Example

A moist-air mixture has a dry-bulb temperature of 85°F and a relative humidity of $\varphi = 60\%$. 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

(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

DEWPOINT TEMP

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

(a) $\phi = \frac{P_v}{P_g}$ $\quad P_g(T=85°C) = 0.5967$ psia

$\therefore P_v = \phi P_g = (0.60)(0.5967 \text{ psia}) = \boxed{0.358 \text{ psia}}$

(b) $\omega = \frac{M_a}{M_v}\left(\frac{\phi P_g}{P - \phi P_g}\right) = 0.622 \frac{(0.60)(0.5967 \text{ psia})}{(14.7 - (0.60 \times 0.5967))\text{ psia}}$

$= \boxed{0.0155}$

(c) $T_{DP} = T_{SAT}(P_v) = T_{SAT}(0.358 \text{ psia}) = \boxed{69.6\,°F}$

(d) $h = h_a + \omega h_v$

$h_v \approx h_g(T_{Mix})$ NOTE WE DO NOT USE IDEAL GAS TABLES!!

$= h_a(85°F) + \omega h_g(85°F)$

$= 130.26 \frac{Btu}{lbm} + 0.0155\left(1098.6 \frac{B}{lbm}\right) = \boxed{147.3 \text{ KJ/Kg}}$

NOT SAME AS H_{Mix}/m_{mix}.