Answer on Question #66214, Physics / Solid State Physics

Four kg of water is placed in an enclosed volume of 1m3. Heat is added until the temperature is 150°C. Find (a) the pressure, (b)the mass of vapor, and (c) the volume of the vapor.

Solution:

a) We use the table of Saturated water—Temperature. In the quality region the pressure is given as p = 476.16 kPa

b) To find the mass of the vapor we must determine the quality. We use the next equation:

$$v = v_f + x(v_g - v_f)$$

Then,

$$0.25\ m^3/kg = 0.001091\ m^3/kg + x(0.39248 - 0.001091)m^3/kg$$

$$0.25 = 0.001091 + 0.391389x$$

$$0.391389x = 0.25 - 0.001091$$

$$0.391389x = 0.248909$$

$$x = 0.248909\ (m^3/kg)/0.391389\ (m^3/kg)$$

$$x = 0.63596$$

Using the relationship of $x = \frac{m_g}{m}$, we find the vapor mass

$$m_g = xm = 0.63596 \times 4kg = 2.544\ kg$$

c) The volume of the vapor is found from

$$V_g = v_g m_g = 2.544\ kg \times 0.39248\ m^3/kg = 0.998\ m^3$$

Answer: 476.16 kPa; $2.544\ kg$; $0.998\ m^3$