國立臺灣科技大學

八十九學年度碩士班招生考試試題

系所組別： 機械工程系甲組、機械工程系丁組

科　目： 動力學

共四題，每題 25 分，可不依序作答，但題號務請標示清楚。解題時請註明所依據之定律或原理。自由體圖須簡明繪於答案卷上；若須自行定義符號或向量，亦請於圖上標示清楚。重力加速度（g）之值請以 9.81 m/sec^2 計算。

1. As shown in figure 1, ball *B*, of mass 5kg, is suspended from a cord of length l = 1m attached to cart *A*, of mass 10kg, which may roll freely on a frictionless horizontal track. If the ball is given an initial horizontal velocity v_0 = 2 m/sec while the cart is at rest, determine
(a)the velocity of *B* as it reaches its maximum elevation,
(b)the maximum vertical distance *h* through which *B* will rise.

2. A small ball *A* is dropped from a height *h*=1m onto a rigid, frictionless plate at *B* and bounces to point *C* at the same elevation as *B*, as shown in figure 2. Knowing that $\theta = 20^\circ$ and that the coefficient of restitution between the ball and the plate is e = 0.4, determine the distance *d*.

3. A slender bar *AB* with a uniform cross section and a mass of 10kg is initially held fixed by two cords as shown in figure 3. Determine the angular acceleration of the bar and the tension in the cord at *B* immediately after the cord at *A* is cut. Assume that the horizontal surface in contact with end *A* of the bar is smooth. The moment of inertia of the bar about its center of mass is $I_G = \frac{1}{12} ml^2$.

4. The 220mm diameter bowling ball shown in figure 4 has a mass of 7.25kg. At the instant that the ball comes in contact with the alley, it has a forward velocity v = 7 m/sec and a backspin $\omega = 6\,rad/\sec$. If the kinetic coefficient of friction between the ball and the alley is 0.15, determine the elapsed time and the distance traveled before the ball begins to roll without slipping. The moment of inertia of the ball about its center of mass is $I_G = 0.4\,mr^2$.

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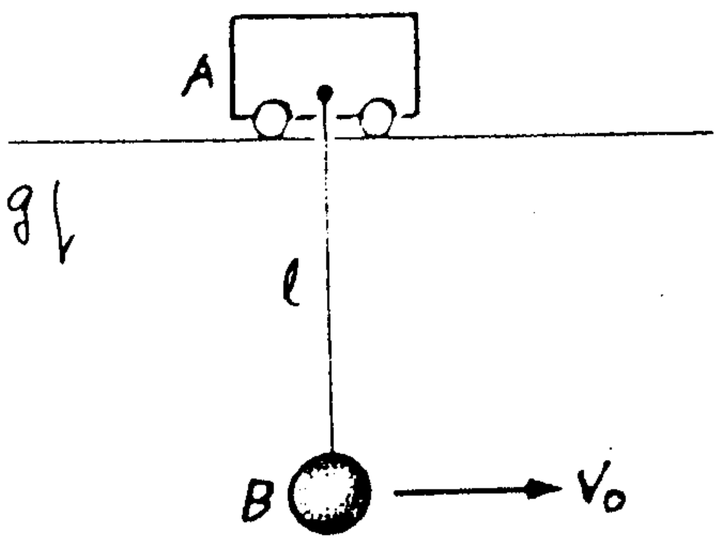

Figure 1.

