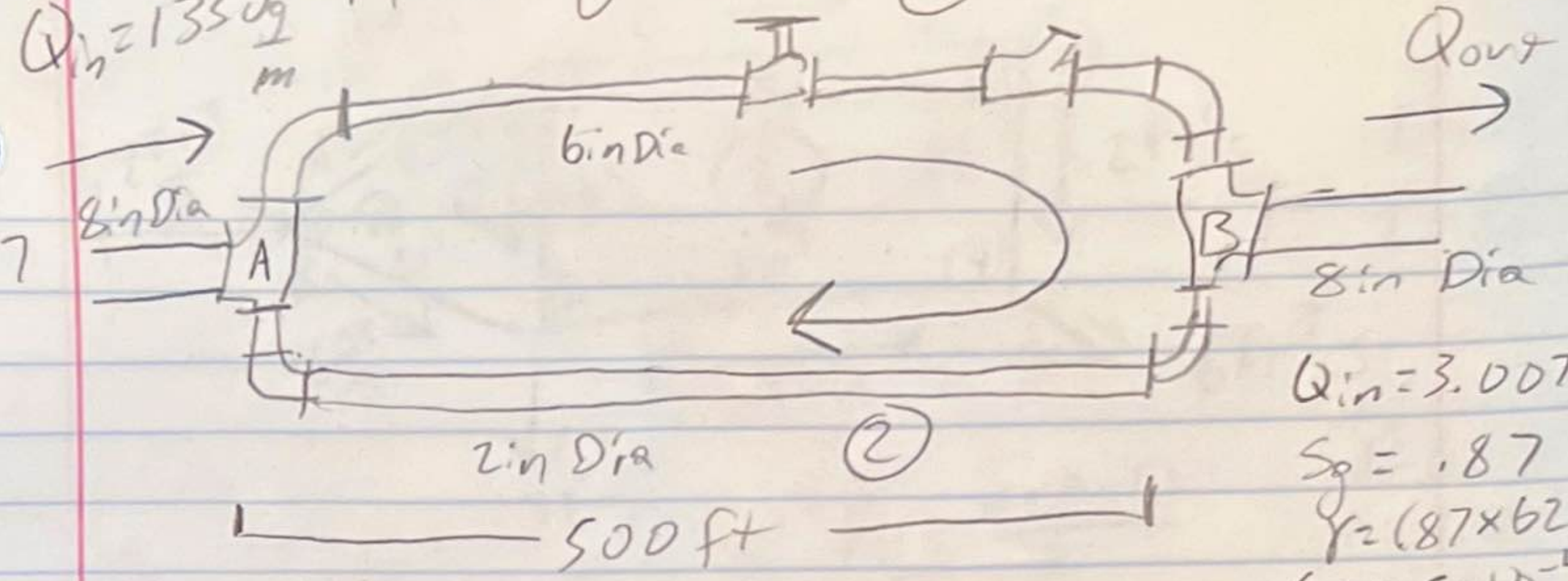
HW 8 ①



Q_{in} = 3.007 ft³/s

S_g = .87

γ = (.87 × 62.4)

$\varepsilon = 1.5 \times 10^{-4}$ ft

γ = 54.29 lb/ft³

$h = kQ^2 \quad k = \frac{8(L+L_e)f}{\pi^2 g D^5}$

Assume $Q_1 + Q_2 = 1.503$ ft³/s

$u = 1.15 \times 10^{-5}$ lb-s/ft²

$Q_1 = 1.503$ ft³/s $\quad D_1 = .5054$ ft

$Q_2 = -1.503$ ft³/s $\quad D_2 = .1723$ ft

$A_1 = .2006$ ft² $\quad A = \frac{\pi}{4} D^2 \quad A_1 = \frac{\pi}{4}(.5054\text{ ft})^2$

