

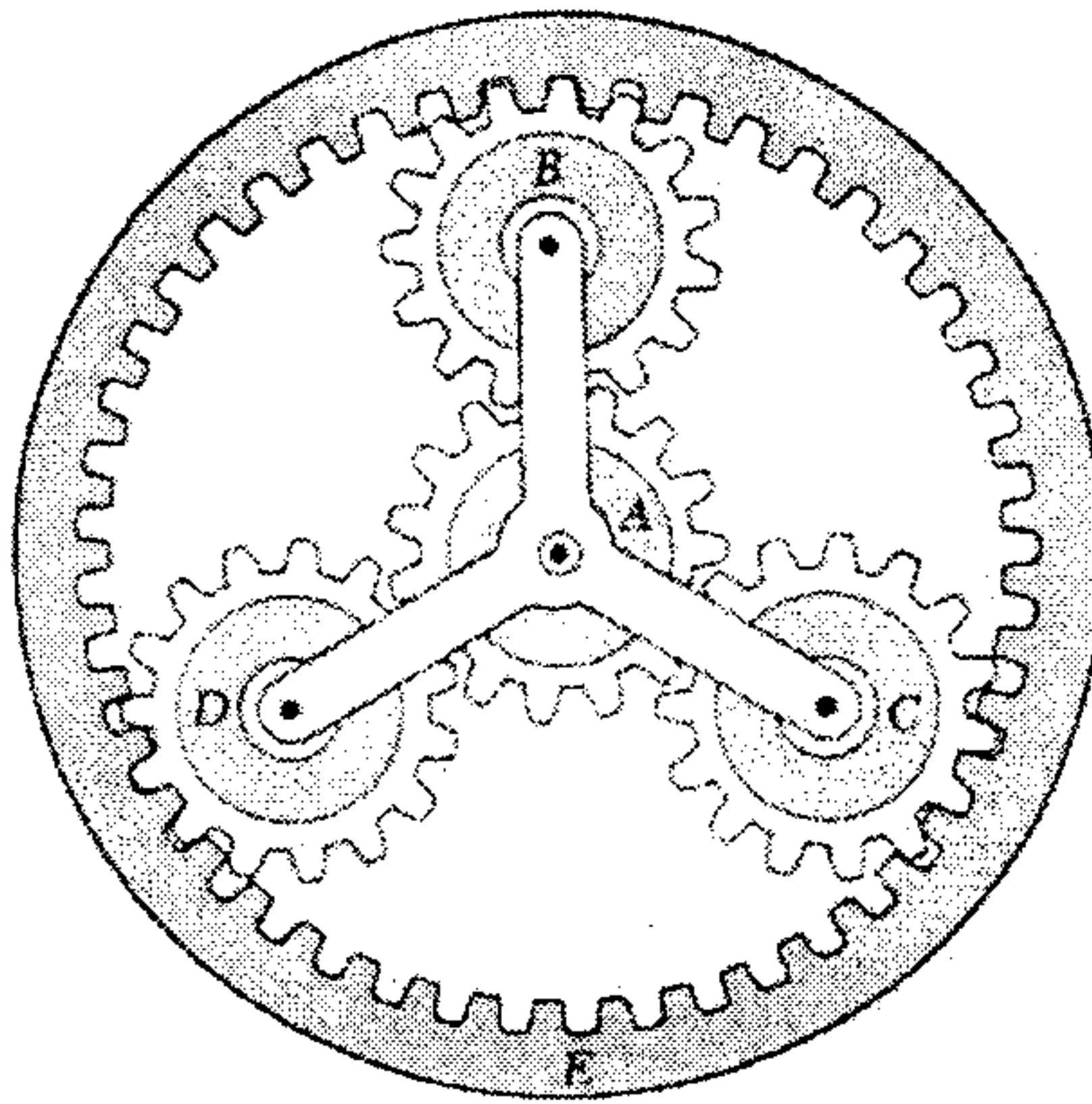
國立清華大學 102 學年度碩士班考試入學試題

系所班組別：動力機械工程學系 丙組

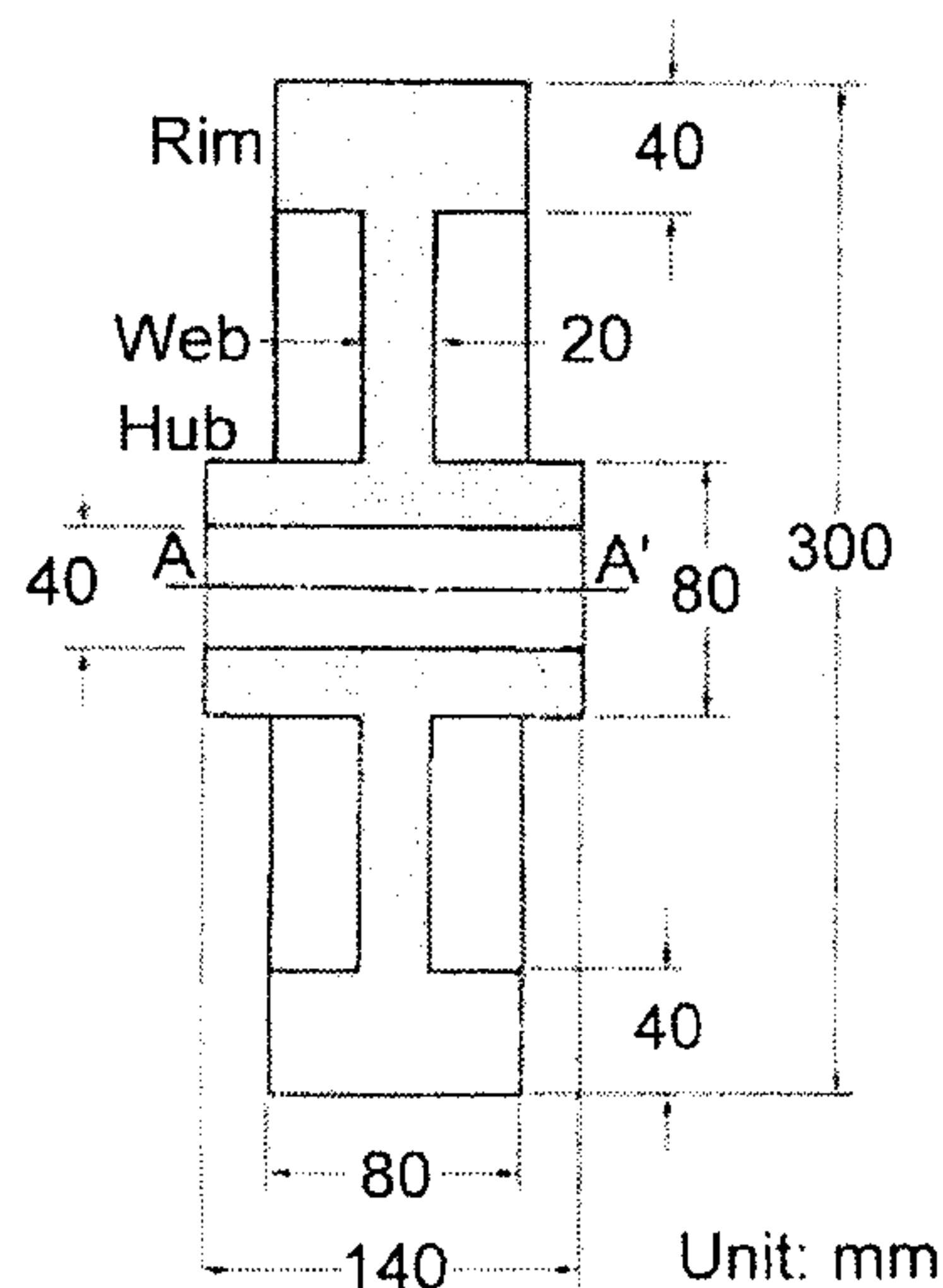
考試科目（代碼）：應用力學 (1302)

共 4 頁，第 1 頁 *請在【答案卷、卡】作答

1. In the planetary gear system shown, the radius of the central gear A is a , the radius of each of the planetary gears (B, C, D) is b , and the radius of the outer gear E is $(a + 2b)$. A clockwise couple of magnitude $M_A = 20 \text{ N}\cdot\text{m}$ is applied to the central gear A , and a counterclockwise couple of magnitude $M_S = 60 \text{ N}\cdot\text{m}$ is applied to the spider BCD . If the system is to be in equilibrium, determine (a) the required ratio b/a , (b) the couple M_E that must be applied to the outer gear E . (15%)



2. The cross section of a steel flywheel is shown below. Determine (a) the mass moment of inertia and (b) the radius of gyration of the steel flywheel shown with respect to its axis of rotation AA' . (The density of steel = 7850 kg/m^3) (15%)



