$$N_t = N + 2$$

$$N = N_t - 2 = 10 - 2 = 8$$

Solve for the spring constant.

$$k = \frac{d^4 G}{8D^3 N} = \frac{(0.15in)^4 \left(10 \times 10^6 \frac{lb_f}{in^2}\right)}{8\,(1in)^3\,(8)} = 79\frac{lb_f}{in}$$

Answer C

47.11 An air handling unit uses 10% outside air at $88°F$ and 60% RH and 90% recirculated air returned from the space, which is maintained at $76°F$ and 50% RH. What is the dew point temperature of the air entering the coil?

A. $56°F$

B. $58°F$

C. $63°F$

D. $65°F$

Define State 1 as the outside air, State 2 as the return air, and State 3 as the mixed air. The question does not concern the supply/discharge air after the coil.

Use the Psychrometric Chart to look up the humidity ratio for State 1 and State 2 which are fully defined.

$$T_1 = 88°F$$

$$RH_1 = 60\%$$

$$\omega_1 = .0172\frac{lb_{H2O}}{lb_{da}}$$

$$T_2 = 76°F$$

$$RH_2 = 50\%$$

$$\omega_2 = .0096\frac{lb_{H2O}}{lb_{da}}$$

Perform a mixing calculation to find the humidity ratio at State 3.

$$\omega_3 = (.1)\left(.0172\frac{lb_{H2O}}{lb_{da}}\right) + (.9)\left(.0096\frac{lb_{H2O}}{lb_{da}}\right) = .01036\frac{lb_{H2O}}{lb_{da}}$$

Follow the psychrometric chart horizonally to the left from ω_3 to the saturation curve to read the corresponding dew point temperature.

$$T_{DP,3} \approx 58°F$$

Answer B

47.12 $2000cfm$ of outside air at $95°F$ dry bulb and $78°F$ wet bulb is cooled to $68°F$ and 60% relative humidity. What quantity of latent heat is removed?

A. $60,000\frac{Btu}{hr}$

B. $70,000\frac{Btu}{hr}$

C. $80,000\frac{Btu}{hr}$

D. $90,000\frac{Btu}{hr}$

Let state 1 be the entering air conditions and state 2 be the leaving air conditions. Use the Psychrometric Chart to find the humidity ratio for both states.

$$T_{1,db} = 95°F$$

$$T_{1,wb} = 78°F$$

$$\omega_1 = 0.0169\frac{lb_{h2o}}{lb_{da}}$$

$$T_2 = 68°F$$

$$\phi_2 = 60\%$$

$$\omega_2 = 0.0088\frac{lb_{h2o}}{lb_{da}}$$

Even though this problem is about calculating the latent heat removed from the air, it is appropriate to use the Latent Heat Gain rule of thumb formula provided the smaller humidity ratio is subtracted from the larger humidity ratio such that $\Delta\omega$ has a positive value. As long as the correct units are used for all inputs, q_l will be specified in the desired units, $\frac{Btu}{hr}$.

$$q_l = 4840Q_s\Delta\omega = 4840\,(2000)\,(0.0169 - 0.0088) = 78,408\frac{Btu}{hr}$$

Answer C