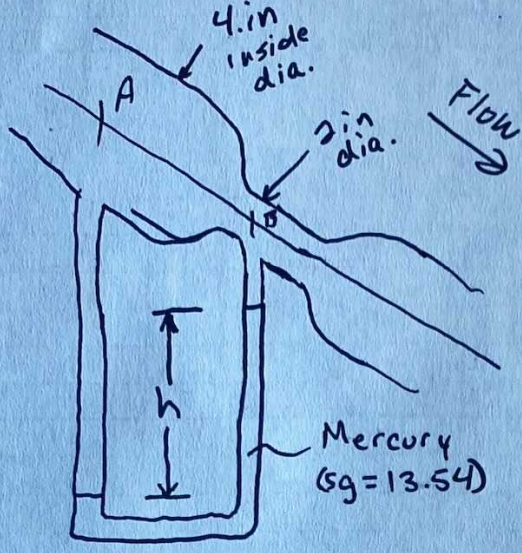
HW1.3

6.79



Oil with SG = 0.90.

h = 28 in

calculate volume flow rate.

$A = \frac{\pi D^2}{4}$

$Q = Av$

$A_B v_B = A_A v_A$

$\frac{\pi (2)^2}{4} v_B = \frac{\pi (4)^2}{4} v_A$

$v_B = 4 v_A$

$\gamma_o = sg_{oil} \times \gamma_{water}$
$= 0.9 \times 62.4$
$= 56.16 \text{ lb/ft}^3$

$\gamma_{Hg} = sg_{Hg} \times \gamma_{water}$
$= 13.54 \times 62.4$
$= 844.896 \text{ lb/ft}^3$

$P_A + \gamma_o z_A = P_B + \gamma_o (z_B - h) + \gamma_{Hg} h$

$P_A - P_B = \gamma_o (z_B - z_A - h) + \gamma_{Hg} h$
$= 56.16 (z_B - z_A - \frac{28}{12}) + 844.896 (\frac{28}{12})$

$\frac{P_A}{\gamma_o} + \frac{V_A^2}{2g} + z_A = \frac{P_B}{\gamma_o} + \frac{V_B^2}{2g} + z_B$

$\frac{P_A - P_B + \gamma_o (z_A - z_B)}{\gamma_o} = \frac{V_B^2 - V_A^2}{2g}$

$56.16 (z_B - z_A) + 1840.38 + 56.16 (z_A - z_B) = \frac{(4 v_A)^2 - v_A^2}{2g}$

$\frac{1840.38}{56.16} = \frac{15 v_A^2}{64.4} \Rightarrow v_A = 11.86 \text{ ft/s}$

$Q = Av = \frac{\pi (\frac{1}{3})^2}{4} (11.86) = 1.035 \text{ ft}^3/\text{s}$