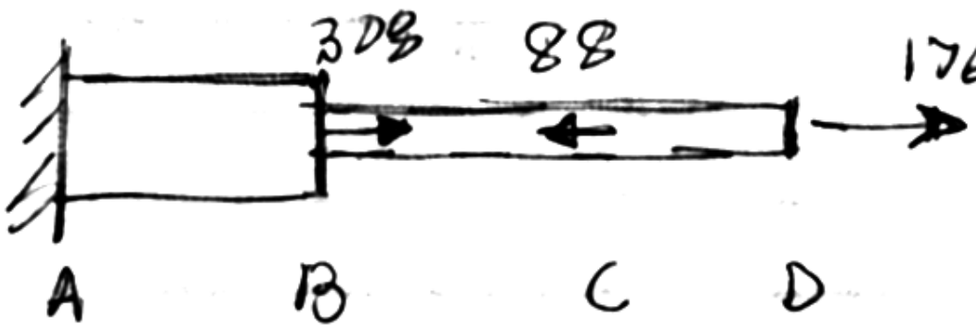
HOMEWORK PROBLEMS - Set #5

9-22



$A_{AB} = 2600\ mm^2$

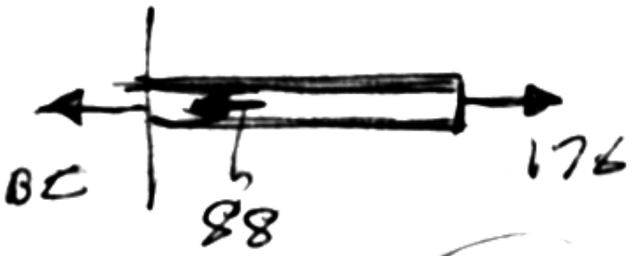
$A_{BD} = 1300\ mm^2$

$A_{BC} = 1300$

$A_{CD} = 1300$

$\sigma_{CD} = \frac{N_{CD}}{A_{CD}}$

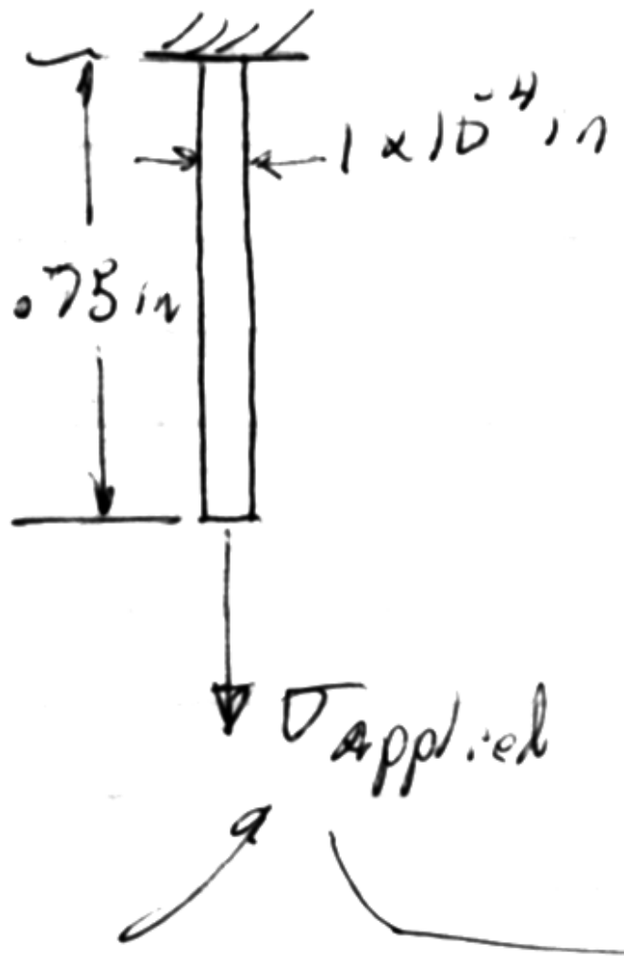
$\sigma_{BC} = \frac{N_{BC}}{A_{BC}}$



$\sigma_{AB} = \frac{N_{AB}}{A_{AB}}$

Determine which stress is largest.

