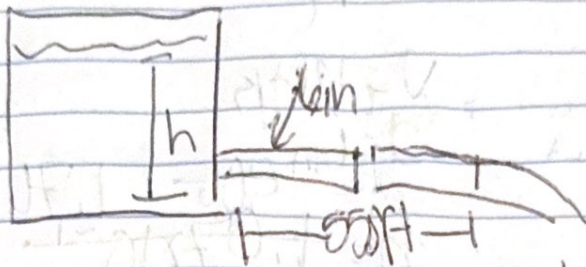


Ch 8 33, 38, 44, 46, 49, 62

33)



Design

incompressible
isothermal
steady state

data

$L = 55 \text{ ft}$
 $D = 0.5054 \text{ ft}$
 $Q = 2.5 \text{ ft}^3/\text{s}$
 roughness = $1.5 \times 10^{-4} \text{ ft}$
 $\gamma = 62.2 \text{ lb/ft}^3$
 $\rho = 1.93 \text{ slugs/ft}^3$
 $\nu = 9.15 \times 10^{-6} \text{ ft}^2/\text{s}$

$$\frac{p_1}{\gamma} + \frac{V_1^2}{2g} + z_1 = \frac{p_2}{\gamma} + \frac{V_2^2}{2g} + z_2 + h_{L,12}$$

$$h = \frac{V_2^2}{2g} + h_{L,12}$$

$$V_2 = \frac{Q}{A} = \frac{2.50 \text{ ft}^3/\text{s}}{\frac{\pi}{4} (0.5054^2 \text{ ft}^2)} = 12.46 \text{ ft/s}$$

$$Re = \frac{VD}{\nu} = \frac{12.46 (0.5054)}{9.15 \times 10^{-6}} = 6.88 \times 10^5$$

$$\frac{D}{\epsilon} = \frac{0.5054}{1.5 \times 10^{-4} \text{ ft}} = 3369$$

$$h = \frac{V_2^2}{2g} \left(1 + f \frac{L}{D} \right) = \frac{(12.46 \text{ ft/s})^2}{2(32.2 \text{ ft/s}^2)} \left(1 + 0.016 \left(\frac{550}{0.5054} \right) \right)$$

$$= 45.7 \text{ ft}$$

6) $\frac{data}{\pi f f}$
 $\frac{6in}{12 ft/s}$

$$N_p = \frac{V D^3}{\eta}$$

$$V = 12 ft/s$$

$$D = 6in$$

$$\eta = \frac{1.76}{1.07 \times 10^{-3}} = 2.24 \times 10^{-3}$$

$$N_p = \frac{12 (6/12)^3 (1.76)}{2.24 \times 10^{-3}} = 474.28$$

$$f = \frac{64}{N_p} = \frac{64}{474.28}$$

$$f = 0.0135$$

ch 10

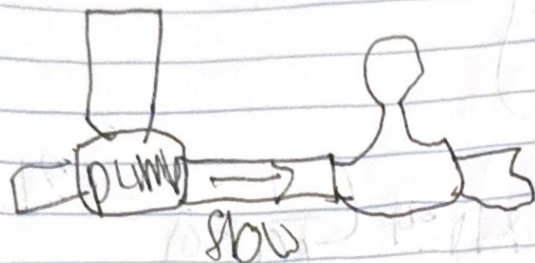
$$20) h_L = 1.0 \left(\frac{V_1^2}{2g} \right)$$

$$V_1 = \frac{Q}{A} = 500$$

$$\frac{3.801 \times 10^{-4}}{0.000001} = 21.92 \text{ m/s}$$

$$h_L = 1.0 \left(\frac{21.92^2}{2(9.81)} \right) = 2357.66 \text{ m}$$

34



data
0.40 ft³/s
Water at 50°F
d = 3 in

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

$$P_1 - P_2 = \gamma \left((z_2 - z_1) + \frac{V_2^2 - V_1^2}{2g} + h_L \right)$$

$$P_1 - P_2 = \gamma h_L$$

$$A = \frac{\pi}{4} d^2 = 0.126$$

$$V = \frac{Q}{A} = \frac{0.40 \text{ ft}^3/\text{s}}{0.126 \text{ m}^2 / 12 \text{ in}} = 0.0642$$

$$h_L = K \frac{V^2}{2g} = 5.78 \frac{(0.0642)^2}{2(32.2)} = 0.0611$$

$$K = f \frac{L_e}{D} = (0.17) (346) = 5.78$$