1.102

1.102 Determine the height water at 60 °F will rise due to capillary action in a clean, ¼-in.-diameter tube. What will be the height if the diameter is reduced to 0.01 in.?

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

For water at 60°F (from Table B.1 in Appendix B), $\sigma = 5.03 \times 10^{-3}\ \frac{lb}{ft}$ and $\gamma = 62.37\ \frac{lb}{ft^3}$. Thus, with $\theta = 0$,

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

or

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

Similarly,

(for $R = 0.005$ in.)

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