

※ 考生請注意：本試題不可使用計算機

**Attention:**

In general, a free-body diagram along with your equations is necessary in order to explain the procedures to solve the problem. Mathematical calculation for the answer is not necessary

- (1) A small box of mass  $m$  is given a speed of  $v = \sqrt{\frac{1}{4}gr}$  at the top of the smooth half cylinder. Draw a free-body diagram and explain how to find the angle  $\theta$  at which the box leaves the cylinder. (15%)

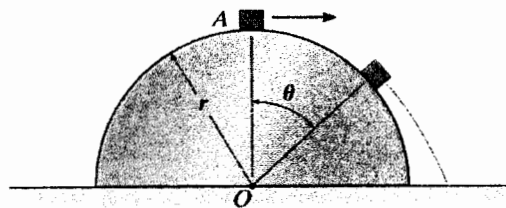


Fig 1

- (2) Use the concept of instantaneous center of zero velocity to find the velocity of point E on link BC and the angular velocity of link AB at the instant shown in Fig 2. (15%)

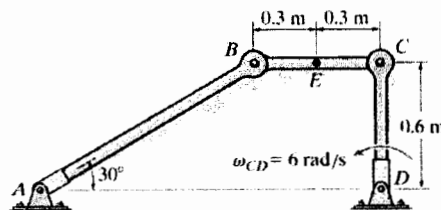


Fig 2.

- (3) Use a rotating coordinate system attached to rod AB and draw a free-body diagram, then write down all the necessary information and equations in order to find angular velocity and angular acceleration of rod CD. Explain your calculation. (15%)

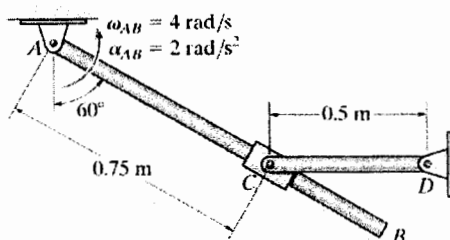


Fig. 3

(背面仍有題目,請繼續作答)

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- (4) The 20-kg square plate is pinned to the 5-kg smooth collar at A. Determine the initial linear acceleration and angular acceleration of the plate when  $P=100\text{N}$  is applied to the collar. The plate is originally at rest. (15%)

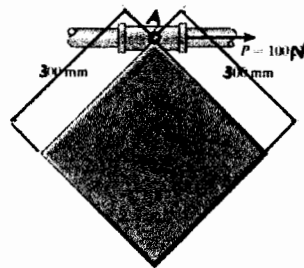


Fig. 4

- (5) If a force  $F=200\text{N}$  is applied to the 30-kg cart, show that the 20-kg block A will slide on the cart. Also determine the time for block A to move on the cart 1.5m. The coefficients of static and kinetic friction between the block and the cart are  $\mu_s=0.3$  and  $\mu_k=0.25$ . Both the cart and the block start from rest. (20%)

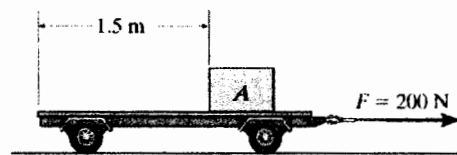


Fig 5

- (6) A ball having a mass of 8kg and initial speed of  $v_1=0.2\text{m/s}$  rolls over a 30-mm-long depression. Assuming that the ball rolls off the edges of the contact first A, then B without slipping, determine its final velocity  $v_2$  when it reaches the other side. Detail explanation to your equations is required! (20%)

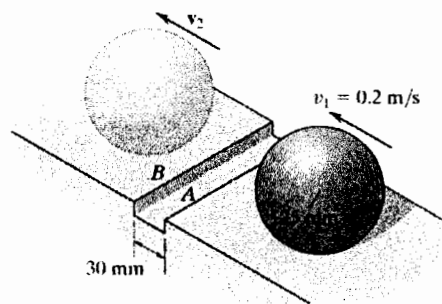


Fig. 6