A1. (15%) As shown in Fig.1, a plate is made up of two rectangular plates A and B by gluing them together. Plate A has a mass of 12Kg and plate B has a mass of 4Kg. Both plates have the same size, 1m by 2m. The plate is resting on a smooth horizontal plane. Determine the velocity of the geometrical center (O) of the plate right after a very short impulse of 40 N-sec has been exerted on the plate as indicated in Fig.1.

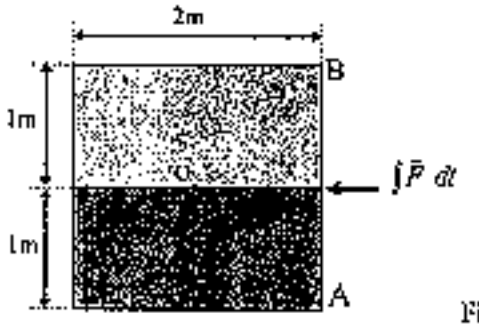

Figure 1.

A2. (15%) The uniform bar AB, of weight 20Kg and length 4m, is attached to the 40-Kg cart C by a hinge at A. Neglect friction, determine immediately after the system has been released from rest as shown in Fig.2, (a) the acceleration of the cart, (b) the angular acceleration of the bar.

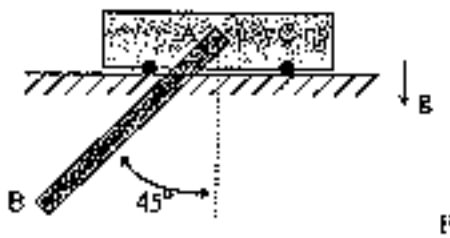

Figure 2.

A3. (20%) As shown in Fig.3, two disks are hinged to the ends of a slender bar AB. Each disk has a radius of 1m and a mass of 6Kg. The bar has a mass of 12Kg and a length of 10m. If the system is released from rest when $\theta = 60°$, determine the velocity of point A when $\theta = 45°$. Assume the disks roll without slipping against the wall and the ground.

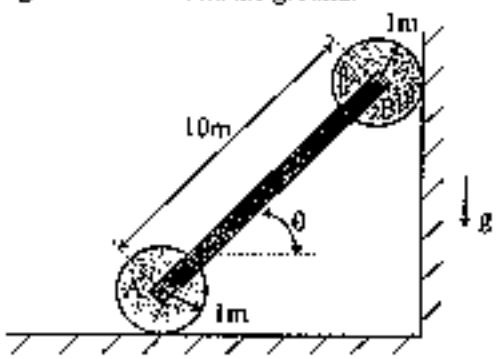

Figure 3.

(背面仍有題目,請繼續作答)

B1. The bell-crank mechanism, shown in Fig.B1, consists of a bent rod, having a density 4 kg/m, and an attached 10-kg ball A with diameter 0.4 m. Determine the differential equation which describes the motion in terms of the angle of the members' rotation. Also determine the critical damping coefficient and the damping natural frequency for small vibrations about the equilibrium position. (20%)

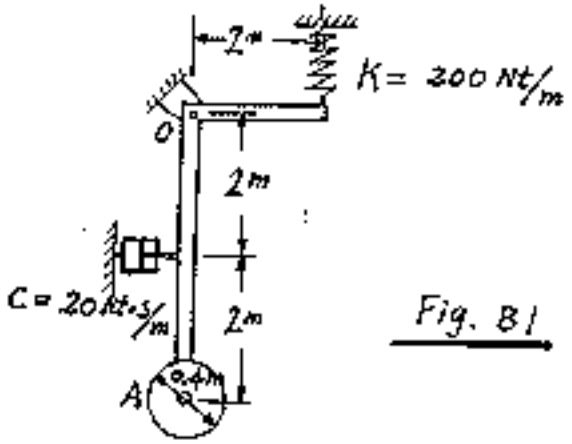

Fig. B1

B2. The Charpy impact test is used in materials testing to determine the energy absorption characteristics of a material during impact. The test is performed using the pendulum, shown in Fig.B2, which has a mass m, mass center at G, and a radius of gyration k_G about G. The pendulum starts swinging from $\theta = \theta_1$ and stops from swinging on the other side after impact when $\theta = \theta_2$. Determine:

(1) for the pendulum above mentioned, show how to determine the radius of gyration k_G about G by simple experiment.(10%)

(2) the vertical reaction at pin A and the energy absorption by specimen during the impact. (10%)

(3) the distance r_P from the pin at A to the point P where the impact with a specimen S should occur so that the horizontal force at the pin is essentially zero during the impact. (10%)

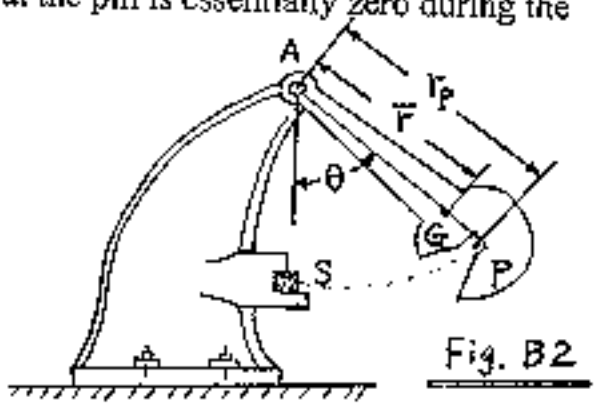

Fig. B2