

**Given and Required:**

Determine the pressure and volume of a rigid container that contains 10 lbm of water at 150°F where water in the liquid form has a mass of 7 lbm.

**Solution:**

The total mass in the rigid container is defined as

$$m_{\text{tot}} := 10 \text{lbm}$$

The temperature at the state point is defined as

$$T_1 := 150 \text{ }^{\circ}\text{F}$$

The mass of the water in just the liquid phase in the rigid container is defined as

$$m_f := 7 \text{lbm}$$

Since it is stated that there is a liquid portion to the mass in the rigid container, this implies that there is also a vapor portion which also means the particular state is in the two-phase region.

Going to Table A-4E @  $T := T_1 = 150 \text{ }^{\circ}\text{F}$  shows

$$P_{\text{sat}} := 3.7234 \text{psi} \quad v_f := 0.01634 \frac{\text{ft}^3}{\text{lbm}} \quad v_g := 96.929 \frac{\text{ft}^3}{\text{lbm}}$$

Since the state is in the two-phase region, the saturation pressure is the pressure of the rigid container so

$P_1 := P_{\text{sat}} = 3.723 \text{psi}$

The quality of the mixture may be found by first finding the mass of the vapor portion. This is shown below.

$$m_g := m_{\text{tot}} - m_f = 3 \text{lbm}$$

The quality is then

$$x := \frac{m_g}{m_{\text{tot}}} = 0.3$$

The specific volume at the state point is then found by

$$v_1 := v_f + x \cdot (v_g - v_f) = 29.09 \frac{\text{ft}^3}{\text{lbm}}$$

The total volume of the container is then given by

$V_{\text{tot}} := m_{\text{tot}} \cdot v_1 = 290.9 \cdot \text{ft}^3$