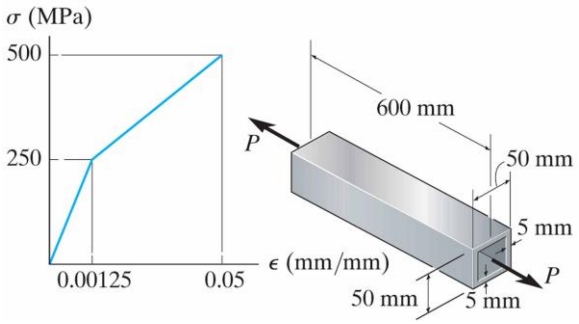
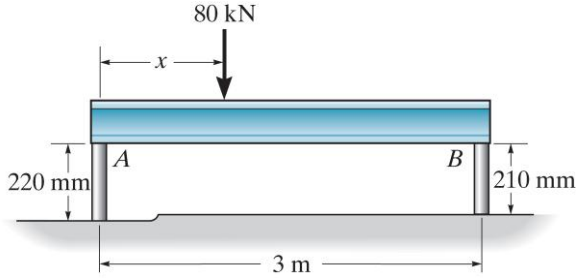
Mechanics of Materials Chapters 3 and 4 11/12/2018 by Shun-Fa Hwang

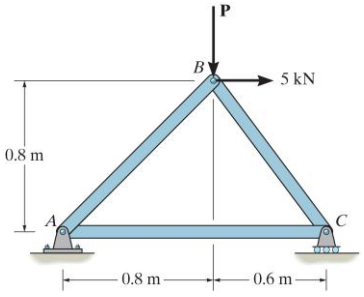
1. Please use words or figures to explain the following terms.
   (a) Brittle material (b) True stress (c) Strain hardening (d) Modulus of toughness (e) Necking [5%x5]
2. Determine the elongation of the square hollow bar when it is subjected to the axial force P=100 kN. If this axial force is increased to P=360 kN and released, find the permanent elongation of the bar. The bar is made of a metal alloy having a stress-strain diagram which can be approximated as shown. [15%]Ans: 0.333mm,17.1mm



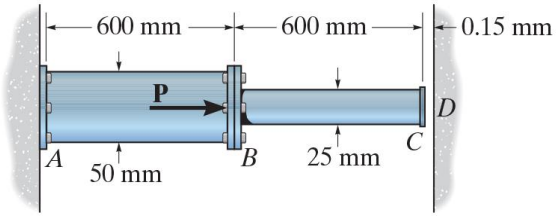
3. The rigid beam rests in the horizontal position on two 2014-T6 aluminum cylinders having the unloaded lengths shown. If each cylinder has a diameter of 30 mm, determine the placement x of the applied 80-kN load so that the beam remains horizontal. What is the new diameter of cylinder A after the load is applied? ν_{al}=0.35, E_{al}=73.1 GPa. [15%] Ans:1.53m,30.008mm



4. The truss is made of three A-36 steel members, each having a cross-sectional area of 400 mm^2. Determine the horizontal displacement of the roller at C when P=8 kN. $E_{st} = 200$ GPa. [15%] Ans:0.0975mm



5. If the gap between C and the rigid wall at D is initially 0.15 mm, determine the support reactions at A and D when the force P=200 kN is applied. The assembly is made of solid A-36 steel cylinders. $E_{st} = 200$ GPa. [15%]Ans:180kN,20.4kN



6. The cylinder CD of the assembly is heated from 30 ^0C to 180 ^0C. Also, the two rods AB and EF are heated from 30 ^0C to 50 ^0C. At the temperature 30 ^0C the gap between C and the rigid bar is 0.7 mm. Determine the force in rods AB and EF caused by the increase in temperature. Rods AB and EF are made of steel, and each has a cross-sectional area of 125 mm^2. CD is made of aluminum and has a cross-sectional area of 375 mm^2. $E_{al} = 70$ GPa, $\alpha_{al} = 23(10^{-6})/^0C$, $E_{st} = 200$ GPa, $\alpha_{st} = 12(10^{-6})/^0C$. [15%]Ans:1.85kN