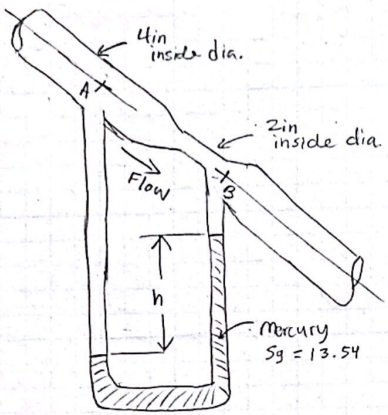
79.



Given: $h = 28$ in Dia A = 4in Dia B = 2in $Sg_{Hg} = 13.54$ $g = 32.2\ ft/s^2$ $\gamma_{water} = 9.81\ KN/m^3$ ↗ From book $Sg_{oil} = 0.9$

Equation needed

Bernoulli equation — $\frac{P_A}{\gamma} + \frac{V_1^2}{2g} + z_A = \frac{P_B}{\gamma} + \frac{V_2^2}{2g} + z_B$

Flow rate — $Q = V \times A = V = \frac{Q}{A}$

Area — $A = \frac{\pi}{4} D^2$

Plug in the flow rate equation to Bernoulli's equation

$$\frac{Q^2}{2g}\left(\frac{1}{A_A^2} - \frac{1}{A_B^2}\right) = \frac{P_B - P_A}{\gamma} + (z_A - z_B)$$

solve for

$$Q = \sqrt{\frac{2g\frac{P_B - P_A}{\gamma} + (z_A - z_B)}{\frac{1}{A_A^2} - \frac{1}{A_B^2}}}$$

NOW

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

$$\frac{P_B - P_A}{\gamma_{Hg}} = (z_A - z_B) + \left(1 - \frac{Sg_{Hg}}{Sg_{oil}}\right) h$$

Cont'.

Plug in to Q equation

$$Q = \sqrt{\frac{2g\left(1 - \frac{Sg_{Hg}}{Sg_{0.1}}\right)h}{\frac{1}{A_A^2} - \frac{1}{A_B^2}}}$$

Solve for Area

$A_A = \frac{\pi}{4} D_A^2 = \frac{\pi}{4}(4in)^2 = 12.56in^2$

$\left(12.56in^2 \times \frac{1ft}{12in} \times \frac{1ft}{12in}\right)$

$= 0.0873ft^2$

$A_B = \frac{\pi}{4} D_B^2 = \frac{\pi}{4}(2in)^2 = 3.14in^2$

$\left(3.14in^2 \times \frac{1ft}{12in} \times \frac{1ft}{12in}\right)$

$= 0.0218ft^2$

Plug in everything we know

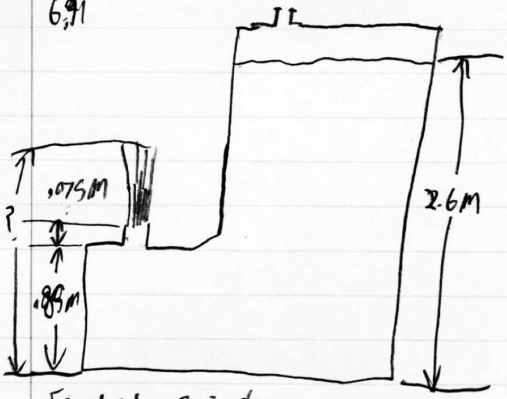
$$Q = \sqrt{\frac{2\left(32.2 ft/s^2\right)\left(1 - \frac{13.54}{0.90}\right) 28in\left(\frac{1ft}{12in}\right)}{\frac{1}{(0.0873ft^2)^2} - \frac{1}{(0.0218ft^2)^2}}}$$

$$Q = \sqrt{\frac{-2110.41}{-1972.98}}$$

$$Q = \boxed{1.034\ ft^3/s}$$

HW 1.3 2/3/22

6.91



Find height of jet

$$V_2 = \sqrt{2g(z_1 - z_2)} = \sqrt{2(9.81 m/s^2)(2.6m - (.85m + .075m))}$$

$$= \sqrt{2(9.81 m/s^2)(2.6m - .925m)}$$

$$= \sqrt{2(9.81 m/s^2)(1.675m)}$$

$$= \sqrt{32.86 m^2/s^2}$$

$$= 5.73 m/s$$

$$2g\Delta y = 32.86 m^2/s^2$$

$$\Delta y = \frac{32.86 m^2/s^2}{2(9.81 m/s^2)} = \frac{32.86 m^2/s^2}{19.62 m/s^2} = 1.675m$$

$1.675m + .925m = \boxed{2.6m}$