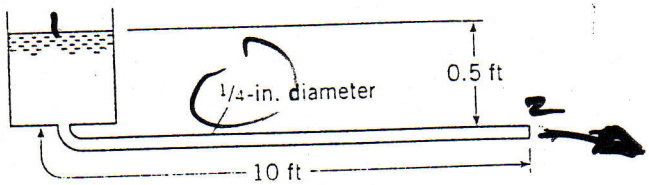
10.8 Kerosene (S = 0.80 and $T = 68°F$) flows from the tank shown and through the $\frac{1}{4}$-in.-diameter (ID) tube. Determine the mean velocity in the tube and the discharge.



PROBLEM 10.8

recall:
$\alpha \approx 1$ turbulent flow
$\alpha = 2$ laminar flow

$$\frac{p_1}{\gamma} + \frac{\alpha V_1^2}{2g} + z_1 = \frac{p_2}{\gamma} + \frac{\alpha V_2^2}{2g} + z_2 + h_L$$

assume laminar flow: $\alpha = 2$

$$h_L = \frac{32 \mu L V}{\gamma D^2}$$

$$\frac{V^2}{g} + \frac{32 \mu L V}{\gamma D^2} - .5 = 0$$

$$V = .812 \text{ ft/s}$$

$$Q = VA = .812 \times \frac{\pi}{4}\left(\frac{1}{48}\right)^2 = 2.77 \times 10^{-4} \text{ cfs}$$

$$Re = \frac{DV}{\nu} = \frac{DV\rho}{\mu} = \frac{\frac{1}{48} \times .812 \times .8 \times 1.94}{4 \times 10^{-5}}$$

$$= 656 < 2000$$

∴ laminar flow assumption OK