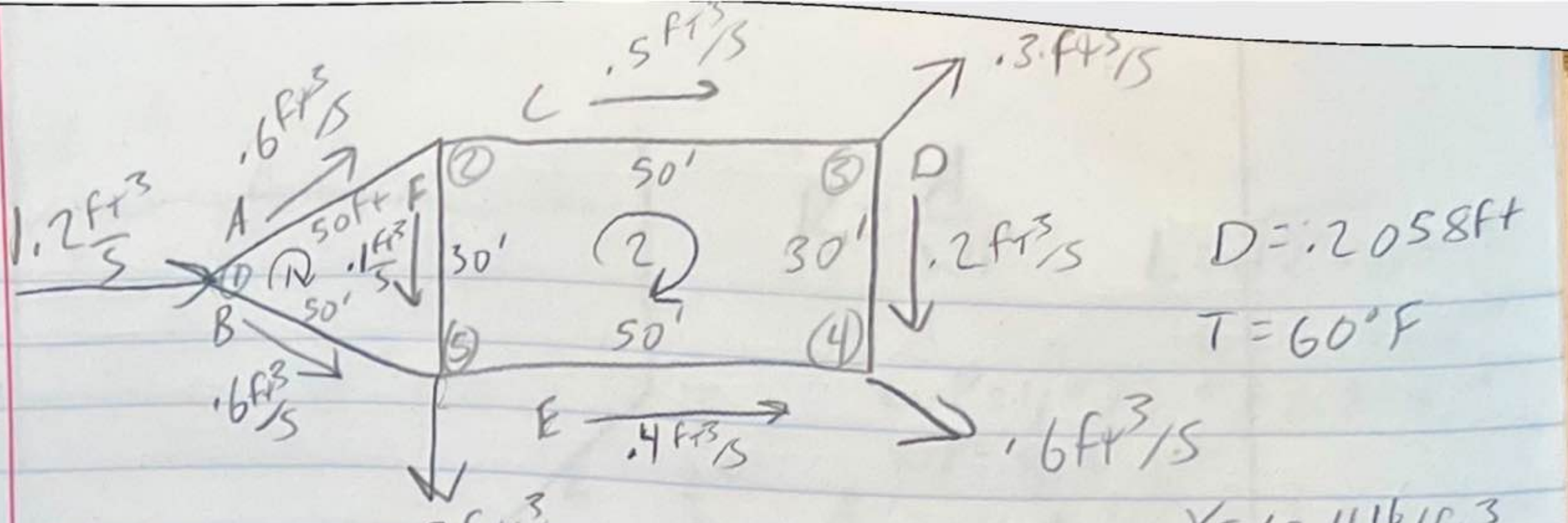
$A_2 = .0378$ ft²

$\frac{L_e}{D_1} = \frac{L_e}{D_{Globe}} + \frac{L_e}{D_{Swing}} + 2\frac{L_e}{D_{elbows}}$

$L_{e_1} = .4801(340 + 100 + 100) \quad L_{e_1} = 259.25$ ft

$L_{e_2} = .1616$ ft$(100) \quad L_{e_2} = 16.16$ ft

$$\boxed{Q_1 = 2.815 \text{ ft}^3/\text{s} \qquad Q_2 = .191 \text{ ft}^3/\text{s}}$$



