

MET330 Homework 2.3

15.4

$Q = 25 \text{ gal/min or } 0.6577 \text{ ft}^3/\text{s}$ Ammonia. $S_g = 0.83$

$D = 10 \text{ in}$

$D_o = 1.0 \text{ in}, 7.0 \text{ in}$

dynamic viscosity $= 2.5 \cdot 10^{-6} \text{ lb/ft}^2$

$\rho = 1.6102 \text{ slugs/ft}^3$

$$Q = V_1 A_1$$

$$V_1 = \frac{Q}{A} = \frac{0.6577}{\frac{1}{4} \cdot \pi \cdot (10)^2} = 0.10212 \text{ ft/s}$$

$$N_R = \frac{V D \rho}{\eta} = \frac{0.10212 \text{ ft/s} \cdot (10)^2 \text{ ft} \cdot 1.6102 \text{ slugs/ft}^3}{2.5 \cdot 10^{-6} \text{ lb/ft}^2}$$

$$N_R = 54811.204 = 5.48 \cdot 10^4$$

$$\rightarrow C \approx 0.595$$

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

$$0.10212 \text{ ft/s} = (0.595) \cdot \sqrt{\frac{2 \cdot (22.32) \text{ ft} \cdot [(62.468 / 51.848) - 1]}{((\frac{1}{4} \cdot \pi \cdot (10)^2) / (\frac{1}{4} \cdot \pi \cdot (7)^2))^2 - 1}}$$

$$h = 22.32 \text{ ft for 1 inch orifice plate}$$

$$0.10212 \text{ ft/s} = 0.595 \cdot \frac{2 \cdot 32.2 \text{ ft} \cdot [(62.468 / 51.848) - 1]}{((\frac{1}{4} \cdot \pi \cdot (10)^2) / (\frac{1}{4} \cdot \pi \cdot (7)^2))^2 - 1}$$

$$h = 0.00706 \text{ ft for 7 inch orifice plate}$$

$$SG = \frac{\rho_A}{\rho_w}$$

$$0.83 = \frac{\rho_A}{1.940 \text{ slugs/ft}^3}$$

$$\rho = 1.6102 \text{ slugs/ft}^3$$

$$\beta = \frac{(\frac{1}{12})}{(\frac{10}{12})} = \frac{1}{10} = 0.1$$

$$\gamma_w = 1.940 \cdot 32.2 = 62.468$$

$$\gamma_A = 1.6102 \text{ slugs/ft}^3 \cdot 32.2 \text{ ft/s}^2 = 51.848$$