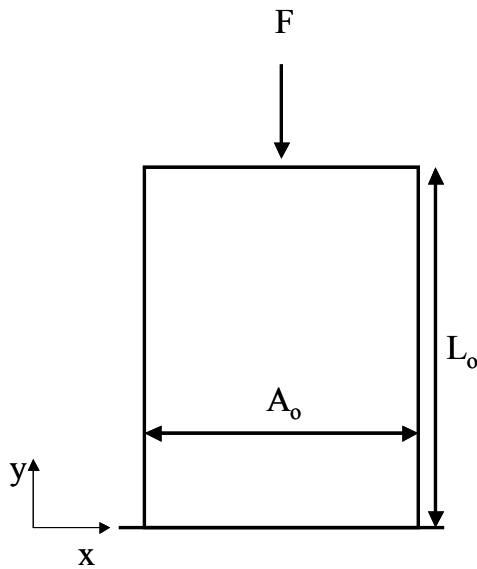
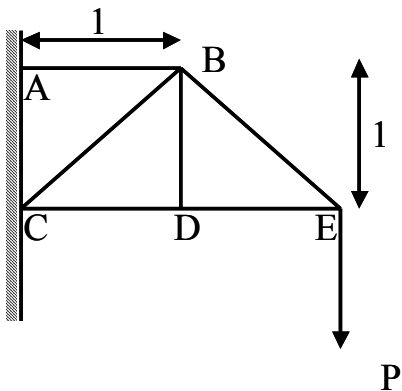


Problem Set #4
3.11 Fall 2003

1. Thermal Expansion Problem: Calculate the force needed to compress the steel bar shown below to $L_o/2$ if the bar is simultaneously heated up by 45°C ($E = 200\text{GPa}$, $\alpha_L = 12 \cdot 10^{-6}/^\circ\text{C}$, $L_o = 0.5\text{m}$, $A_o = 0.05\text{m}^2$)



2. For the diagram below:



(a) Determine forces of all members in terms of P . Label whether or not members are in tension or compression. Show all work.

(b) Calculate the total strain energy, U_T , contained in the truss as a function of P , where the lengths are in meters, and the cross-sectional area of each member is 9^{-4} m^2 . All members are made with a material with elastic modulus of 175 GPa .

(c) What is the displacement, δ , in joint E if load $P = 45 \text{ kN}$? (Use load Q in exchange for P at joint of interest, E.)

3. An aluminum alloy cylinder 3ft. in diameter and 6 ft. long is placed between two walls at room temperature (25°C) as shown below. Assuming no friction between the cylinder and walls, calculate the load (in lbs.) applied on the cylinder by the walls when it is heated up to 500°C .