9-23



σ_{max} tension $= 500 \times 10^3$ lb/in^2

$\sigma_{applied} = 450 \times 10^3$

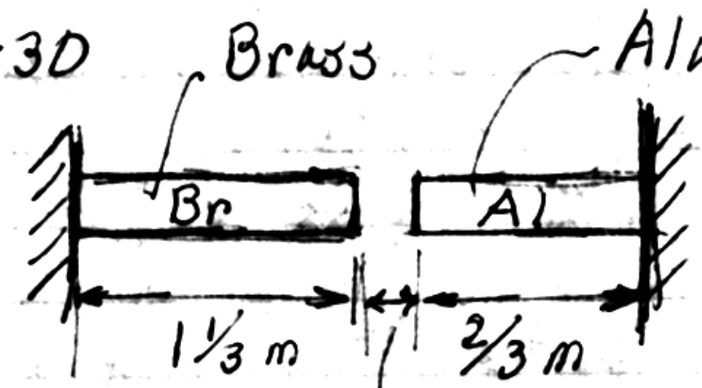
since $\sigma_{applied} < \sigma_{max}$ will elongate before breaking

$\delta = \frac{PL}{AE}$

$= \sigma_{applied} \frac{L}{E}$

this is also the internal stress but you have to make sure by checking with a FBD.

9-30



$\Delta T = 100°C$ increase

Diameter = 50 mm

$E_{Br} = 100\,GPa$

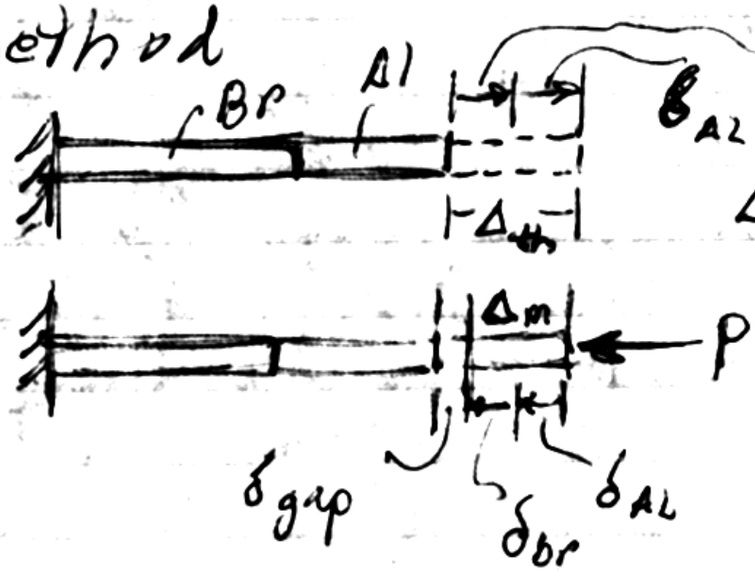
$E_{Al} = 70\,GPa$

$\alpha_{Br} = 19.1 \times 10^{-6}/°C$

$\alpha_{Al} = 23 \times 10^{-6}/°C$

If the increase in temp. closes the gap then stress will be created in bars.

Use redundant method



$\Delta_{th} = (L\alpha\Delta T)_{Al} + (L\alpha\Delta T)_{Br}$

$\Delta_m = \left(\frac{PL}{AE}\right)_{Al} + \left(\frac{PL}{AE}\right)_{Br}$

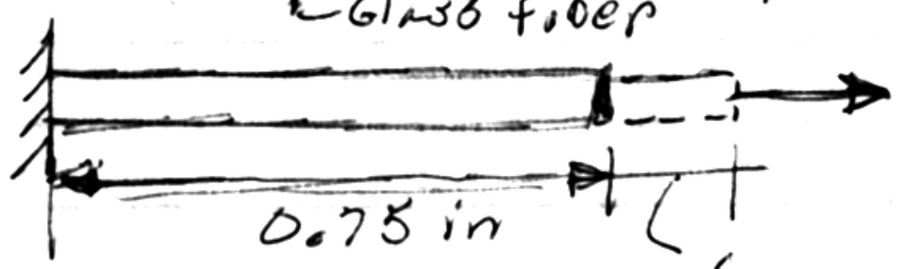
Conditional Displacement Eq.

$\Delta_{th} = \Delta_m + \underbrace{0.002\,m}_{\Delta_{gap}}$

Solve for P

9-35

$E_{Glass\ fiber} = 50 \times 10^6\ lb/in^2$



$$\delta = \frac{PL}{AE}$$

$$\sigma = P/A \quad \therefore \delta = \sigma \frac{L}{E}$$

Solve for δ