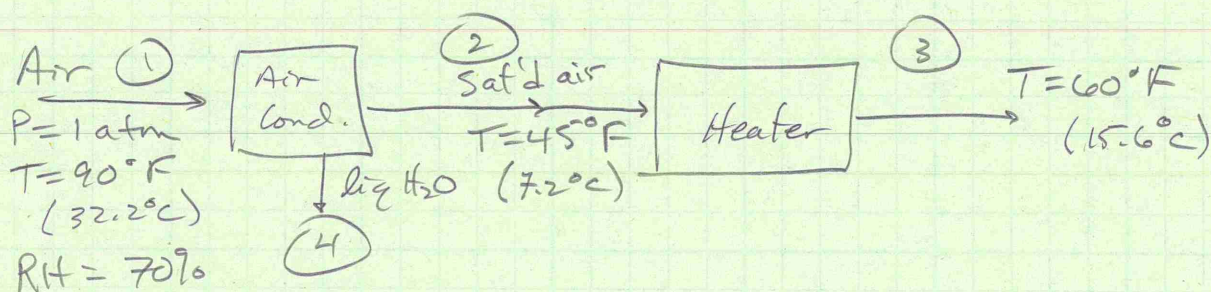


Air Conditioner Example



① $P_{1, \text{H}_2\text{O}}^* = 36.068 \text{ mm Hg}$

$$Y_{\text{H}_2\text{O},1} = \frac{(0.7)(36.068)}{760} = 0.0332$$

Assume 100 moles of moist air coming in (stream 1)

$$n_{\text{dry air},1} = 96.68 \text{ moles}$$

$$n_{\text{H}_2\text{O},1} = 3.32 \text{ moles}$$

② $\text{RH} = 100\%$

$$P_2^* = 7.617 \text{ mm Hg} = P_{\text{H}_2\text{O},2}$$

$$Y_{\text{H}_2\text{O},2} = \frac{7.617}{760} = 0.01$$

③ $Y_{\text{H}_2\text{O},3} = Y_{\text{H}_2\text{O},2} = 0.01$, so $P_{\text{H}_2\text{O},3} = P_{\text{H}_2\text{O},2} = 7.617 \text{ mm Hg}$

$$P_3^* = 13.29 \text{ mm Hg}$$

$$\text{RH} = \frac{7.617}{13.29} = 0.4898 \text{ or } 49\% \text{ RH}$$

$$n_{\text{dry air},3} = n_{\text{dry air},1} = 96.68 \text{ moles}$$

$$Y_{\text{air}} = 1 - 0.01 = 0.99$$

$$Y_{\text{air}} n_{\text{tot},3} = n_{\text{air},3} = 96.68 \text{ moles}$$

$$n_{\text{tot},3} = \frac{96.68}{0.99} = 97.66 \text{ moles}$$

$$n_{\text{H}_2\text{O},3} = (0.01)(97.66) = 0.9766 \text{ moles}$$

water balance: $n_{4, \text{H}_2\text{O}} = n_{1, \text{H}_2\text{O}} - n_{3, \text{H}_2\text{O}}$

$$= 3.32 - 0.9766 = 2.34 \text{ moles}$$