball A is released from rest when it is just touching the cord and acquires a velocity v_0 before striking ball B . (a) Assuming perfectly elastic impact ($e = 1$) and no friction, determine the magnitude and direction of the velocity of each ball immediately after impact. (b) Assuming $e = 0.9$, determine the magnitude and direction of the velocity of each ball immediately after impact. (15%)

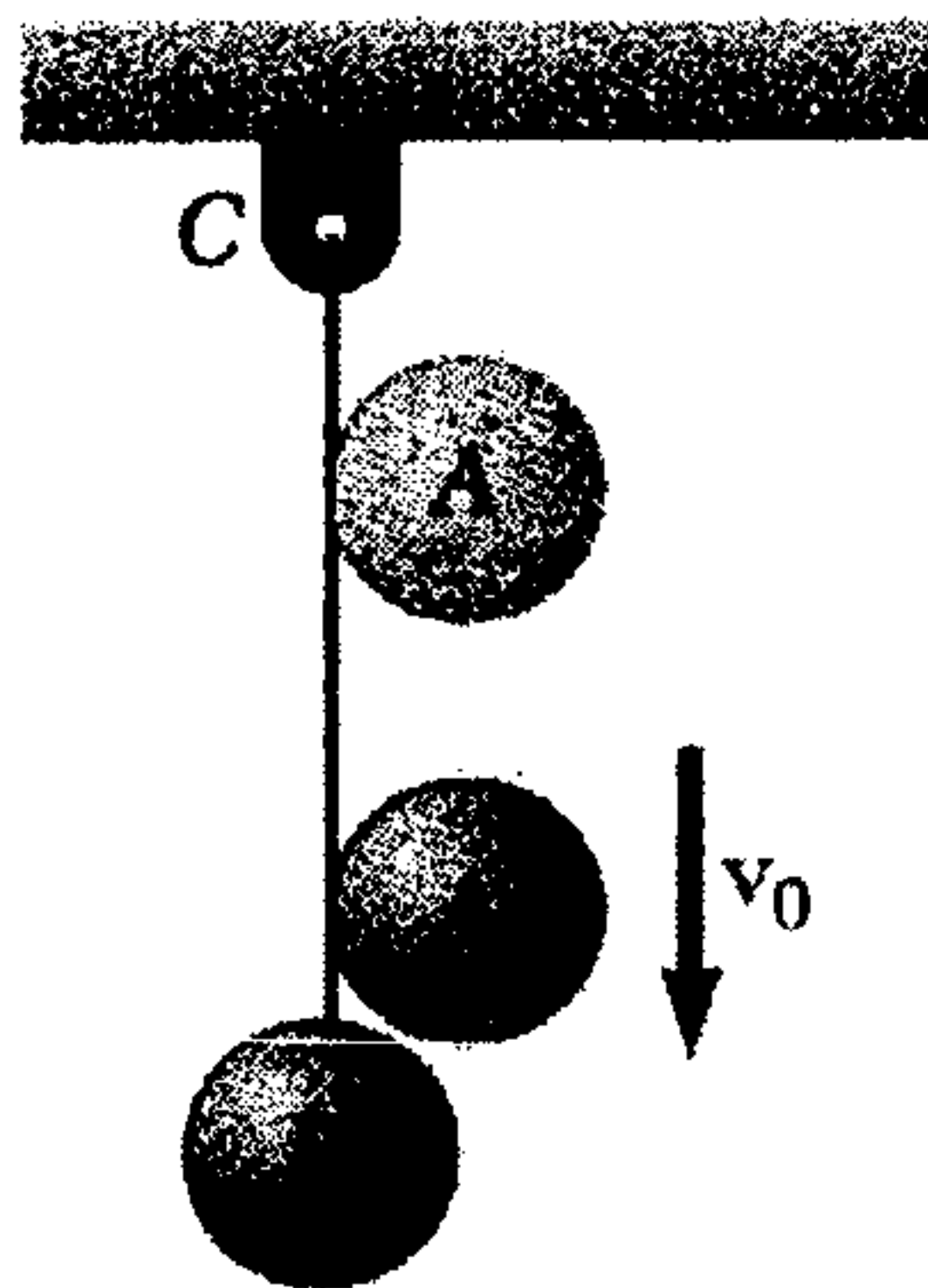


Fig. 5

6. The motion of the uniform rod AB is guided by small wheels of negligible mass that roll on the surface shown. If the rod is released from rest when $\theta = 0$, determine ($\theta = 30^\circ$) (a) the angular acceleration of the rod, (b) the reactions at A and B , (c) the velocities of A and B when $\theta = 30^\circ$. (20%)

