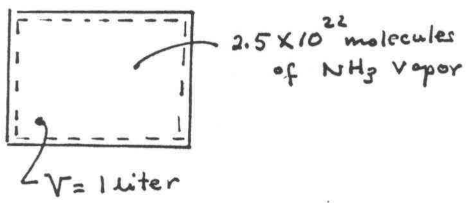
PROBLEM 1.22



(a) From Sec. 1.5, the number of molecules in a gram mole (mol) is 6.022×10^{23} (Avogadro's number).

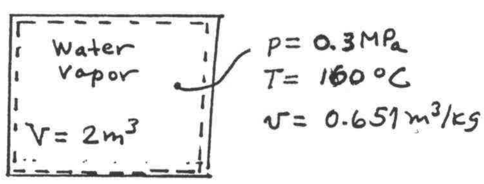
Thus $$n = \frac{2.5 \times 10^{22} \text{ molecules}}{6.022 \times 10^{23} \text{ molecules/mol}} = 4.15 \times 10^{-2} \text{ mols}$$

Converting to kmol,
$$n = 4.15 \times 10^{-2} \text{ mol} \left| \frac{1 \text{ kmol}}{10^3 \text{ mol}} \right| = 4.15 \times 10^{-5} \text{ kmol}$$

Using Eq. 1.8, $m = nM$, so
$$m = 4.15 \times 10^{-5} \text{ kmol} \left(\underbrace{17.03}_{\text{Table A-1}} \frac{\text{kg}}{\text{kmol}} \right) = 7.07 \times 10^{-4} \text{ kg}$$

Then
$$v = \frac{V}{m} = \frac{(1 \text{ liter})}{7.07 \times 10^{-4} \text{ kg}} \left| \frac{10^{-3} \text{ m}^3}{1 \text{ liter}} \right| = 1.41 \frac{\text{m}^3}{\text{kg}}$$
$$\bar{v} = \frac{V}{n} = \frac{10^{-3} \text{ m}^3}{4.15 \times 10^{-5} \text{ kmol}} = 24.1 \frac{\text{m}^3}{\text{kmol}}$$

PROBLEM 1.23



(a) $$v = \frac{V}{m} \Rightarrow m = \frac{V}{v}$$
$$\therefore \quad m = \frac{2 \text{ m}^3}{0.651 \text{ m}^3/\text{kg}} = 3.07 \text{ kg}$$

Eq. 1.8, $$n = \frac{m}{M} = \frac{3.07 \text{ kg}}{\underbrace{18.02}_{\text{Table A-2}} \text{ kg/kmol}} = 0.17 \text{ kmol}$$

(b) From Sec. 1.5, the number of molecules in a gram mole (mol) is 6.022×10^{23} (Avogadro's number). Thus,

$$\begin{bmatrix} \text{Number of molecules} \\ \text{in the vessel} \end{bmatrix} = (0.17 \text{ kmol}) \left| \frac{10^3 \text{ mol}}{\text{kmol}} \right| \left(6.022 \times 10^{23} \frac{\text{molecules}}{\text{mol}} \right)$$
$$= 1.02 \times 10^{26}$$

PROBLEM 1.24

$$\underbrace{p}_{\text{lbf/ft}^2} = A + \frac{B}{\underbrace{V}_{\text{ft}^3}}$$

By inspection of this equation, A has units of lbf/ft².

Rearranging,

$$B = \underbrace{[p - A]}_{\text{lbf/ft}^2} \underbrace{V}_{\text{ft}^3} \Rightarrow$$ B has units of ft·lbf.
