GAS LAW WORKSHEET 1 KEY

1. A sample of oxygen gas occupies a volume of 436.2 mL at 1.02 atm. If the temperature is held constant, what would the pressure of this gas be when the gas is compressed to 231.6 mL?

$$\frac{P_1V_1}{T_1} = \frac{P_2V_2}{T_2} \quad \text{since } T_1 = T_2 \quad P_1V_1 = P_2V_2 \quad P_2 = P_1\frac{V_1}{V_2} = 1.02 \text{ atm}\left(\frac{436.2 \text{ mL}}{231.6 \text{ mL}}\right) = \mathbf{1.92\ atm}$$

To check with reasoning: decreased V leads to increased P, so the volume ratio should be greater than one to yield the expected increased pressure.

2. If a gas originally occupying 6.75 L at 19.21 °C and 762.5 torr is compressed to give a pressure of 1.26 atm at 26.35 °C, what would the new volume be?

$$\frac{P_1V_1}{T_1} = \frac{P_2V_2}{T_2} \quad V_2 = V_1\left(\frac{T_2}{T_1}\right)\left(\frac{P_1}{P_2}\right) = 6.75 \text{ L}\left(\frac{299.50 \text{ K}}{292.36 \text{ K}}\right)\left(\frac{762.5 \text{ torr}}{1.26 \text{ atm}}\right)\left(\frac{1 \text{ atm}}{760 \text{ torr}}\right) = \mathbf{5.51\ L}$$

To check with reasoning: increased T leads to increased V, so the temperature ratio should be greater than one to yield the expected increase in volume. Increased P leads to decreased V, so the pressure ratio should be less than one to yield the expected decreased volume.

3. Calculate the number of grams of hydrogen sulfide gas, H_2S, in a 3.6 L container at 32.6 °C and 712 mmHg.

$$PV = \frac{g}{M}RT \quad g = \frac{PVM}{RT} = \frac{712 \text{ mmHg } (3.6 \text{ L})\ 34.080 \frac{\text{g}}{\text{mol}}}{0.082058 \frac{\text{L atm}}{\text{K mol}}\ (305.8 \text{ K})}\left(\frac{1 \text{ atm}}{760 \text{ mmHg}}\right) = \mathbf{4.6\ g\ H_2S}$$

4. Calculate the density of 0.625 g of carbon dioxide at 26.32 °C and 1.03 atm.

$$PV = \frac{g}{M}RT \quad \frac{g}{V} = \frac{PM}{RT} = \frac{1.03 \text{ atm}\left(44.010 \frac{\text{g}}{\text{mol}}\right)}{0.082058 \frac{\text{L atm}}{\text{K mol}}\ (299.47 \text{ K})} = \mathbf{1.84\ g/L\ CO_2}$$