

Practice Problem Set 9: Engineering Mechanics (NMEC101)

Kinetics of Particles

Instruction: Figure numbers correspond to the problem numbers.

1. A small 250-g collar C can slide on a semicircular rod which is made to rotate about the vertical AB at a constant rate of 7.5 rad/s. Determine the three values of θ for which the collar will not slide on the rod, assuming no friction between the collar and the rod.
2. A 300 g collar can slide on a horizontal rod which is free to rotate about a vertical shaft. The collar is initially held at A by a cord attached to the shaft and compresses a spring of constant 5 N/m, which is undeformed when the collar is located 750 mm from the shaft. As the rod rotates at the rate $d\theta /dt = 12 \text{ rad/s}$, the cord is cut and the collar moves out along the rod, determine for position B of the collar,
 - (a) The transverse component of the velocity of the collar,
 - (b) The radial and transverse component of its acceleration
 - (c) The acceleration of the column relative to rod.
3. A 6-kg block B starts from rest and slides on the 10-kg wedge A, which is supported by a horizontal surface. Neglecting friction, determine (a) the velocity of B relative to A after it has slid 1 m down the inclined surface of the wedge, (b) the corresponding velocity of A.
4. A 0.5-kg block B slides without friction inside a slot cut in arm OA which rotates in a vertical plane at a constant rate $\dot{\theta} = 2 \text{ rad/s}$

At the instant when $\theta = 30^\circ$, $r = 0.6 \text{ m}$ and the force exerted on the block by the arm is zero. Determine, at this instant, (a) the relative velocity of the block with respect to the arm, (b) the relative acceleration of the block with respect to the arm.

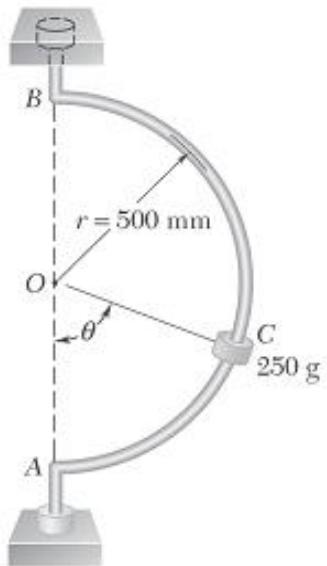


Fig. 1

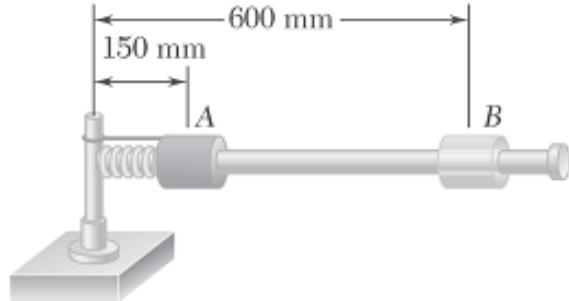


Fig. 2

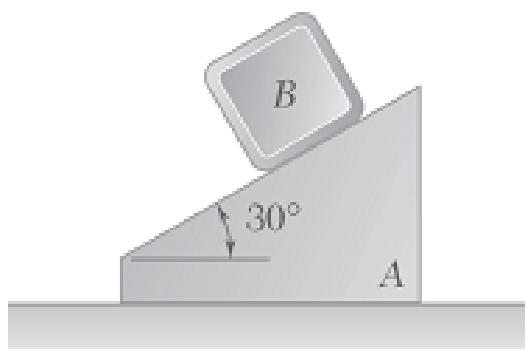


Fig. 3

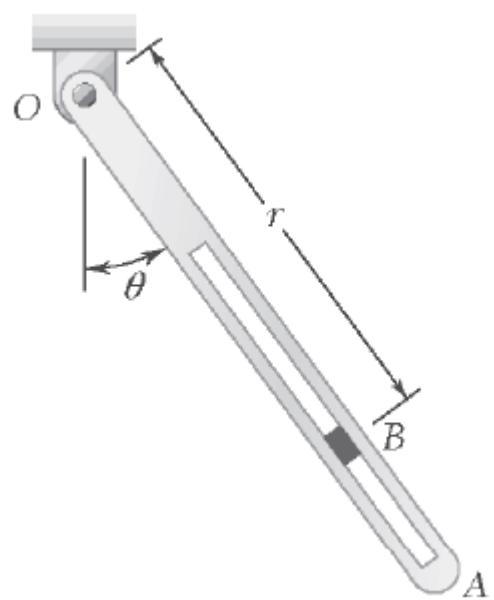


Fig. 4