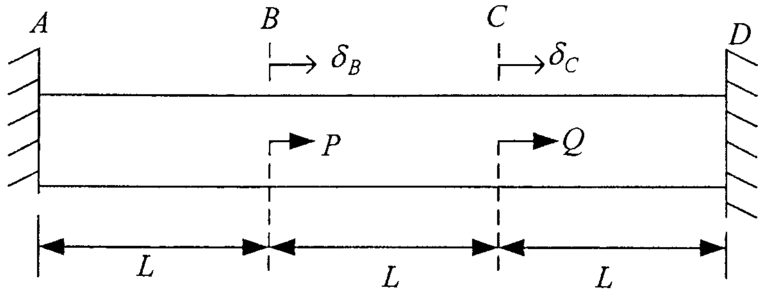
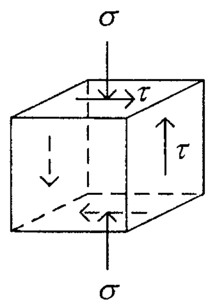
※ 考生請注意：本試題不可使用計算機

1. The prismatic bar AD of length 3L is supported as shown. The bar having the cross-sectional area $A^{\bullet}$ and Young's modulus E is subjected to axial loads P and Q at points B and C, respectively. It is known that the displacements at points B and C are $\delta_B = \Delta$ and $\delta_C = 2\Delta$, respectively. (a) Find the axial loads P and Q. (15%) (b) Calculate the $\tau_{\max}$ occurred in the bar AD.(10%) (Answers should be expressed in terms of $A^{\bullet}, E, L, and\ \Delta.$)



2. The property of an element is considered to be linearly isotropic. (a) Show that the bulk modulus K for the element is $K = E/[3(1-2\nu)]$ where E is the Young's modulus and ν is the Poisson's ratio. (15%) (b) Determine the unit volume change for the element with the element being subjected to the normal stress σ and shear stress τ as shown in the figure. (10%) (Express answer in terms of $K, \sigma, \tau, \cdots etc.$)



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3. (a) Show that the maximum shear stress for a beam with a solid circular cross section is $\tau_{\max} = 4V/(3A)$ where V is the shear force and A is the area of the cross section. (15%) (b) What assumptions will be made in obtaining the maximum shear stress? (10%)

4. A beam of length 2L and height h has sliding supports at both ends as shown. The sliding support permits vertical movement but no rotation. The beam has constant flexural rigidity EI. The coefficient of thermal expansion of the beam is α. The beam is subjected to a temperature change such that the temperature at the top is T_1 and at the bottom is T_2 $(T_2 > T_1)$. The temperature varies linearly between the top and bottom of the beam. (a) Determine the reaction at support A. (15%). (b) Determine the deflection at support A. (10%)