7–36 A student team is to design a human-powered submarine for a design competition. The overall length of the prototype submarine is 2.24 m, and its student designers hope that it can travel fully submerged through water at 0.560 m/s. The water is freshwater (a lake) at $T = 15^\circ C$. The design team builds a one-eighth scale model to test in their university’s wind tunnel (Fig. P7–36). A shield surrounds the drag balance strut so that the aerodynamic drag of the strut itself does not influence the measured drag. The air in the wind tunnel is at 25°C and at one standard atmosphere pressure. At what air speed do they need to run the wind tunnel in order to achieve similarity?

Hints: Don’t need all parameters to determine velocity.

Same method as problem done in class.

$\rho_{\text{water}} (15^\circ C) = 999.1 \text{ kg/m}^3$

$\rho_{\text{air}} (25^\circ C) = 1.184 \text{ kg/m}^3$

$\mu_{\text{water}} (15^\circ C) = 1.138 \times 10^{-3} \text{ kg/m/s}$

$\mu_{\text{air}} (25^\circ C) = 1.849 \times 10^{-5} \text{ kg/m/s}$