D = .2058 ft

T = 60°F

$\gamma = 62.41 \, lb/ft^3$

$\rho = 1.94 \, slugs/ft^3$

$\mu = 2.35 \times 10^{-5} \, lb \cdot s/ft^2$

$e = 1.5 \times 10^{-4}$

$Q_A = .6 ft^3/s$

$Q_B = -.6 ft^3/s$

$Q_C = .5 ft^3/s$

$Q_D = .2 ft^3/s$

$Q_E = -.4 ft^3/s$

$Q_F = +.1 ft^3/s$

$$Re = \frac{V \times \rho \times D}{\mu}$$

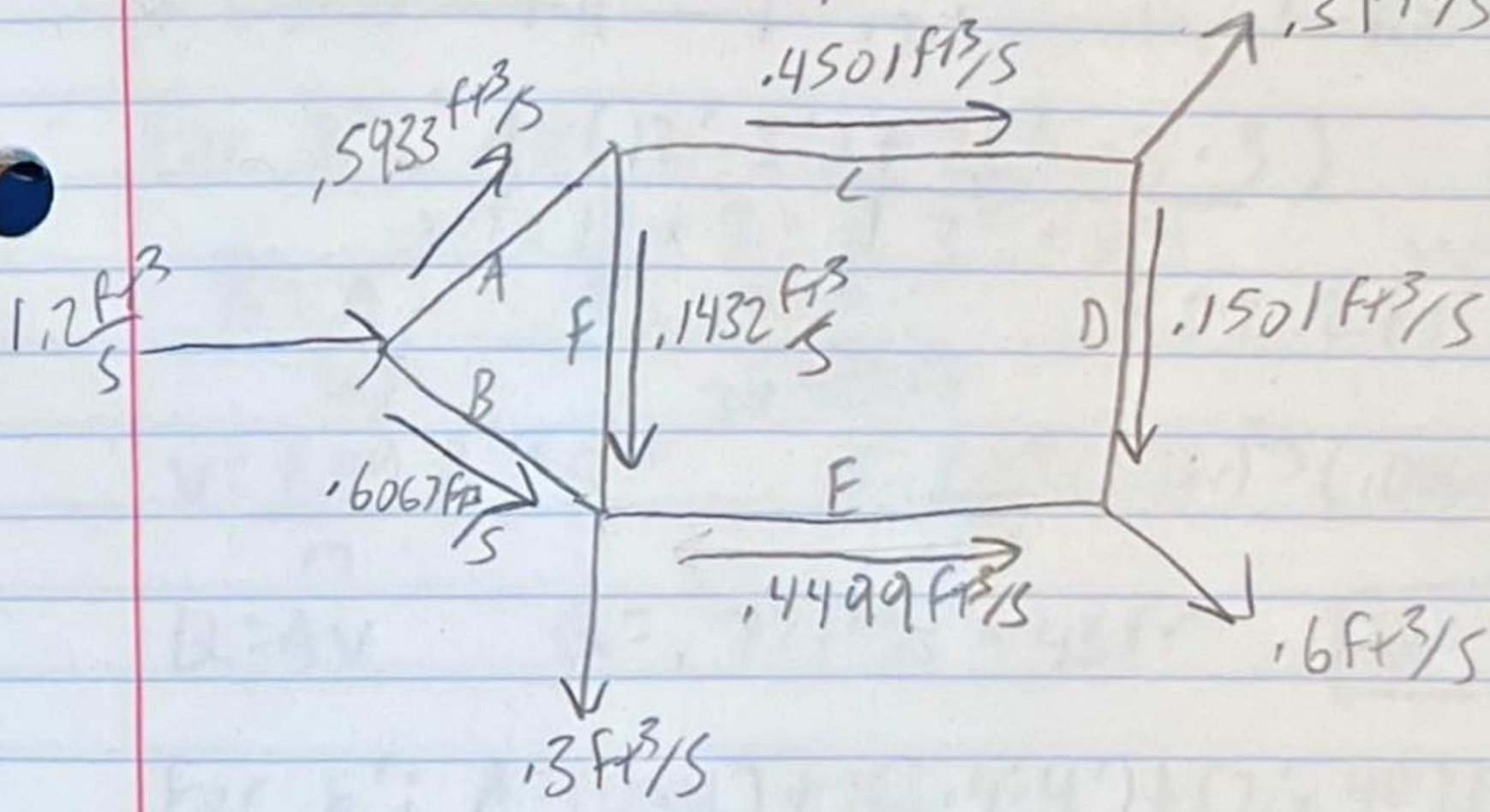
$$f = \frac{.25}{\left[\log\left(\frac{1}{3.7\frac{D}{e} + \frac{5.74}{Re^{.9}}}\right)^2\right]}$$

