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

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

The temperature at the state point is defined as

$$T_1 := 150\,°\text{F}$$

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 @ $T := T_1 = 150 \cdot °\text{F}$ shows

$$P_{sat} := 3.7234\text{psi} \qquad \nu_f := 0.01634\,\frac{\text{ft}^3}{\text{lbm}} \qquad \nu_g := 96.929\,\frac{\text{ft}^3}{\text{lbm}}$$

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

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

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

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

The quality is then

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

The specific volume at the state point is then found by

$$\nu_1 := \nu_f + x \cdot \left(\nu_g - \nu_f\right) = 29.09 \cdot \frac{\text{ft}^3}{\text{lbm}}$$

The total volume of the container is then given by

$$\boxed{V_{tot} := m_{tot} \cdot \nu_1 = 290.9 \cdot \text{ft}^3}$$