## Problem 1 MSH Problem 2.2

*Solution:*

$$dP + g\rho dZ = 0, \quad \rho = \frac{PM}{RT}, \quad T = 288 - 0.005Z$$

$$\Rightarrow dP + \frac{gPM}{R(288 - 0.005Z)}dZ = 0 \Rightarrow \int \frac{1}{P}dP = \int -\frac{gM}{R(288 - 0.005Z)}dZ$$

$$\Rightarrow \ln\frac{P_b}{P_a} = -\frac{gM}{R}\frac{-1}{0.005}\ln\left|\frac{288 - 0.005Z}{288}\right|$$

$$\Rightarrow \ln\frac{1}{2} = \frac{9.8 \cdot 28.8 \cdot 10^{-3}}{8.3145}\frac{1}{0.005}\ln\left|\frac{288 - 0.005Z}{288}\right|$$

$$\Rightarrow Z = 5591\text{m}$$

## Problem 2 MSH Problem 2.7

*Solution:*

$$r_2 = \frac{0.150}{2} = 0.075\text{m}, \quad r_B = r_1 = 0.04\text{m}$$

$$V_A = V_B \Rightarrow \pi(r_2^2 - r_i^2) = \pi(r_i^2 - r_B^2) \Rightarrow r_i = 0.060\text{m}$$

$$\rho_B(r_i^2 - r_B^2) = \rho_A(r_i^2 - r_A^2) \Rightarrow \frac{\rho_B}{\rho_A}(r_i^2 - r_B^2) = r_i^2 - r_A^2$$

$$\Rightarrow r_A = \sqrt{r_i^2 - \frac{\rho_B}{\rho_A}(r_i^2 - r_B^2)} = \sqrt{0.060^2 - \frac{1020}{1109}(0.060^2 - 0.04^2)} = 0.042m$$

## Problem 3

*Solution:*

$$P_g = -1.7psi + 62.42\frac{lb}{ft^3} \cdot 1.6 \cdot 1.5ft\frac{ft^2}{144in^2} = -0.66psi$$

$$-0.66psi + 62.42 \cdot SG_B \cdot 1.25 \cdot \frac{1}{144} = 0$$

$$\Rightarrow SG_B = 1.22$$