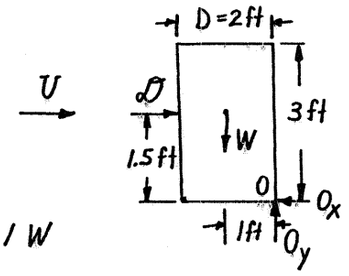
9.53

9.53 Estimate the wind velocity necessary to knock over a 10-lb garbage can that is 3 ft tall and 2 ft in diameter. List your assumptions.



If the can is about to tip around corner O, then $\Sigma M_O = 0$, or $1.5\mathcal{D} = 1\,W$

or $1.5\,C_D \frac{1}{2}\rho U^2 A = W$ A typical value of C_D for a cylinder is $C_D \approx 1$ (see Fig. 9.21)

Thus,

$(1.5\,\text{ft})(1)\left(\frac{1}{2}\right)\left(0.00238\,\frac{\text{slugs}}{\text{ft}^3}\right) U^2 (2\,\text{ft})(3\,\text{ft}) = 10\,\text{ft}\cdot\text{lb}$, where $U \sim \frac{\text{ft}}{\text{s}}$

or $U = \underline{\underline{30.6\,\frac{\text{ft}}{\text{s}}}}$