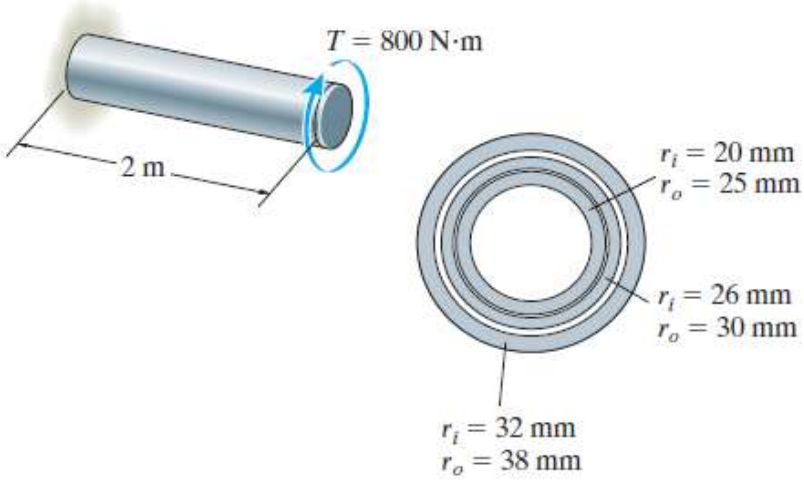
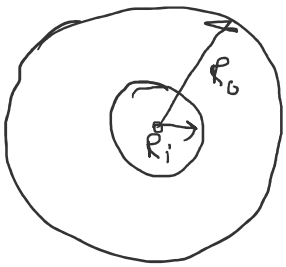
•5–9. The shaft consists of three concentric tubes, each made from the same material and having the inner and outer radii shown. If a torque of $T = 800\ \text{N} \cdot \text{m}$ is applied to the rigid disk fixed to its end, determine the maximum shear stress in the shaft.





$$J = \sum \frac{\pi}{2}\left(R_o^4 - R_i^4\right)$$

$$J = \frac{\pi}{2}\left(0.038^4 - 0.032^4\right) + \frac{\pi}{2}\left(0.03^4 - 0.026^4\right) + \frac{\pi}{2}\left(0.025^4 - 0.02^4\right)$$

$$J = 2.545 \times 10^{-6}\ m^4$$

We know; Torque Equation:

$$\frac{T}{J} = \frac{\tau}{R} = \frac{C\theta}{L}$$

$$\Rightarrow \tau_{Max} = \frac{TR}{J} = \frac{800 \times 0.038}{2.545 \times 10^{-6}} = 11.9\ MPa \quad \text{Ans}$$