1. If 325.0 ml of oxygen are collected at 298 K and 98.5 kPa, what will be the volume of dry oxygen at STP?

$325 ml \times \frac{98.5}{101.3} \times \frac{273}{298} = 289.5 ml$

2. What is the volume of 190.0 grams of nitrogen at -23.5 C and 99.0 kPa?

$PV = nRT$

$(99 kPa)(V) = (6.79 mol)(8.31 \frac{L\,kPa}{mol\,K})(249 K)$

$V = 142 L$

3. What is the density of elemental oxygen in grams per liter at 25°C and .850 atm?

$PV = \frac{m}{MW} RT$

$\frac{m}{V} = \frac{P\,MW}{RT} = \frac{(.85)(32)}{(.08205)(298)}$

$D = 1.11 g/L$

4. Chloroform, $CHCl_3$, is a volatile (easily vaporized) liquid solvent. Calculate the density of chloroform vapor at 98°C and 781 mm Hg. Obtain the density in grams per liter.

$D = \frac{P(MW)}{RT}$

$4.03 g/L$

5. You vaporize a liquid substance at 100°C and 755 mm Hg. The volume of .548 grams of vapor is 237 mL. What is the molecular weight of the substance?

$PV = \frac{m}{MW} RT$

$MW = 71.3 g/mol$

6. A 1.00 L sample of dry air at 25°C and 786 mm Hg contains .925 g of nitrogen, plus other gases including oxygen, argon, and carbon dioxide. What is the partial pressure, in mm Hg, of the nitrogen in the air? What is the mole fraction and mole percent of nitrogen in the mixture?

$PV = nRT$

$n = .0423$ mole gas.

$.925 g\,N_2 \times \frac{1 mol\,N_2}{28} = .033 mol\,N_2$

$\frac{.033 mol\,N_2}{.0423 mol\,air} = .78 = mf$

or 78%

78% of 786 = 613 mm P_{N_2}

7. The U.S. Navy developed an undersea habitat. In one experiment, the mole percent composition of the atmosphere in the habitat was 79.0% helium, 17.0% nitrogen, and 4.0% oxygen. What will be the partial pressure of each gas when the habitat is 58.8 meters below sea level, where the pressure is 6.91 atm?

extra cam

$.79 \times 6.91 = 5.459$

$.04 \times 6.91 = 0.276$

$.17 \times 6.91 = 1.175$

8. Calculate the total pressure in atm of a mixture of .0300 moles of helium, and .0200 moles of oxygen, in a 4.00-liter flask at 20°C. Assume ideal gas behavior!

$PV = nRT$

$(4 L)\,P = (.05 mol)(8.31 \frac{L\,kPa}{mol\,K})(293 K)$

$P = 30.4 kPa$

9. Formic Acid, $HCHO_2$, is a convenient source of small quantities of carbon monoxide. When warmed with an acid catalyst, it decomposes to give off water and carbon monoxide. If 3.85 liters of CO was collected over water at 25°C and 689 mm Hg, how many grams of formic acid were used?

$HCHO_2 \rightarrow CO + H_2O$

$PV = nRT$

$(689 mm)(3.85 L) = n\,(62.4 \frac{L\,mm}{mol\,K})(298 K)$

$n = .1427$ mole CO

$.1427 mol\,CO \times \frac{1 mol\,HCHO_2}{1 CO} \times \frac{46 g}{1 mol} = 6.56 g$

10. Calculate the ratio of effusion rates of molecules of carbon dioxide and sulfur dioxide from the same container and the same T and P.

$\frac{\bar{v}_1}{\bar{v}_2} = \sqrt{\frac{m_2}{m_1}}$

$\frac{\bar{v}_1}{\bar{v}_2} = \sqrt{\frac{64}{44}} = 1.21$

11. How many liters of gas are required to react with excess aluminum hydroxide powder at 35°C and 25 psi, **if the gas is reacted over water?** Assume that 85.5 grams of aluminum sulfite and water are products of the reaction!

$3SO_2 + 3H_2O + 2Al(OH)_3 \rightarrow Al_2(SO_3)_3 + 6H_2O$

.29 mole

.87 mole SO_2

$PV = nRT$

$(172 kPa - 5.6 kPa)V = (.87)$