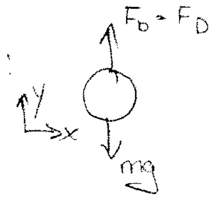
Wegman's Creeping Flow Problem

$\rho_{air} = 1.2 kg/m^3$ $\rho_{Flour} = 700 kg/m^3 \approx$ Akn $(48 lb/ft^3)$

FBD :



$C_D \frac{1}{2} \rho V^2 A + \rho \forall g$ ← Derived From FBD

$\Sigma F_y = F_D + F_B - mg$

$V = \sqrt{\frac{2(\rho_p - \rho_{air}) g \forall}{C_D \rho_{air} A}}$ $A = \frac{\pi D^2}{4}$ $\forall = \frac{\pi D^2}{6}$

height = 2.5 m = 8.2 ft

$V = \sqrt{\frac{2(700 kg/m^3 - 1.2 kg/m^3)(9.81 m/s^2)(\frac{\forall}{A})}{(24)(1.81 \times 10^{-5})(1.2)(\frac{(2)(0.0001)}{3})}}$

$V = \frac{(\rho_P - \rho_{Air}) g D^2}{18\mu} = \frac{(700 - 1.2)(9.81)(0.01 \times 10^{-3})}{(18)(1.81 \times 10^{-5})} = 0.0001 m/s$

$V = DT$ $0.0001 m/s = 2.5 m(t)$

$t = \frac{0.0001}{2.5}(sec)\left(\frac{60 sec}{1 min}\right)\left(\frac{60 min}{1 hr}\right) = \boxed{1.44 hrs}$