1.54

1.54 Calculate the Reynolds numbers for the flow of water and for air through a 4-mm-diameter tube, if the mean velocity is 3 m/s and the temperature is 30 °C in both cases (see Example 1.4). Assume the air is at standard atmospheric pressure.

For water at 30°C (from Table B.2 in Appendix B):

$$\rho = 995.7 \ \frac{kg}{m^3} \qquad \mu = 7.975 \times 10^{-4} \ \frac{N \cdot s}{m^2}$$

$$Re = \frac{\rho V D}{\mu} = \frac{(995.7 \ \frac{kg}{m^3})(3 \ \frac{m}{s})(0.004 \ m)}{7.975 \times 10^{-4} \ \frac{N \cdot s}{m^2}} = 15{,}000$$

For air at 30°C (from Table B.4 in Appendix B):

$$\rho = 1.165 \ \frac{kg}{m^3} \qquad \mu = 1.86 \times 10^{-5} \ \frac{N \cdot s}{m^2}$$

$$Re = \frac{\rho V D}{\mu} = \frac{(1.165 \ \frac{kg}{m^3})(3 \ \frac{m}{s})(0.004 \ m)}{1.86 \times 10^{-5} \ \frac{N \cdot s}{m^2}} = 752$$