4.2 HW Nicholas Albano Ch6: ~~79, 82, 91~~ Ch7: 11, 16, 22, 30, 35, 42, 44

6.79:

$h = 28\text{ in}$ $D_A = 4\text{ in}$

Oil sg = .9 $D_B = 2\text{ in}$

merc sg = 13.54 $\gamma_{wat} = 9.81 \frac{kN}{m^3}$

- $\frac{P_1}{\gamma} + \frac{V_1^2}{2g} + z_1 = \frac{P_2}{\gamma} + \frac{V_2^2}{2g} + z_2$
- $Q = V \cdot A \rightarrow V = \frac{Q}{A}$
- $\Delta p = \gamma \cdot h$

Find Volume flow rate (Q):

$A_A = \frac{\pi}{4} D_A^2 = .0873\text{ ft}^2$

$A_B = \frac{\pi}{4} D_B^2 = .0218\text{ ft}^2$

$$\frac{Q^2}{2g}\left(\frac{1}{A_A^2} - \frac{1}{A_B^2}\right) = \frac{P_B - P_A}{\gamma} + (z_1 - z_2)$$

solve for Q

$$Q = \sqrt{\frac{2g\left(\frac{P_B - P_A}{\gamma} + (z_1 - z_B)\right)}{\frac{1}{A_A^2} - \frac{1}{A_B^2}}}$$

- $P_A + \gamma_{oil}((z_A - z_B) + h' + h) - \gamma_{mer} h - \gamma_{oil} h' = P_B$

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

Into Q

$$Q = \sqrt{\frac{2 \cdot 32.2 \frac{ft}{s^2}\left(1 - \frac{13.54}{.9}\right) \cdot 28\text{in} \cdot \frac{1\text{ft}}{12\text{in}}}{\frac{1}{.0873^2} - \frac{1}{.0218^2}}} = \boxed{1.07\ \frac{ft^3}{s}}$$

6.82:

Data

$SG_{oil} = 55\ lb/ft^3$

$\gamma_{wat} = 62.4\ lb/ft^3$

$D_B = 2in \rightarrow A = 3.14in^2$

ch 40pic $D_A = 4in \rightarrow A = 12.57in^2$

Find Q of oil:

$P_A + \gamma_{oil} \cdot h - \gamma_{wat} \cdot h - \gamma_{oil} \cdot h = P_B$

$P_B - P_A = \gamma_{oil} \cdot 1.16ft - \gamma_{wat} \cdot .66ft - \gamma_{oil} \cdot 2$

$P_B - P_A = 63.8 - 41.18 - 110$

$P_B - P_A = -87.38\ lb/ft^2$

$Q = V \cdot A \rightarrow V = \frac{Q}{A}$

$\frac{P_1}{\gamma} + \frac{V_1^2}{2g} + z_1 = \frac{P_2}{\gamma} + \frac{V_2^2}{2g} + z_2$

$Q = \sqrt{\frac{2g\left(\frac{(P_B - P_A)}{\gamma} + (z_A - z_B)\right)}{\frac{1}{A_A^2} - \frac{1}{A_B^2}}} \rightarrow Q = \sqrt{\frac{2 \cdot 32.2\left(\frac{-87.38}{55}\right) + (1.16 - 3.16)}{\frac{1}{3.14^2} - \frac{1}{12.57^2}}}$

