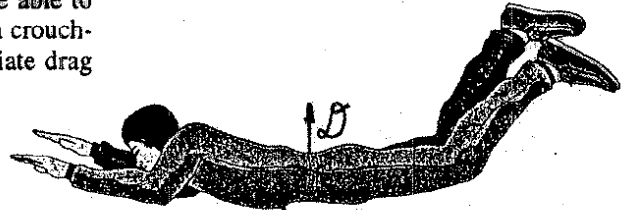


9.69 As shown in Video V9.7 and Fig. P9.69 a vertical wind tunnel can be used for skydiving practice. Estimate the vertical wind speed needed if a 150-lb person is to be able to "float" motionless when the person (a) curls up as in a crouching position or (b) lies flat. See Fig. 9.30 for appropriate drag coefficient data.



For equilibrium conditions

$$W = D = C_D \frac{1}{2} \rho U^2 A$$

■ FIGURE P9.69



Assume $W = 160 \text{ lb}$ and $C_D A = 9 \text{ ft}^2$ (see Fig. 9.30)

Thus,

$$150 \text{ lb} = \left(\frac{1}{2}\right) \left(0.00238 \frac{\text{slug}}{\text{ft}^3}\right) U^2 (9 \text{ ft}^2) \text{ where } U \sim \frac{\text{ft}}{\text{s}}$$

or

$$U = (118 \frac{\text{ft}}{\text{s}}) \left(\frac{1 \text{ mi}}{5280 \text{ ft}}\right) \left(\frac{3600 \text{ s}}{1 \text{ hr}}\right) = \underline{80.5 \text{ mph}}$$

Note: If the skydiver "curled up into a ball", then $C_D A \approx 2.5 \text{ ft}^2$ (see Fig. 9.30) and $U = \underline{153 \text{ mph}}$