Example

A moist-air mixture has a dry-bulb temperature of 85°F and a relative humidity of φ = 60%. The total pressure of the mix is 14.7 psia.

~~(a) If the water vapor existed alone at T_{mix} and V_{mix}, what would its pressure be? I.e., determine the~~

Partial pressure (or vapor pressure)

~~(b) For every lbm of dry air, how much water vapor is there? I.e., determine the~~

Humidity ratio

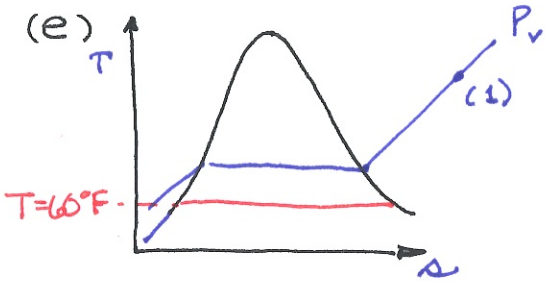
~~(c) If you cooled this mix at constant pressure, at what temperature would the water start condensing? I.e., determine the~~

Dew point temperature

~~(d) Determine the enthalpy of the mixture **per unit mass of dry air.** Is this the same as H_{mix}/m_{mix}?~~

(e) If the mixture is cooled to T= 60°F, how much liquid condenses per lbm of dry air?

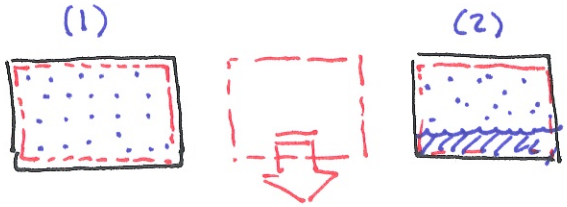
NEW!



$P_{v,2} = P_{sat}(T=60°F)$ OTHERWISE LIQUID & VAPOR NOT IN EQUILIBRIUM.

$P_{v,2} = P_g(60°F)$

= 0.2563 psia



Cons of mass

$\frac{dm}{dt} = \dot{m}_{in} - \dot{m}_{out}$

$m_2 - m_1 = 0 \quad m_2 = m_1$

$m_1 = m_a + m_{v,1}$

$m_2 = m_a + m_{v,2} + m_{w,2}$

$\Rightarrow \quad m_a + m_{v,2} + m_{w,2} = m_a + m_{v,1}$

$m_{w,2} = m_{v1} - m_{v2} = m_a\omega_1 - m_a\omega_2$

$\frac{m_{w,2}}{m_a} = \omega_1 - \omega_2$

VERY IMPORTANT!

CAN FIND ω_2 FROM P_{v2}:

$$\omega_2 = 0.622 \frac{P_{v2}}{P - P_{v2}} = 0.622 \frac{0.2563}{14.7 - 0.2563}$$

$$= 0.01105 \qquad \text{(NOTE THAT } \phi_2 = 100\%\text{)}$$

$$\therefore \frac{m_{w,2}}{m_a} = 0.0155 - 0.01105$$

$$= \boxed{0.00445}$$

YOU SHOULD BE ABLE TO PROVE THAT QUALITY x IS

$$x_2 = \frac{\omega_2}{\omega_1}$$