$$K = \frac{8 \cdot L \cdot f}{\pi^2 \cdot g \cdot D^5}$$

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

$$A = \frac{\pi}{4} (.2058 ft)^2$$

$$A = .0333 ft^2$$



$Q_A = .5933 ft^3/s$

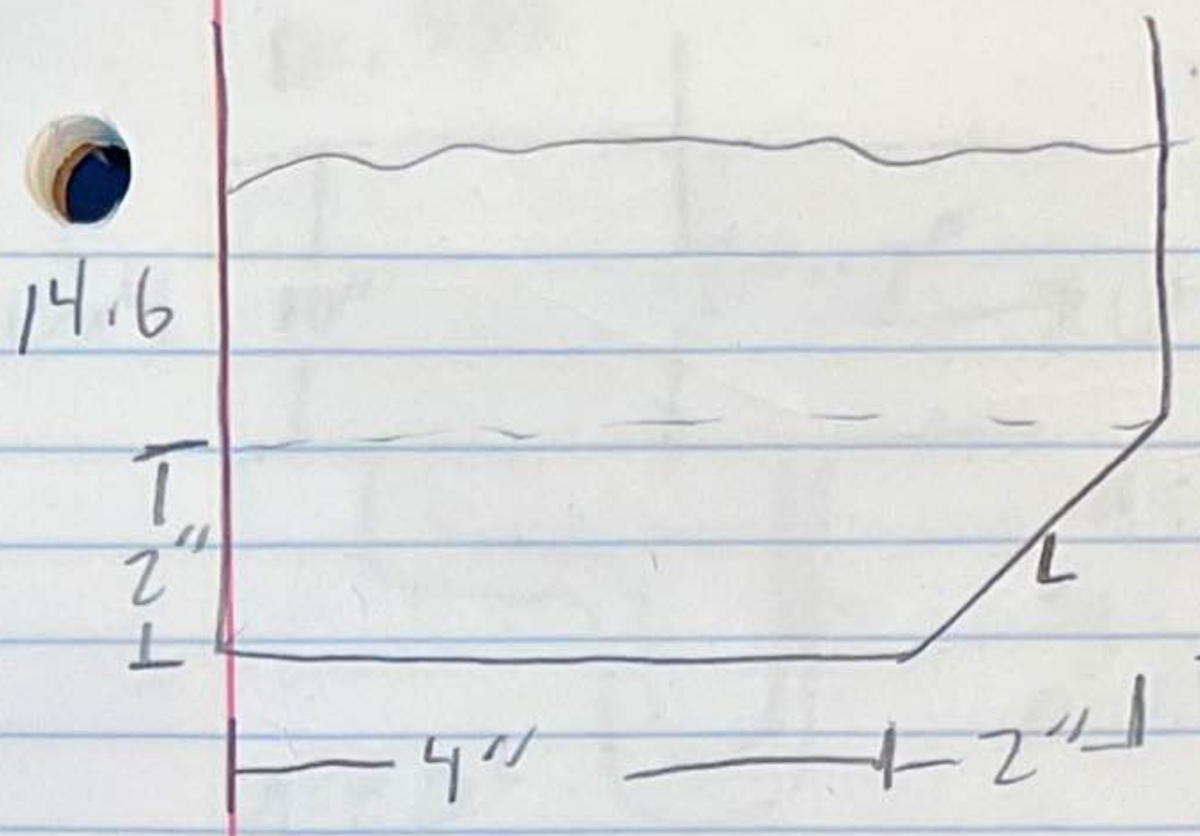
$Q_B = .6067 ft^3/s$

$Q_C = .4501 ft^3/s$

$Q_D = .1501 ft^3/s$

$Q_E = .4499 ft^3/s$

$Q_F = .1432 ft^3/s$



$$R = \frac{A}{WP} \qquad L = \sqrt{2^2+2^2}$$

$$L = 2.828''$$

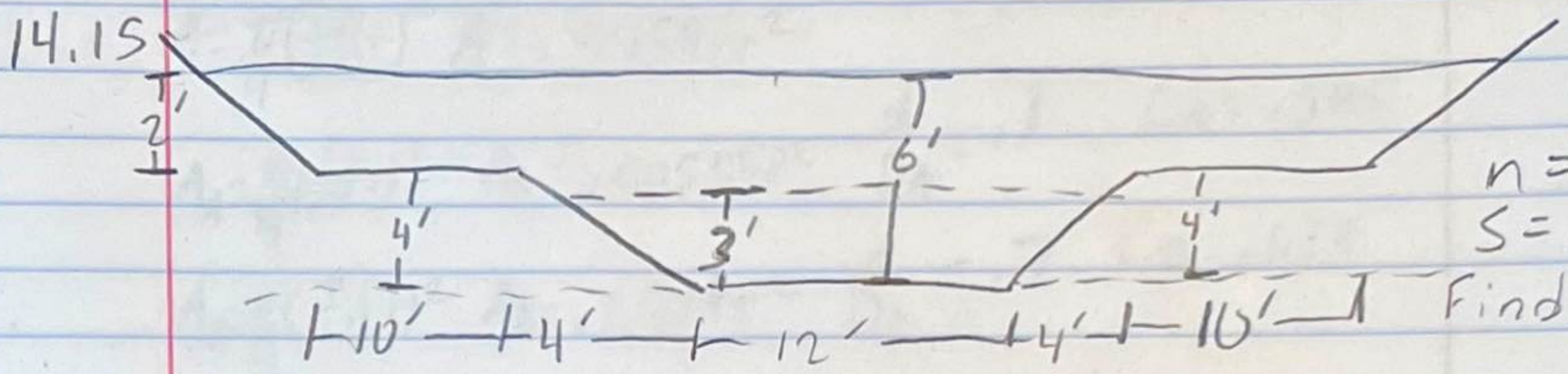
$$WP = 4'' + 2'' + 2.828''$$

$$WP = 8.828''$$

$$A = 2\times4 + \tfrac{1}{2}(2\times2) \quad A = 10in^2$$

$$R = \frac{10in^2}{8.828in}$$

$$\boxed{R = 1.133in}$$



$n = .04$

$S = .00015$

Find: Q

