

AE 209 THERMODYNAMICS

QUIZ 4

A 1.8-m³ rigid tank contains steam at 220°C. One third of the volume is in the liquid phase and the rest is in the vapor form. Determine, (a) the quality of the saturated mixture, and (b) the density of the mixture, with the given table values.

$$v_f = 0.001190 \text{ m}^3/\text{kg}$$

$$v_g = 0.086094 \text{ m}^3/\text{kg}$$

$$P = 2320 \text{ kPa}$$

$$a) \quad m_f = \frac{V_f}{v_f} = \frac{\frac{1}{3} (1.8 \text{ m}^3)}{0.001190 \text{ m}^3/\text{kg}} = 504,2 \text{ kg}$$

$$m_g = \frac{V_g}{v_g} = \frac{\frac{2}{3} (1.8 \text{ m}^3)}{0.086094 \text{ m}^3/\text{kg}} = 13,94 \text{ kg}$$

$$m_T = m_f + m_g = 504,2 + 13,94 = 518,1 \text{ kg}$$

$$x = \frac{m_g}{m_T} = \frac{13,94}{518,1} = 0,0269$$

$$b) \quad v = v_f + x (v_g - v_f) = 0,001190 + 0,0269 \cdot (0,086094 - 0,00119)$$

$$= 0,003474 \text{ m}^3/\text{kg}$$

$$\rho = \frac{1}{v} = 287,8 \text{ kg/m}^3$$