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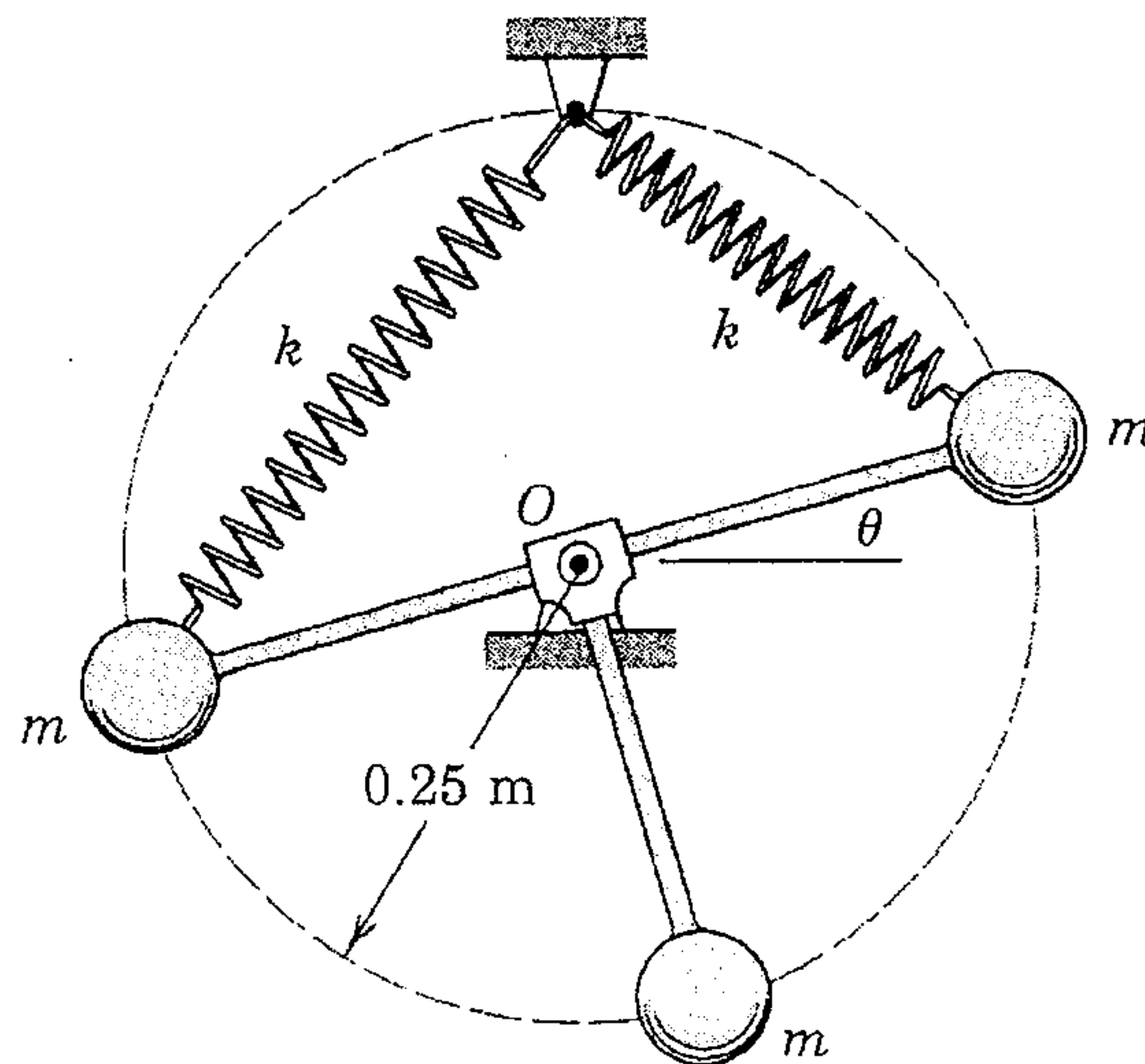
共 4 頁，第 2 頁 *請在【答案卷、卡】作答

3. Two springs, each of stiffness $k = 1.2 \text{ kN/m}$ as shown in the figure, are of equal length and un-deformed when $\theta = 0^\circ$. If the mechanism is released from rest in the position $\theta = 20^\circ$,

(a) determine its angular velocity $\dot{\theta}$ when $\theta = 0^\circ$ for the case when the whole system is placed on table. (7%)

(b) determine its angular velocity $\dot{\theta}$ when $\theta = 0^\circ$ for the case when the whole system is subjected to gravitational force pointing downward. (8%)

In either case, the mass m of each sphere is 3 kg and the spheres can be viewed as particles and rods and springs are inertia-less (no mass).