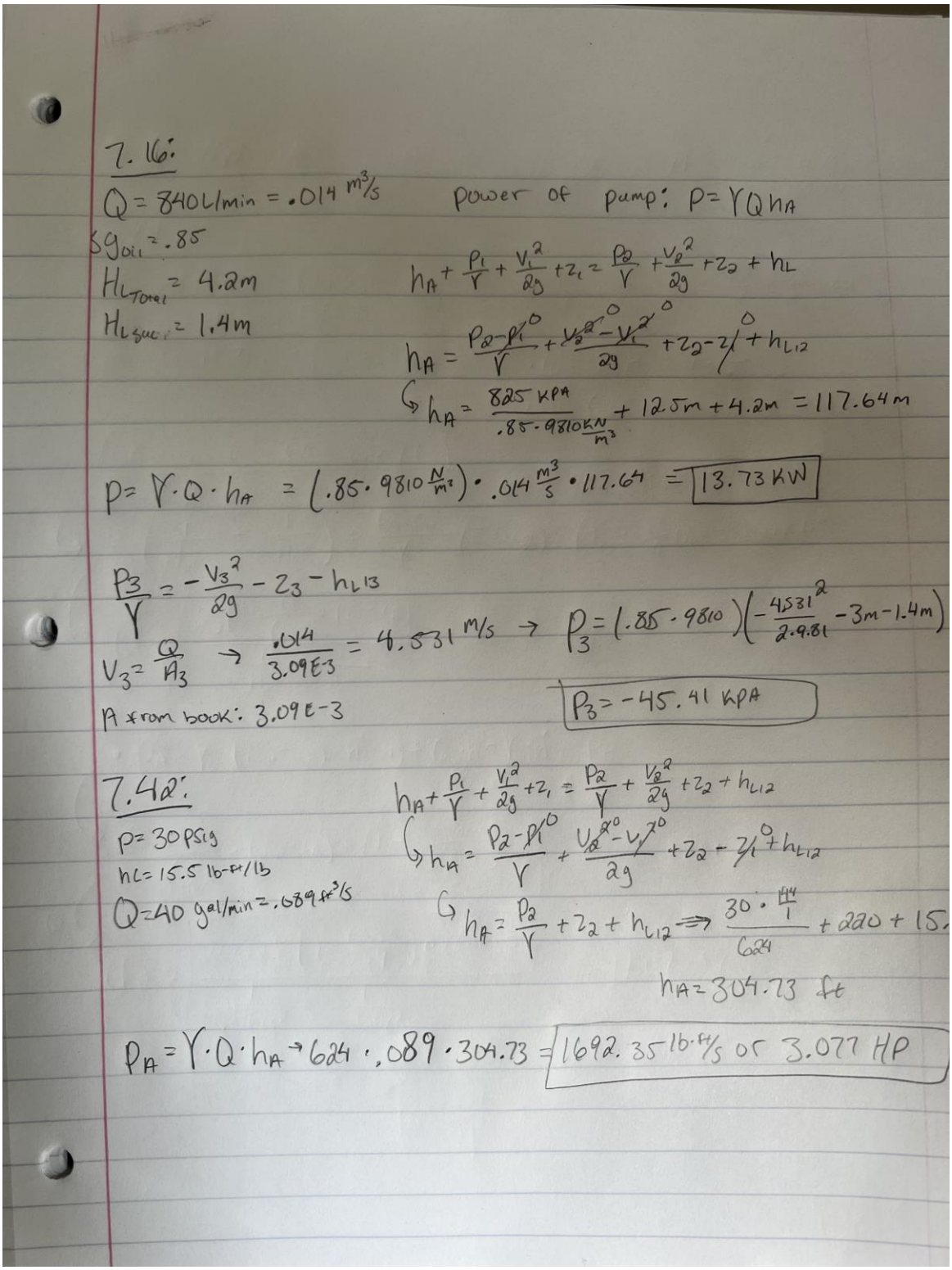
$Q = 32.47\ ft^3/s$

6.91

$\frac{P_1}{\gamma} + \frac{V_1^2}{2g} + z_1 = \frac{P_2}{\gamma} + \frac{V_2^2}{2g} + z_2$

Solve for z_2: (Atm press; 0 since at rest)

$z_2 = \frac{P_1 - P_2}{\gamma} + \frac{V_1^2 - V_2^2}{2g} + z_1 \rightarrow z_2 = z_1 \rightarrow z_2 = 2.6m$



Survey 1: 640972Albano

Survey 2: 654321Albano