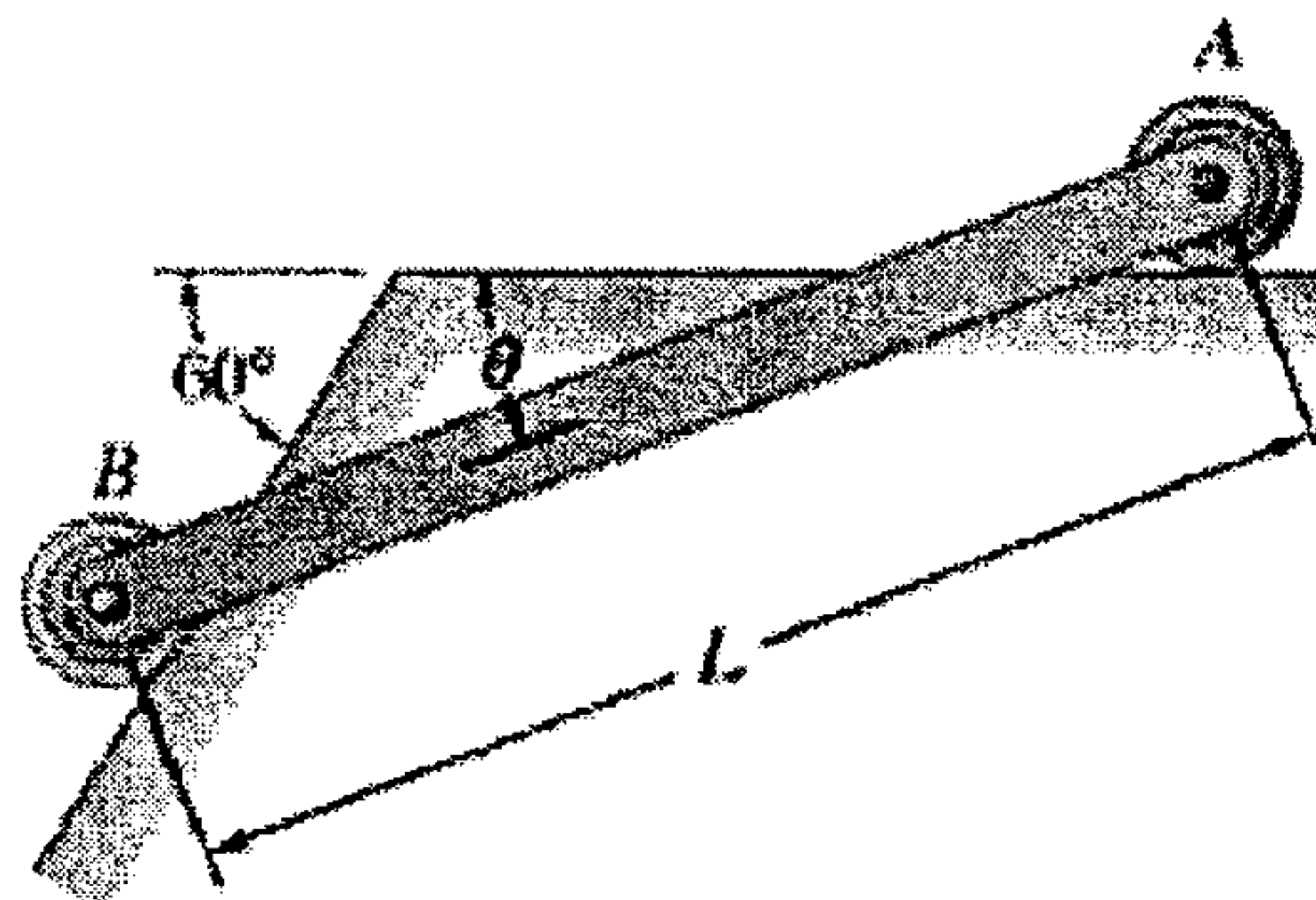


Fig. 6