For 3': $A = (12'\cdot3') + 2(\tfrac{1}{2}\cdot3\cdot3) \qquad A = 45ft^2$

$$WP = 12 + 2\times\sqrt{3^2+3^2} \qquad WP = 20.485ft$$

$$R = \frac{A}{WP} \qquad R = \frac{45ft^2}{20.485ft} \qquad R = 2.2ft$$

$$V = \frac{1.49}{n} R^{2/3} S^{1/2} \qquad V = \frac{1.49}{.04}(2.2ft)^{2/3}(.00015)^{1/2}$$

$$V = .771\,ft/s$$

$$Q = AV \qquad Q = .771ft/s \times 45ft^2 \qquad \boxed{Q = 34.69ft^3/s}$$

For 6': $A = (12'\times4') + 2(\tfrac{1}{2}\cdot4'\cdot4') + (2'\times40') + 2(\tfrac{1}{2}\cdot2'\cdot2')$

$$A = 148ft^2$$

$$WP = 12' + 10' + 10' + 2\sqrt{4^2+4^2} + 2\sqrt{2^2+2^2}$$

$$WP = 48.97ft$$

$$R = 3.022ft$$

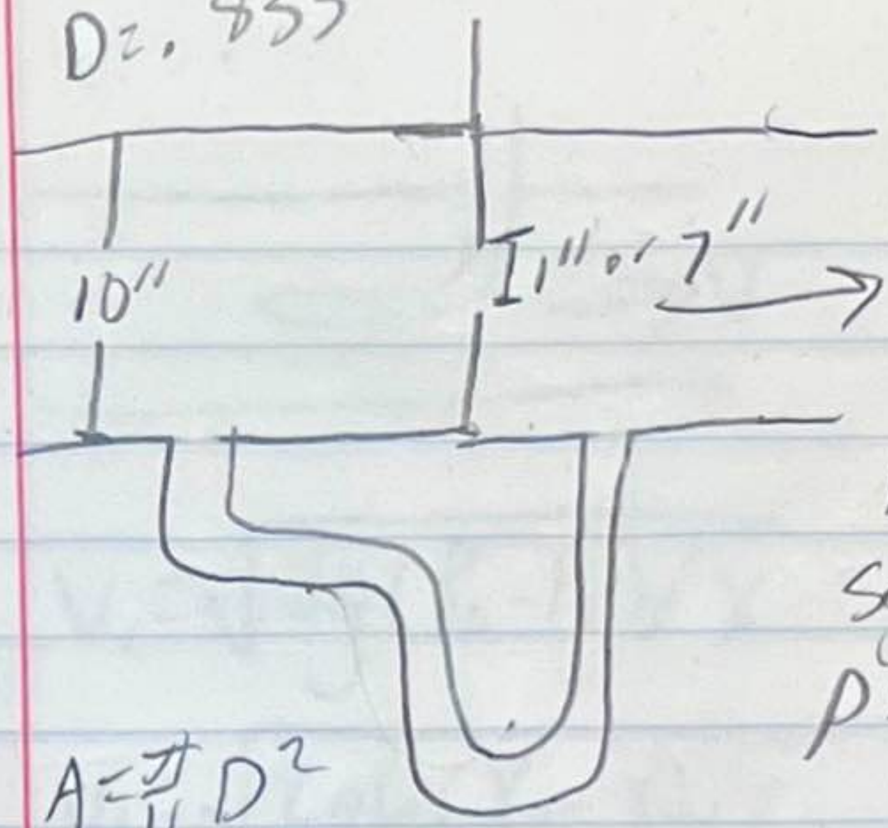
$$R = \frac{A}{WP} = \frac{148ft^2}{48.47ft}$$

