7.40

7.40 The lift and drag developed on a hydrofoil are to be determined through wind tunnel tests using standard air. If full scale tests are to be run, what is the required wind tunnel velocity corresponding to a hydrofoil velocity in seawater of 15 mph? Assume Reynolds number similarity is required.

For Reynolds number similarity,

$$\frac{V_m \ell_m}{\nu_m} = \frac{V\ell}{\nu}$$

where ℓ is some characteristic length of the hydrofoil. Thus,

$$V_m = \frac{\nu_m}{\nu} \frac{\ell}{\ell_m} V$$

and with $\ell/\ell_m = 1$ (full scale test)

$$V_m = \frac{\nu_m}{\nu} V = \frac{(1.57 \times 10^{-4} \frac{ft^2}{s})}{(1.26 \times 10^{-5} \frac{ft^2}{s})} (15 \text{ mph})$$

$$= \underline{\underline{187 \text{ mph}}}$$