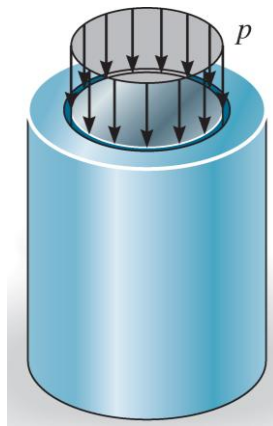
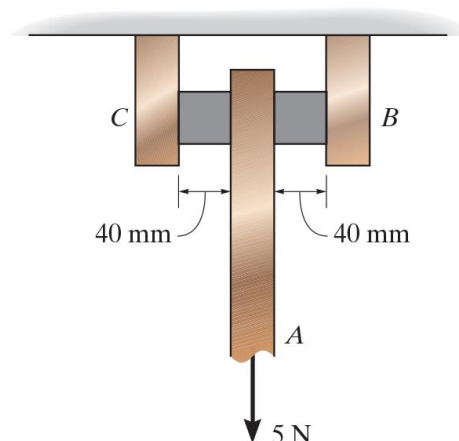


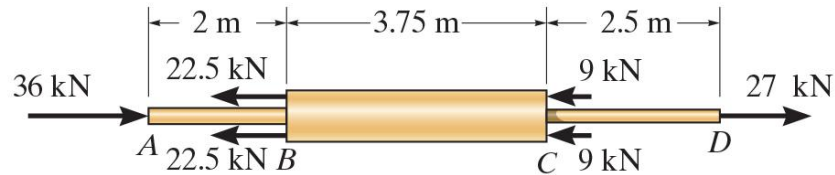
1. Please use words or figures to explain the following terms.
(a) Brittle material (b) True strain (c) Mechanical hysteresis (d) Necking (e) Strain energy density [5%×5]
2. The plug (塞子) has a diameter of 30 mm and fits within a rigid sleeve having an inner diameter of 32 mm. Both the plug and the sleeve are 50 mm long. Determine the axial pressure p that must be applied to the top of the plug to cause it to contact the sides of the sleeve. Also, how far must the plug be compressed downward in order to do this? The plug is made from a material for which $E=5 \text{ MPa}$, $\nu=0.45$. [15%] Ans: 741 kPa, 7.41 mm



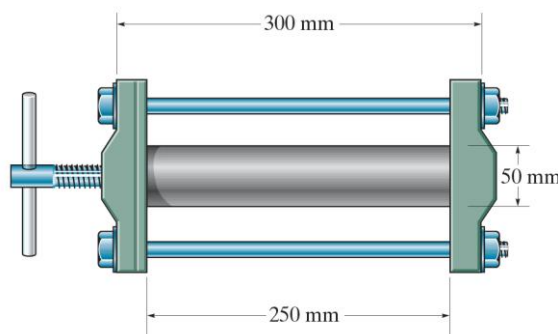
3. The support consists of three rigid plates, which are connected together using two symmetrically placed rubber pads (墊). If a vertical force of 5 N is applied to plate A, determine the approximate vertical displacement of this plate due to shear strains in the rubber. Each pad has cross-sectional dimensions of 30 mm and 20 mm. $G=0.20 \text{ MPa}$. [15%] Ans: 0.833 mm



4. The copper shaft is subjected to the axial loads shown. Determine the displacement of end A with respect to end D if the diameters of each segment are $d_{AB}=20$ mm, $d_{BC}=25$ mm, and $d_{CD}=12$ mm. Take $E_{cu}=126$ GPa. [15%] Ans:3.46 mm



5. The press consists of two rigid heads that are held together by the two A-36 steel 12-mm-diameter rods. A 6061-T6-solid-aluminum cylinder is placed in the press and the screw is adjusted so that it just presses up against the cylinder. If it is then tightened one-half turn, determine the average normal stress in the rods and in the cylinder. The single-threaded screw on the bolt has a lead of 0.25 mm. Note: The lead represents the distance of the screw advanced along its axis for one complete turn of the screw. $E_{st}=200$ GPa, $E_{al}=68.9$ GPa. [15%] Ans:65.2, 7.51 MPa



6. The 2014-T6 aluminum rod has a diameter of 12 mm and is lightly attached to the rigid supports at A and B when $T_1=25$ °C. If the temperature becomes $T_2=-20$ °C and an axial force of $P= 80$ N is applied to the rigid collar as shown, determine the reactions at A and B. $E=73.1$ GPa, $\alpha_{al} = 23 \times 10^{-6}$ $1/^{\circ}\text{C}$ [15%]
Ans:8.61, 8.53 kN