$$V = \frac{1.49}{.04}\cdot(3.022ft)^{2/3}\cdot(.00015)^{1/2} \qquad V = .954ft/s$$

$$Q = .954\frac{ft}{s} \times 148\,ft^2$$

$$\boxed{Q = 141.14\frac{ft^3}{s}}$$

15.4



Find: Δh Monometer

$Q = 25 \frac{gal}{min} = .0557 \frac{ft^3}{s}$

$\mu = 2.5 \times 10^{-6}\ lb \cdot s/ft^2$

$Sg = .83$

$\rho = 1.94 \frac{slugs}{ft^3}$ $V = Q/A$ $.0557 \frac{ft^3}{s} / .5454 ft^2$

$V = .1021 ft/s$

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

$A = \frac{\pi}{4}(\frac{10}{12}(ft))^2$ $A = .5454 ft^2$

$A_A = \frac{\pi}{4}(\frac{1}{12} ft)^2$ $A_A = .0055 ft^2$ $\frac{d}{D_A} = .1$ $C_A = .595$

$A_B = \frac{\pi}{4}(\frac{7}{12} ft)^2$ $A_B = .267 ft^2$ $\frac{d}{D_B} = .7$ $C_B = .619$

$R_e = \frac{\rho \cdot Sg \cdot v \cdot D}{\mu}$ $R_e = \frac{1.94 \cdot .83 \cdot .1021 \cdot .833}{2.5 \times 10^{-6}}$ $R_e = 54800.5$

$V_1 = C \sqrt{\frac{2gh[(\gamma_m/\gamma_f) - 1]}{(A_1/A_2)^2 - 1}}$

$\gamma_m = 62.4\ lb/ft^3$

$\gamma_f = 51.8\ lb/ft^3$

$A_1/A_2 = 99.16$

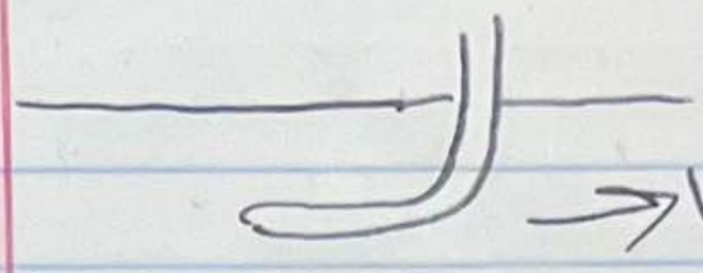
$A_1/A_{2B} = 2.041$

$\left(\frac{V}{C}\right)^2 \times (A_1/A_2)^2 - 1 = 2gh[(\gamma_m/\gamma_f) - 1]$

$\frac{\left(\frac{.1021}{.595}\right)^2 \times [(99.16)^2 - 1]}{2 \times 32.2 \times (62.4/51.8 - 1)} = h_A$ $\boxed{h_A = 21.97 ft}$

$h_B = \frac{\left(\frac{.1021}{.619}\right)^2 \times [(2.04)^2 - 1]}{2 \times 32.2 \times (62.4/51.8 - 1)} = h_B$ $\boxed{h_B = .0065 ft}$

15.15



Find i V

$T = 80°F$ $\quad g = 32.2 \frac{ft}{sec^2}$

$\gamma = .0736 lb/ft^3$

$\rho = 2.28 \times 10^{-3} slugs/ft^3$

$h = .24'' H_2O$

$\gamma_g = 62.4 lb/ft^3$

$V_1 = \sqrt{2g(P_s - P_1)/\gamma}$

$V_1 = \sqrt{2gh(\gamma_g - \gamma)/\gamma}$

$V_1 = \sqrt{\frac{2 \times 32.2 ft}{sec^2} \times .24'' \times \frac{1 ft}{12''} (62.4 - .0736)}{.0736}$

$\boxed{V = 33.026 ft/sec}$.