1. (20%) For a brass alloy, the stress at which plastic deformation begins is 345 MPa, and the modulus of elasticity is 10.3×10^4 MPa. (a) What is the maximum load that may be applied to a specimen with a cross-sectional area of 130 mm^2 without plastic deformation? (b) If the original specimen length is 76 mm, what is the maximum length to which it may be stretched without causing plastic deformation?

2. (20%) The two-bar truss *ABC* shown in the following figure has pin supports at points *A* and *C*, which are 2.0 m apart. Members *AB* and *BC* are steel bars, pin connected at joint *B*. The length of bar *BC* is 3.0 m. A sign weighting 5.4 kN is suspended from bar *BC* at points *D* and *E*, which are located 0.8 m and 0.4 m, respectively, from the ends of the bar. Determine (a) the reaction at *A* (R$_A$), and (b) the reaction at *C* (R$_C$).
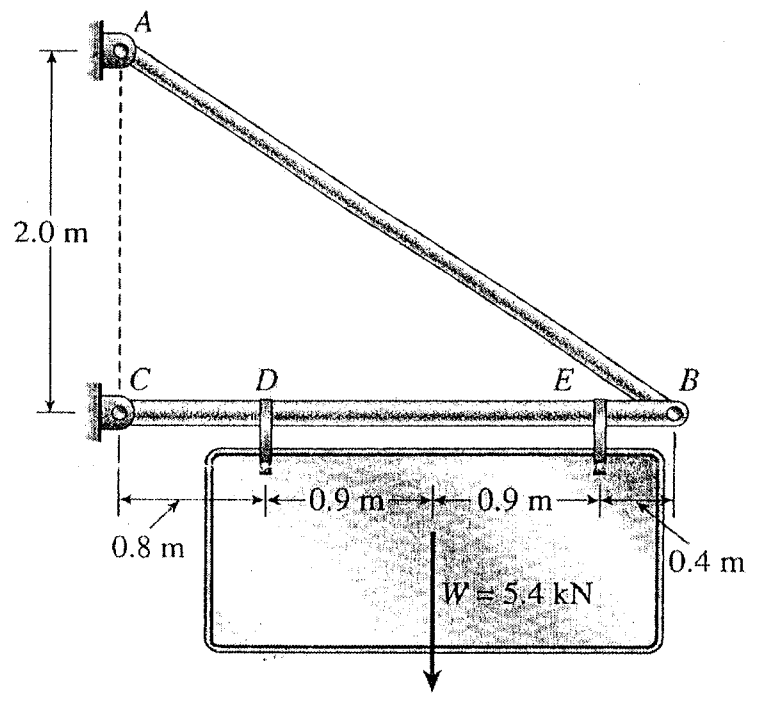
3.　(30%) The bar ACB shown in the following two figures is fixed at both ends and loaded by a torque T_0 at point C. Segments AC and CB of the bar have diameter d_A and d_B, length L_A and L_B, and polar moments of inertia I_{PA} and I_{PB}, respectively. The material of the bar is the same throughout both segments. Obtain formula for (a) the reactive torque T_A and T_B at the ends, (b) the maximum shear stresses τ_{AC} and τ_{CB} in each segment of the bar, and (c) the angle of rotation ϕ_C at the cross section where the load T_0 is applied.
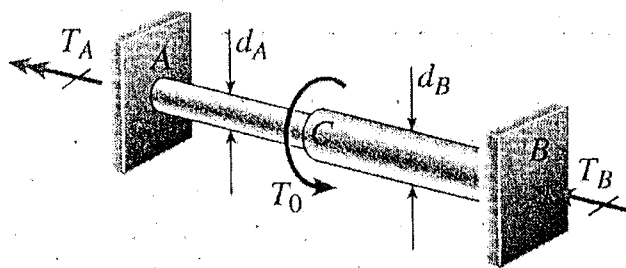
(a)
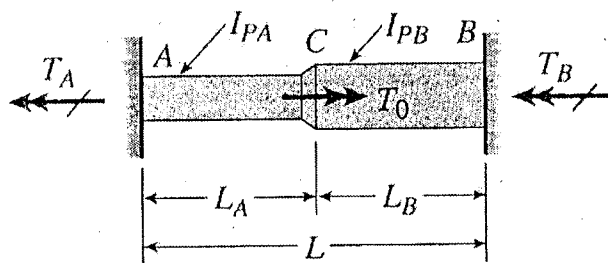
(b)

4.　(30%) A fixed-end beam AB of length L is subjected to a moment M_0 acting at the position shown in the following figure. (a) Determine all reactions for this beam. (b) Draw shear-force and bending-moment diagrams for the special case in which $a = b = L/2$.