(20.2) The amount of steam found in example 20.1 is released into an air-filled large dry containment where the pressure may not exceed 0.7 MPa. Assume steam and air in the containment can be treated as ideal gases. Estimate the necessary containment volume.

$T_0 := (25 + 273) \cdot K$ $\quad p_0 := 0.097 \cdot 10^6 \cdot Pa$ $\quad M_{H2O} := 18 \cdot gm \cdot mole^{-1}$

Base calculation on $p_0 * V = n_0 * \boldsymbol{R} * T_0$ and $p_1 * V = (n_0 + n_1) * \boldsymbol{R} * T_1$, assume $T_1 = (n_0 * T_0 + n_1 * T_2)/(n_0 + n_1)$, where T_2 is the initial steam temperature.

$R_{gas} := 8.31451 \cdot joule \cdot mole^{-1} \cdot K^{-1}$ $\quad T_2 := (287 + 273) \cdot K$ $\quad p_1 := 0.7 \cdot 10^6 \cdot Pa$

$m_{H2O} := 34 \cdot 10^3 \cdot kg$ $\quad n_1 := \dfrac{m_{H2O}}{M_{H2O}}$

Guess values: $\quad V := 1000 \cdot m^3$ $\quad n_1 = 1.889 \cdot 10^6$

$n_0 := \dfrac{p_0 \cdot V}{R_{gas} \cdot T_0}$ $\quad n_0 = 3.915 \cdot 10^4$

Given

$$\frac{n_0 \cdot R_{gas} \cdot T_0}{p_0} - \frac{(n_0 + n_1) \cdot R_{gas} \cdot (n_0 \cdot T_0 + n_1 \cdot T_2)}{p_1 \cdot (n_0 + n_1)} = 0 \cdot m^3$$

Search for a root to this eqn

$n := Find(n_0)$ $\quad$ Locate n, i.e. the value of n_0 that satisfies the equation above

$n = 5.71 \cdot 10^5$ $\quad V_{cont} := \dfrac{n \cdot R_{gas} \cdot T_0}{p_0}$ $\quad V_{cont} = 1.459 \cdot 10^4 \cdot m^3$