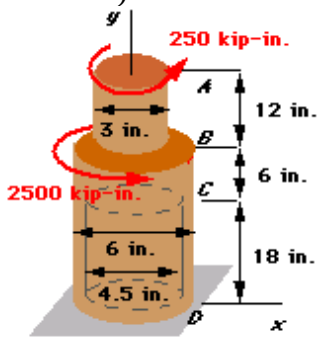
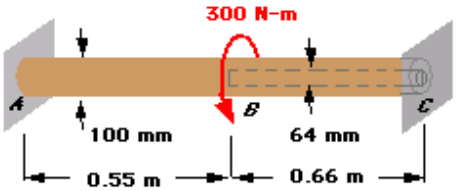
1)



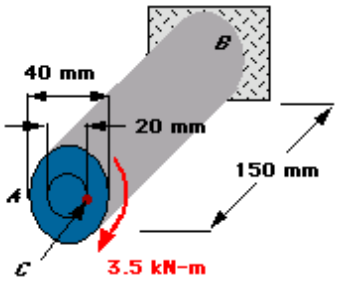

The vertical shaft shown is attached to a fixed base at $D$. A 4.5-in.-diameter hole has been bored into section $CD$. Determine the angle of twist at $A$ if the material is steel with $G = 12 \times 10^6$ psi.

2)



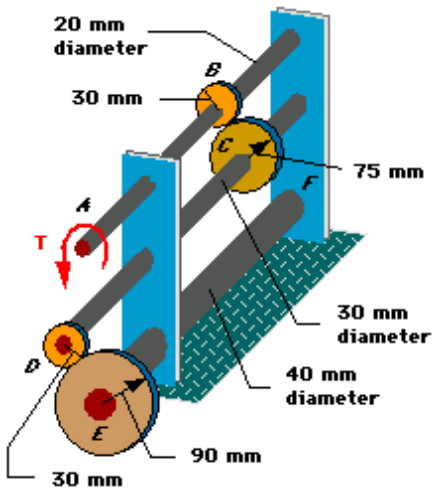

Circular shaft $AC$ has a 100-mm outside diameter. Section $BC$ of the shaft is hollow and has a wall thickness of 18 mm. A 300 N-m torque is applied as shown. We wish to determine the reactions at $A$ and $C$. The shear modulus for this material is 80 MPa.

3)



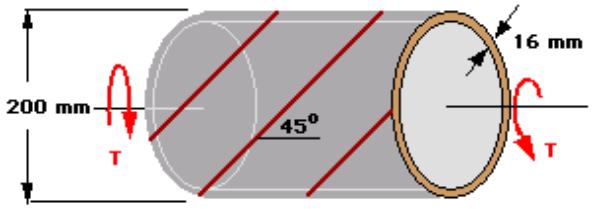

A 3.5 kN-m torque is applied to a solid cylindrical aluminum shaft. Determine the maximum shearing stress in the shaft and the percent of the torque carried by the portion of the cylinder within the 10-mm radius.

4)



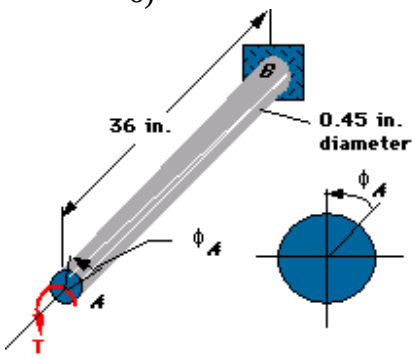

Each shaft of the gear train shown has an allowable shearing stress of 65 MPa. Determine the largest torque T that may be applied at $A$.

5)



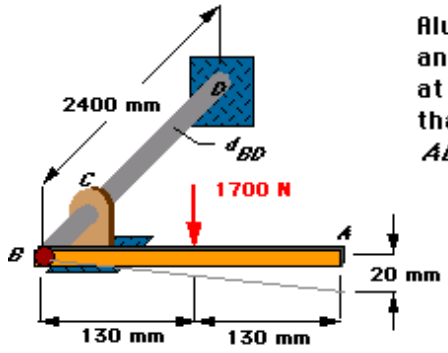

A pipe is formed by bending a 16-mm-thick plate and butt welding the plate along a helix forming an angle of $45^{\circ}$ with the horizontal. Determine the maximum torque that can be applied if the allowable normal stress along the helix is 85 MPa.

6)



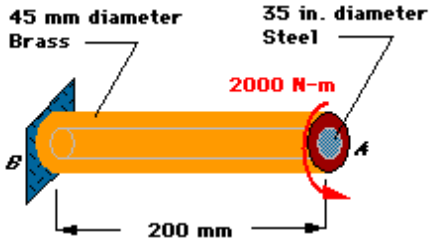

A solid steel shaft is subjected to an end torque T. The yield stress of the material in shear is 30 ksi. Knowing that for this material $G = 11.5 \times 10^{6}$ psi, determine the angle of twist (in degrees) of end $A$ when yielding occurs.

7)



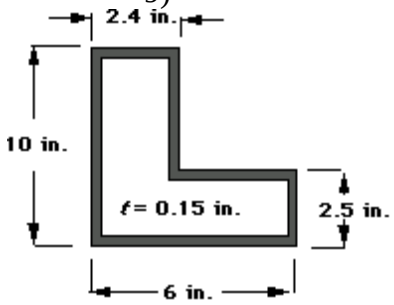

Aluminum shaft $BCD$ ($G$ = 70 GPa) is fixed to a wall at $D$ and a rigid bar at $B$ and passes through a smooth bearing at $C$. Determine the required diameter of shaft $BCD$ so that when a 1700-N load is applied as shown, end $A$ of bar $AB$ does not deflect more than 20-mm.

8)



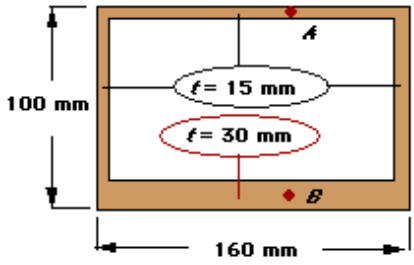

A bimetallic shaft with a 35-mm-diameter solid steel core and 45-mm-outside-diameter brass casing is loaded and supported as shown. Determine the maximum shearing stress in the steel core and brass casing knowing $G_{br}$ = 39 GPa and $G_{st}$ = 80 GPa.

9)




A hollow section has the shape and dimensions shown. The thickness of the section is 0.15 in. Knowing that the maximum shearing stress may not exceed 10 ksi, determine the maximum allowable torque that may be applied.

10)




A hollow section having the shape and dimensions shown is subjected to a 2000 N-m torque. Determine the shearing stress at points $A$ and $B$.