

**Problem 1. (20 Points)** A small sphere **B** of mass  $m$  is released from rest in the position shown in **Figure 1** and swings freely in a vertical plane, first about **O** and then about the peg **A** after the cord comes in contact with the peg. Please determine the tension in the cord **(a)** just before the sphere comes in contact with the peg, **(b)** just after it comes in contact with the peg. In both cases, please draw the corresponding free-body diagram before making any computation. Without the free-body diagram, you will not be able to obtain any credits.

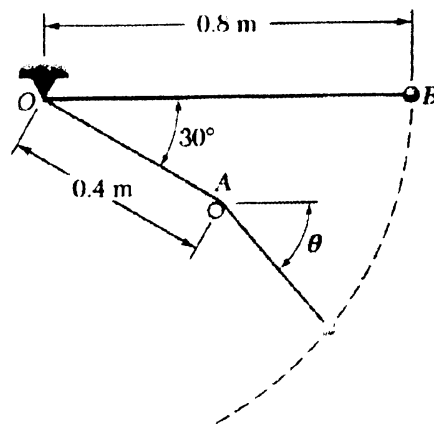


Figure 1

**Problem 2. (20 Points)** Consider the system shown in **Figure 2**.

- (a) Is the system a conservative system? Why? (4 Pts)
- (b) Please define your own variable and express the kinetic energy and potential energy of this system (8 pts)
- (c) Please find the equation of motion and its natural frequency (8 pts)

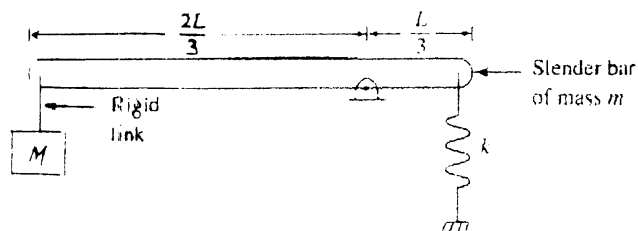


Figure 2

(背面仍有題目,請繼續作答)

Problem 3. (20 Points) As shown in Figure 3, a disk rolls without slipping such that it has an angular acceleration of  $\alpha = 4 \text{ rad/s}^2$  and angular velocity of  $\omega = 2 \text{ rad/s}$  at the instance shown. Determine the accelerations of point A and B on the link and the link's angular acceleration.

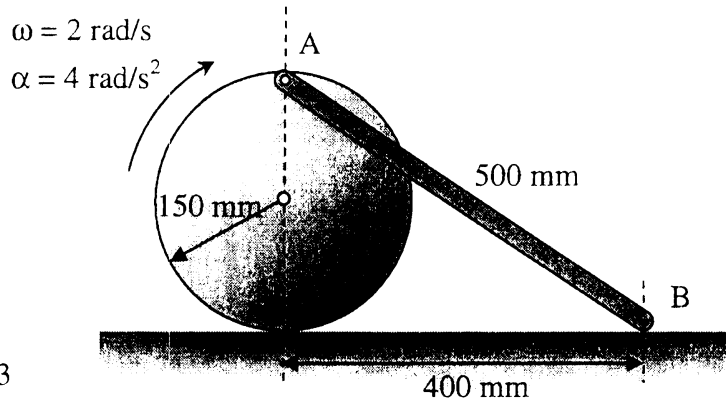


Figure 3

Problem 4. (20 Points) As shown in Figure 4, a slender 100-kg bar is supported by two cords AB and AC. If cord AC suddenly breaks, determine the initial angular acceleration of the bar and the tension in cord AB.

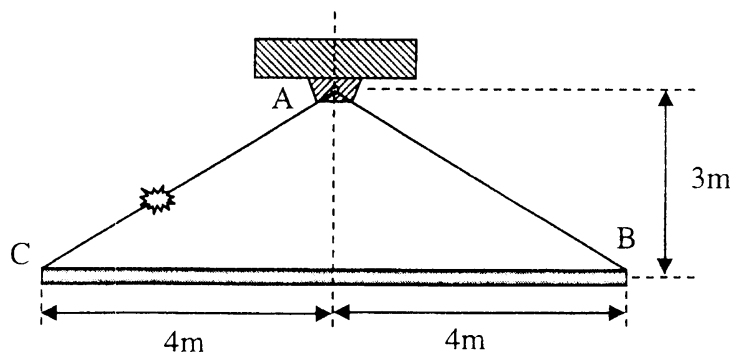


Figure 4

Problem 5. (20 Points) As shown in Figure 5, a horizontal rigid rod is dropped from a height 10 ft above a heavy table. The end of the rod collides with the table. If the coefficient of impact,  $e$ , between the end of the rod and the corner of the table is 0.6, what is the angular velocity of the rod right after the impact? The rod is 1 ft in length and weight 1.5 lb.

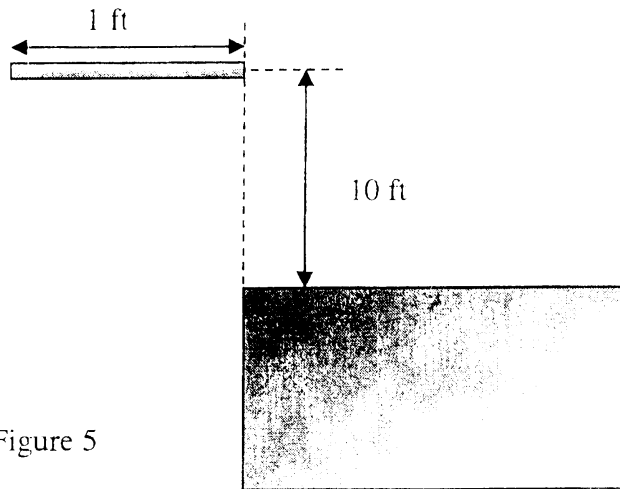


Figure 5