

6.21 (a) This portion of the problem asks that we compute the elongation of the brass specimen. The first calculation necessary is that of the applied stress using Equation 6.1, as

$$\sigma = \frac{F}{A_0} = \frac{F}{\pi \left(\frac{d_0}{2}\right)^2} = \frac{10,000 \text{ N}}{\pi \left(\frac{10 \times 10^{-3} \text{ m}}{2}\right)^2} = 127 \text{ MPa} \quad (17,900 \text{ psi})$$

From the stress-strain plot in Figure 6.12, this stress corresponds to a strain of about  $1.5 \times 10^{-3}$ . From the definition of strain, Equation 6.2

$$\Delta l = \varepsilon l_0 = (1.5 \times 10^{-3})(101.6 \text{ mm}) = 0.15 \text{ mm} \quad (6.0 \times 10^{-3} \text{ in.})$$

(b) In order to determine the reduction in diameter  $\Delta d$ , it is necessary to use Equation 6.8 and the definition of lateral strain (i.e.,  $\varepsilon_x = \Delta d/d_0$ ) as follows

$$\begin{aligned} \Delta d &= d_0 \varepsilon_x = -d_0 \nu \varepsilon_z = -(10 \text{ mm})(0.35)(1.5 \times 10^{-3}) \\ &= -5.25 \times 10^{-3} \text{ mm} \quad (-2.05 \times 10^{-4} \text{ in.}) \end{aligned}$$