EX_3

EX 3.1

A mass of $200\ g$ of saturated liquid water is completely vaporized at a constant pressure of $100\ kPa$

Determine (a) the volume change and (b) the amount of energy transferred to the water

(a)

according to the properties of the phase transition, we can get the information from the table

$$v_f = 0.001043 \qquad v_g = 1.6941$$

$$v_{fg} = v_g - v_f = 1.693057$$

$$V = mv_{fg}$$

$$= 0.2 \times 1.693057 = 0.3386 m^3$$

(b)

$$E = mh_{fg}$$

$$= 0.2 \times 2257.5 = 451.5 kJ$$

EX 3.2

A rigid tank contains 10 kg of water at 90°C. If 8 kg of the water is in the liquid form and the rest is in the vapor form

Determine (a) the pressure in the tank and (b) the volume of the tank.

(a)

according to the properties of the saturated water, the pressure of the saturating water remains the same.

Finding the table on the table A-4 on p.904

$$P_{sat} = 70.183\ kPa$$

(b)

Finding the same data in the table A-4 on p.904

$$\begin{aligned} V &= m_g \cdot v_g + m_f \cdot v_f \\ &= 2 \times 2.3593 + 8 \times 0.001036 \\ &= 4.7269 m^3 \end{aligned}$$

EX 3.3

Determine the mass os the air in a room whose dimensions are $4\ m \times 5\ m \times 6\ m$ at $100\ kPa$ and $25^\circ C$

$$\begin{aligned} PV &= mRT \\ m &= \frac{PV}{RT} \\ &= \frac{100\ kPa \times 120\ m^3}{0.2870\ kJ/kg \cdot K \times (25+273)K} \\ &= 140.31\ kg \end{aligned}$$

EX 3.4 (Different model to describe the gas, skipped)