35.25 **A $2,500 ft^2$ conference center with $14 ft$ ceilings is maintained at $72^\circ F$ and 50% relative humidity. What is the total mass of water vapor in the air?**

A. $15 lb$

B. $22 lb$

C. $140 lb$

D. $290 lb$

Find the total volume of the room by multiplying the area and the height.

$$V = \left(2500 ft^2\right)(14 ft) = 35,000 ft^3$$

Find the humidity ratio and specific volume for the room conditions using the Psychrometric Chart.

$$T = 72^\circ F$$

$$\phi = 50\%$$

$$\omega = 0.0084 \frac{lb_w}{lb_{da}}$$

$$v = 13.6 \frac{ft^3}{lb_{da}}$$

Recall the definition of the humidity ratio as described under Psychrometric Properties. Rearrange to solve for the mass of water.

$$\omega = \frac{m_w}{m_{da}}$$

$$m_w = (m_{da})(\omega)$$

The mass of air can be expressed as density times volume, or volume over specific volume.

$$m_{da} = \rho V = \frac{V}{v} = \frac{35,000 ft^3}{13.6 \frac{ft^3}{lb_{da}}} = 2574 lb_{da}$$

Determine the mass of water.

$$m_w = (m_{da})(\omega) = (2574 lb_{da}) \left(0.0084 \frac{lb_w}{lb_{da}}\right) = 21.6 lb_w$$

Answer B