37.11 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