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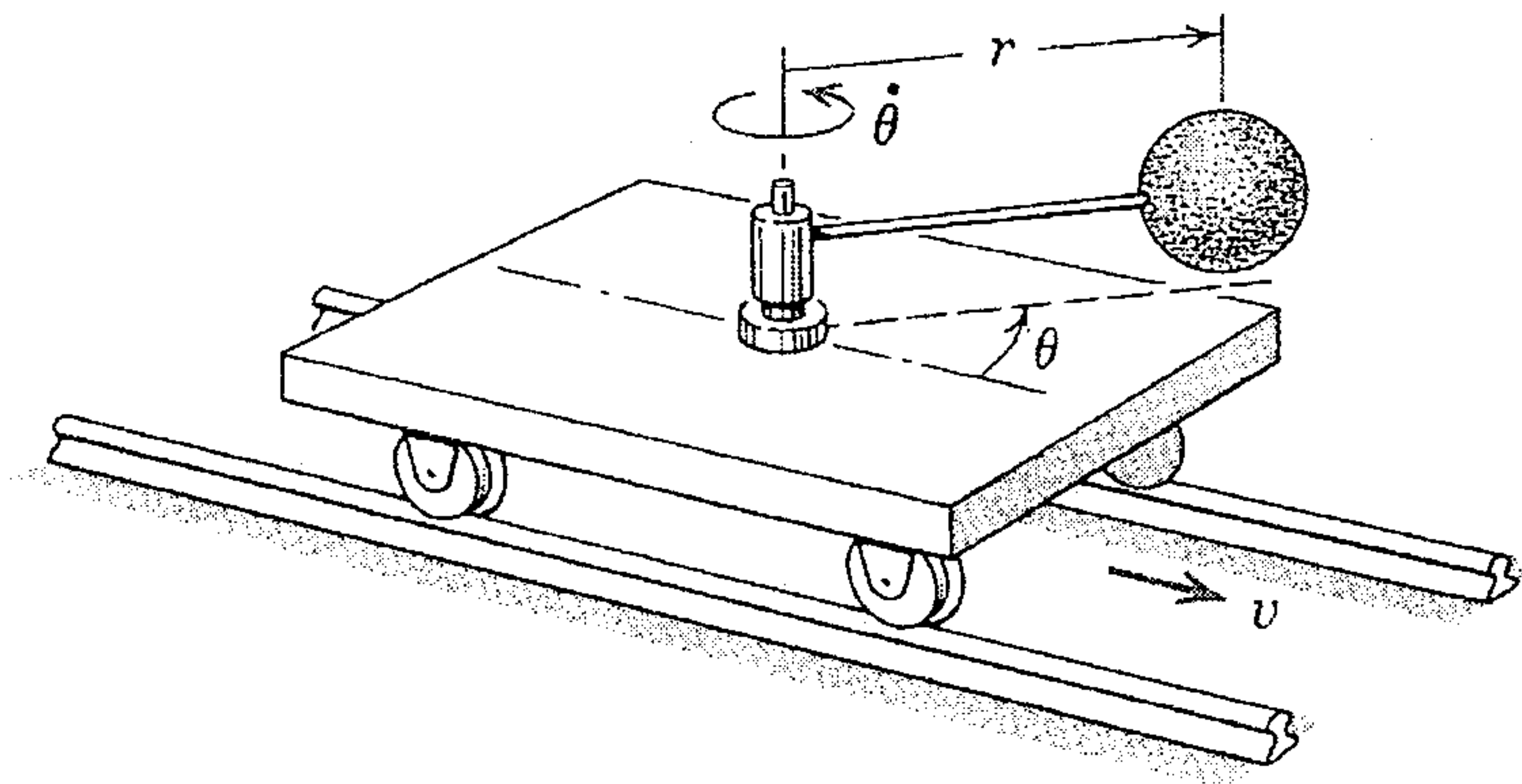
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共 4 頁，第 3 頁 *請在【答案卷、卡】作答

4. The small car having a mass of 20 kg as shown in the figure rolls freely on the horizontal track and carries the 5-kg sphere mounted on the light (inertia-less) rotating rod with $r = 0.4$ m. A geared motor drive maintains a constant angular speed $\dot{\theta} = 4$ rad/s of the rod. Neglecting the mass of the wheels and any friction, determine

