（總分為100分）
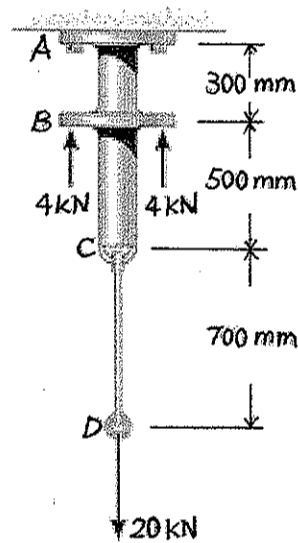
總分為100分，每題皆為25分。

1. The following assembly consists of a 20-mm-diameter aluminum bar *ABC* with fixed collar at *B* and a 10-mm-diameter steel rod *CD*. Determine the displacement of point *D* when the assembly is loaded as shown. Neglect the size of the collar at *B* and the connection at *C*. E_{steel}=150 GPa, $E_{aluminum}$=60 GPa . (25 %)

2. Draw the shear and moment diagrams for the following beam. (25 %)
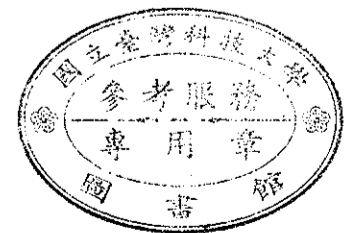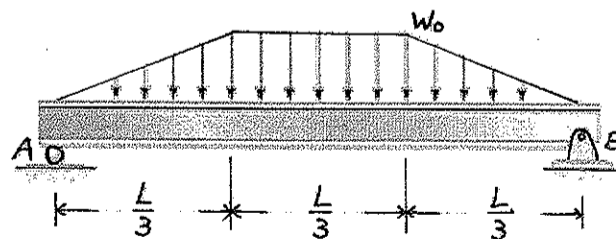
（總分為100分）

3. The collar P slides outward at a constant relative speed u along rod AB, which rotates counterclockwise with a constant angular velocity ω of 20 rpm. Knowing that $r = 250$ mm when $\theta = 0$ and that the collar reaches B when $\theta = 90°$, determine the magnitude and direction of the absolute acceleration of the collar P just as it reaches B. (25%)
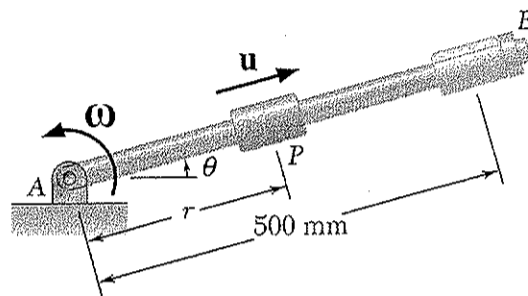
4. A tiny 2-kg collar C can slide freely on a thin ring of mass 3 kg and radius 250 mm. The ring is welded to a short vertical shaft, which can rotate freely in a fixed bearing. Initially the ring has an angular velocity of 35 rad/s and the collar is at the top of the ring ($\theta = 0$) when it is given a slight nudge. Neglecting the effect of friction, determine (a) the angular velocity of the ring as the collar passes through the position $\theta = 90°$ (10%), (b) the corresponding velocity of the collar relative to the ring. (15%) Note that the acceleration of gravity $g = 9.81$ m/s^2 and the mass moment of inertia of the ring about the axis of rotation is $\frac{1}{2} m_R R^2$ where m_R is the mass of the ring. (兩小題共 25%)