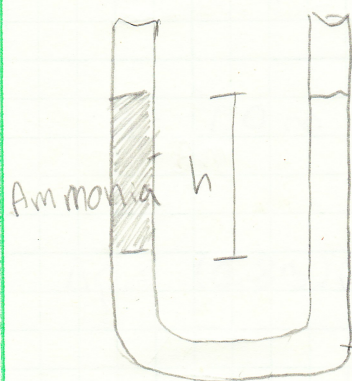


HW 2.3

15.4



Pipe diameter - 10 in

$$Q = 25 \text{ gal/min} = 0.056 \text{ ft}^3/\text{s}$$

$$\text{orifice diameter (a)} = 1.0 \text{ in}$$

$$(b) = 7.0 \text{ in}$$

$$\text{ammonia sg} = 0.83$$

$$\gamma = 2.5 \times 10^{-6}$$

$$a) \quad Q^2 = C^2 A_1^2 \left[\frac{2g(P_1 - P_2)/\gamma}{(A_1/A_2)^2 - 1} \right]$$

$$P_1 - P_2 = \frac{\gamma Q^2 [(A_1/A_2)^2 - 1]}{2g C^2 A_1^2}$$

$$A_2 = 0.0055 \text{ ft}^2$$

$$\Delta P = \frac{(0.83)(62.4)(0.056)^2 \times [(100^2) - 1]}{2(32.2)(0.59)^2(0.55)^2}$$

$$\Delta P = 239.5 \text{ lb/ft}^2$$

manometer:

$$h = \frac{P_1 - P_2}{\gamma_{H_2O} - \gamma_a} \rightarrow \frac{\Delta P}{62.4 - 51.8} \rightarrow \frac{239.5}{10.6}$$

$$h = 22.6 \text{ ft}$$

$$b) \quad \Delta p = \frac{K Q^2 (A_1/A_2)^2 - 1}{2 g C^2 A_1^2}$$

$$d = 7.0 \text{ in} ; A = \frac{\pi 7^2}{4} / 144 = 0.27 \text{ ft}^2$$

$$\Delta p = \frac{(0.83)(62.4)(0.056)^2 \left(\left[\frac{0.545}{0.27} \right]^2 - 1 \right)}{2 (32.2)(0.62)^2 (0.55)^2}$$

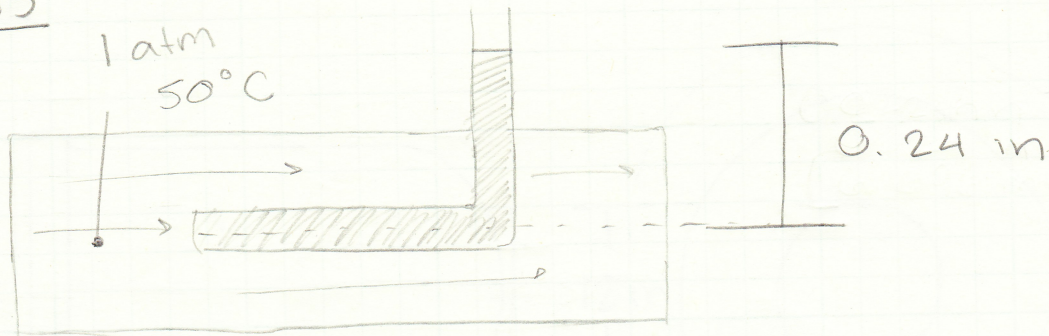
$$\Delta p = 0.067 \text{ lb/ft}^2$$

$$h = \frac{\Delta p}{10.6} \rightarrow \frac{0.067}{10.6}$$

$$h = 0.0063 \text{ ft}$$

HW 2.3

15.15



air @ standard atm pressure

- 50°C $\approx$ 122°F
- manometer 0.24 in water
- γ_{H_2O} @ 120°F = 61.7 lb/ft³

Eqn for Pitot tube velocity probe

$$V = \sqrt{2g(p_s - p_i) / \gamma}$$

Static pressure in main fluid stream

$$= 1 \text{ atm}$$

$$\hookrightarrow 1 \text{ atm} \times \frac{14.696 \text{ psi}}{1 \text{ atm}} = 14.67 \text{ psi}$$

$$= 2112.48 \frac{\text{lb}}{\text{ft}^2}$$

$$P_i = 406.79 \text{ in H}_2\text{O}$$

Differential manometer = 0.24 in

$$0.24 \text{ in} \times \frac{1 \text{ psi}}{27.68 \text{ in H}_2\text{O}} = 0.008 \text{ psi}$$

$$= 1.25 \frac{\text{lb}}{\text{ft}^2}$$

$$V = \sqrt{2 \times 32.2 \frac{\text{ft}}{\text{s}^2} \times (2112.48 - 1.25) \frac{\text{lb}}{\text{ft}^2} / 61.7 \frac{\text{lb}}{\text{ft}^3}}$$

$$V = 46.9 \text{ ft/s}$$