- (a) maximum value of the velocity v of the car in meter per second, (10%) and
- (b) the corresponding angle θ in degree. (10%)



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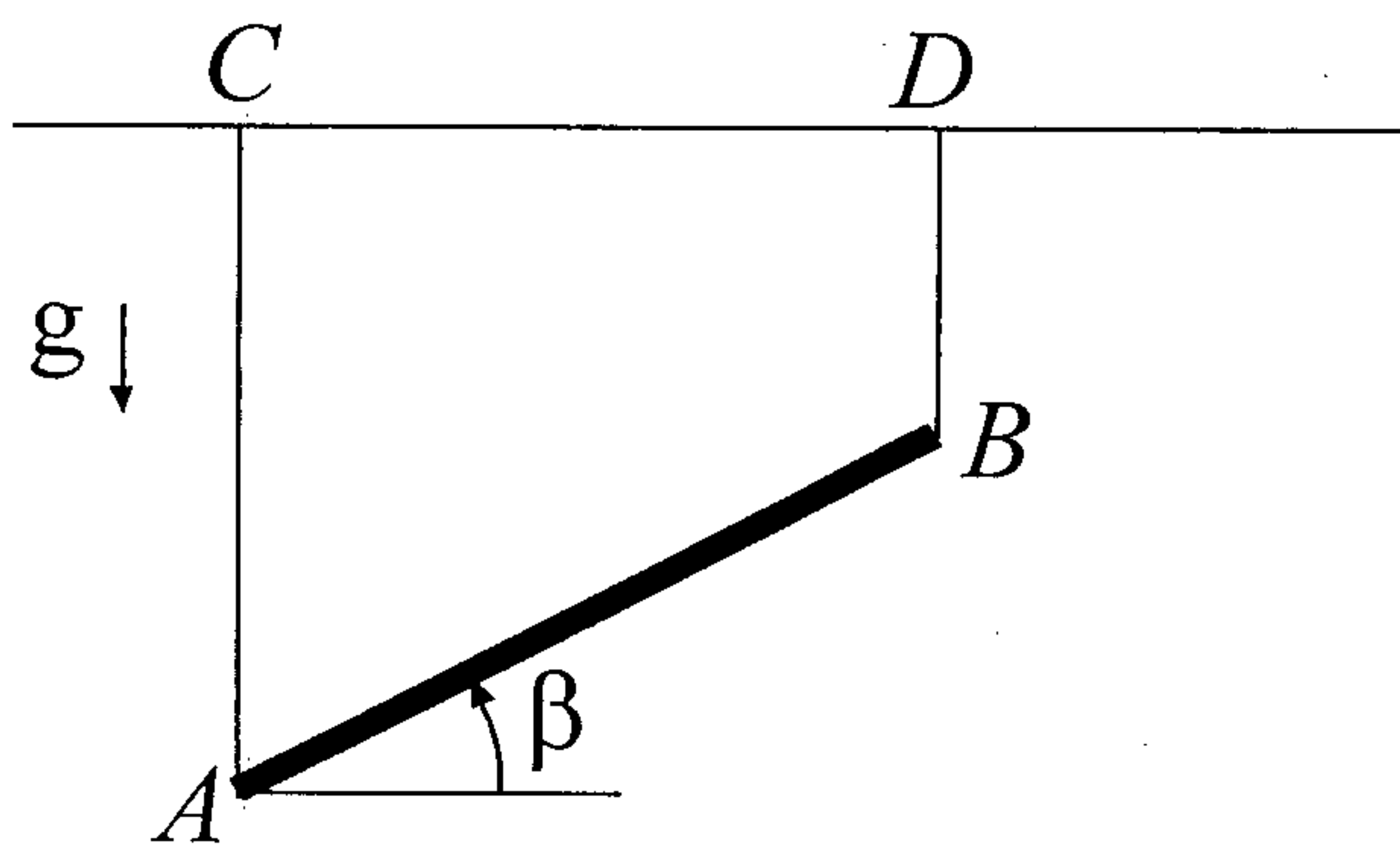
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共 4 頁，第 4 頁

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- 5 A slender, uniform rod of mass m and length L is suspended from two inextensible cables at two ends. If cable DB breaks, determine at that instant the angular acceleration of the rod. (15%)



- 6 A triangular prism ABC of mass m is placed on a frictionless horizontal plane. A solid homogeneous circular cylinder of equal mass m and of radius r rolls down the face BC without slipping. Determine the acceleration of the prism. (20%)