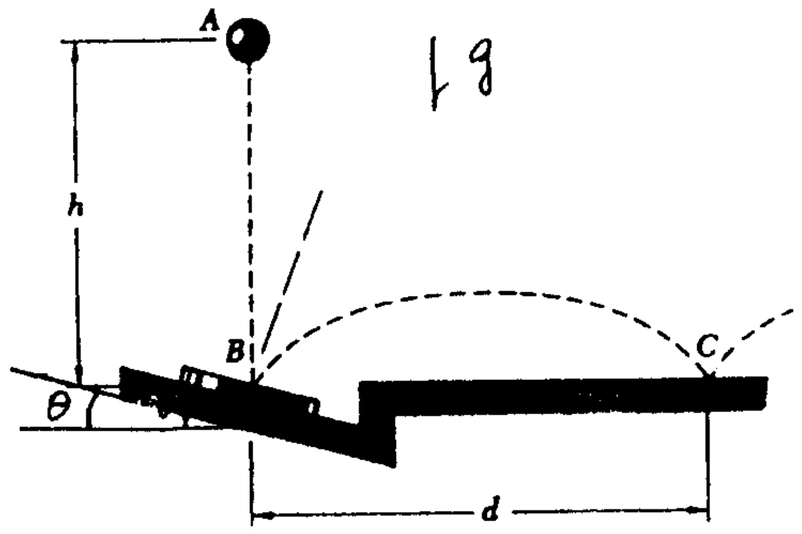

Figure 2.

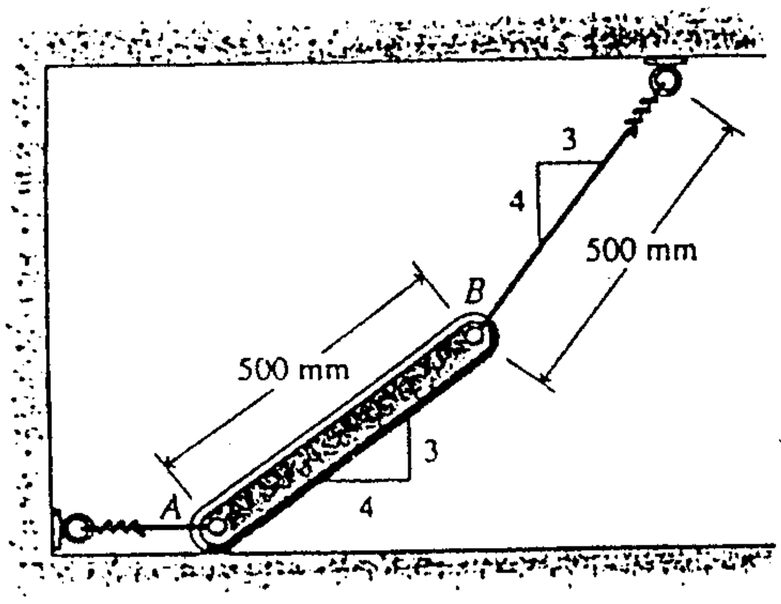

Figure 3.

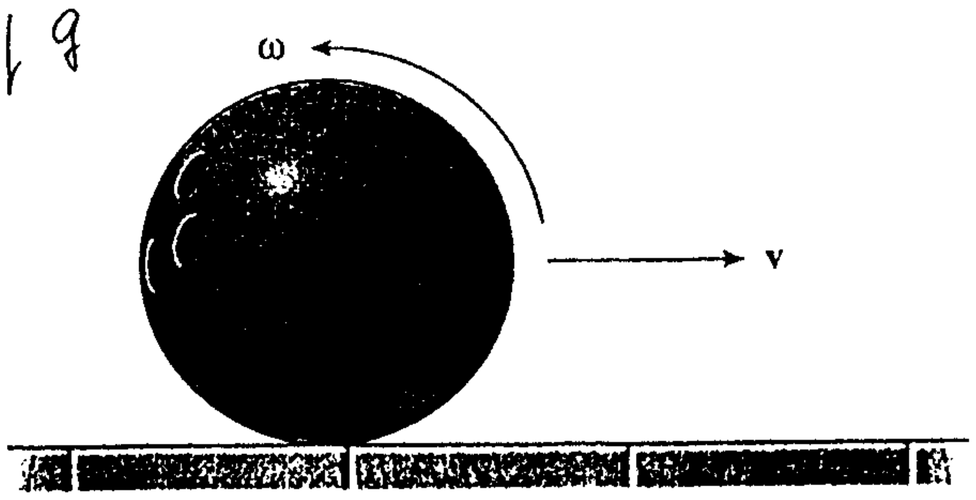

Figure 4.