

1.129

1.129 Determine the height water at 60 °F will rise due to capillary action in a clean, $\frac{1}{4}$ -in.-diameter tube. What will be the height if the diameter is reduced to 0.01 in.?

$$h = \frac{2\sigma \cos\theta}{\gamma R} \quad (\text{Eq. 1.22})$$

For water at 60 °F (from Table B.1 in Appendix B),

$$\sigma = 5.03 \times 10^{-3} \frac{\text{lb}}{\text{ft}} \quad \text{and} \quad \gamma = 62.37 \frac{\text{lb}}{\text{ft}^3}. \quad \text{Thus, with } \theta = 0,$$

$$(\text{for } R = 0.125 \text{ in.}) \quad h = \frac{2(5.03 \times 10^{-3} \frac{\text{lb}}{\text{ft}})(1)}{(62.37 \frac{\text{lb}}{\text{ft}^3})(\frac{0.125}{12} \text{ ft})} = 1.55 \times 10^{-2} \text{ ft}$$

or

$$h = (1.55 \times 10^{-2} \text{ ft}) \left(\frac{12 \text{ in.}}{\text{ft}} \right) = \underline{\underline{0.186 \text{ in.}}}$$

Similarly,

(for $R = 0.005 \text{ in.}$)

$$h = (0.186 \text{ in.}) \left(\frac{0.125 \text{ in.}}{0.005 \text{ in.}} \right) = \underline{\underline{4.65 \text{ in.}}}$$