(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

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

$n = 5.71\cdot 10^5$ $\quad V_{cont} := \dfrac{n\cdot R_{gas}\cdot T_0}{p_0}$ $\quad V_{cont} = 1.46\cdot 10^4\cdot m^3$