

87. (a) Since $n/V = p/RT$, the number of molecules per unit volume is

$$\frac{N}{V} = \frac{nN_A}{V} = N_A \left(\frac{p}{RT} \right) (6.02 \times 10^{23}) \frac{1.01 \times 10^5 \text{ Pa}}{\left(8.31 \frac{\text{J}}{\text{mol K}} \right) (293 \text{ K})} = 2.5 \times 10^{25} \frac{\text{molecules}}{\text{m}^3} .$$

- (b) Three-fourths of the 2.5×10^{25} value found in part (a) are nitrogen molecules with $M = 28.0 \text{ g/mol}$ (using Table 20-1), and one-fourth of that value are oxygen molecules with $M = 32.0 \text{ g/mol}$. Consequently, we generalize the $M_{\text{sam}} = NM/N_A$ expression for these two species of molecules and write

$$\frac{3}{4} (2.5 \times 10^{25}) \frac{28.0}{6.02 \times 10^{23}} + \frac{1}{4} (2.5 \times 10^{25}) \frac{32.0}{6.02 \times 10^{23}} = 1.2 \times 10^3 \text{ g} .$$