

**Pre-AP Chemistry/AP Chemistry**

**Unit #17—Gas Laws**

Molar Mass of a Gas

Calculate the average molar mass of dry air if it has a density of 1.17 g/L at 21 °C and 740 torr.

$$21\text{ }^{\circ}\text{C} + 273.15\text{ K} = 294.15\text{ K}$$

$$\frac{740\text{ torr}}{760\text{ torr}} \left| \frac{1\text{ atm}}{760\text{ torr}} \right. = 0.974\text{ atm}$$

$$\frac{(1.17\text{ g/L})(0.08206\text{ Latm/Kmol})(294.15\text{ K})}{0.974\text{ atm}} = 28.995\text{ g/mol}$$

The molar mass of a volatile substance was determined by the Dumas-bulb method. The unknown vapor had a mass 0.846 grams, the volume of the bulb was 354 mL, the pressure 752 torr, and the temperature 100 °C. Calculate the molar mass of the vapor.

$$\frac{354\text{ mL}}{1000\text{ mL}} \left| \frac{1\text{ L}}{1000\text{ mL}} \right. = 0.354\text{ L}$$

$$\frac{0.846\text{ g}}{0.354\text{ L}} = 2.390\text{ g/L}$$

$$100\text{ }^{\circ}\text{C} + 273.15\text{ K} = 373.15\text{ K}$$

$$\frac{752\text{ torr}}{760\text{ torr}} \left| \frac{1\text{ atm}}{760\text{ torr}} \right. = 0.989\text{ atm}$$

$$\frac{(2.390\text{ g/L})(0.08206\text{ Latm/Kmol})(373.15\text{ K})}{0.989\text{ atm}} = 73.997\text{ g/mol}$$