Gases
Chemistry 110

1] 76.3 mL of carbon dioxide is at 31^{O}C and 755 mm Hg. What would the final volume be in ml at 2.73 atm? Assume that the temperature remains constant.

$$\textbf{2.73 atm X } \frac{\textbf{760mm}}{\textbf{1atm}} \textbf{ = 2.07 x } 10^3 \textbf{ mm}$$

$$V_2 = \frac{\textbf{(755mm) x (76.3ml)}}{\textbf{(2.07 x } 10^3\textbf{mm)}} \textbf{ = 27.8 ml}$$

Answer _____

2] 9.00 L of nitrogen gas is at -74 ^{O}C. At what temperature will the volume be 5601ml? (Assume constant pressure)

K = 273 + (-74) = 199K

$$T_2 = \frac{\textbf{(199K) x (5.601 L)}}{\textbf{9.00L}} \textbf{ = 124 K or -149°C}$$

Answer _____

3] A gas occupies a volume of 14L at 455 mm Hg pressure 25^{O}C. What will be its new volume if the pressure is increased by 50% and the temperature remains constant?

$$V_2 = \frac{\textbf{(455mm) x (14L)}}{\textbf{1.5(455mm)}} \textbf{ = 9.3 L}$$

Answer _____

4] A sample of a gas is in a 17.2 L container is at a pressure of 0.33 atm and 34.3 ^{O}C. What is its new pressure if the Kelvin temperature was cut in half with the volume remaining constant?]

K = 34.3 + 273 = 307.3 K

$$P_2 = \frac{\textbf{(0.33atm) x (307.3K).50}}{\textbf{307.3K}} \textbf{ = 0.17 atm}$$

Answer _____

5] A 250.0 L cylinder contains 78.0 g of nitrogen at 100.^{O}C. How many grams of nitrogen must be removed to decrease the pressure by 20.0 mm Hg?

$$P_{initial} = \frac{\textbf{(78.0g/28}\frac{\textbf{g}}{\textbf{mole}}\textbf{) x (0.0821}\frac{\textbf{L-atm}}{\textbf{mol-K}}\textbf{) x (373K)}}{\textbf{250.0L}} \textbf{ = 0.3411 atm}$$

$$\textbf{20.0 mm x } \frac{\textbf{1atm}}{\textbf{760mm}} \textbf{ = 0.0263 atm}$$

$$P_{final} = \textbf{0.341 atm - 0.0263 atm = 0.315 atm}$$

$$\textbf{grams}_{final} = \frac{\textbf{(28.0}\frac{\textbf{g}}{\textbf{mol}}\textbf{) x (0.315atm) x (250.0L)}}{\textbf{(0.0821}\frac{\textbf{L-atm}}{\textbf{mol-K}}\textbf{) x (373K)}} \textbf{ = 72.0 g}$$

$$\textbf{grams}_{removed} \textbf{ = 78.0 g - 72.0 g = 6.0 g}$$ Answer _____

6] . A gas mixture contains oxygen, argon and nitrogen. The oxygen has a partial pressure of 99 mm Hg, nitrogen gas at 0.330 atm, and the total pressure is of 675 mm Hg. If all the oxygen is removed from the mixture, what will be the total pressure?

P = 675 mm Hg - 99 mm Hg = 576 mm

Answer _____

7] A sample of oxygen is collected over water at 20^{O}C and 1.00 atm. What is the partial pressure of the oxygen in atm? (at 20^{O}C, pure water has a vapor pressure of 17.5 torr)

$$P_{O_2} = \textbf{1.00 atm - } \frac{\textbf{17.5torr}}{\textbf{760torr/1atm}} \textbf{ = 0.977atm or 742 torr}$$

Answer _____

8]. Given a 9.0 L sample of gas at STP, what would be the new volume if the pressure was triple the original pressure?

$$V_2 = \frac{(1atm) \times (9.0L)}{3atm} = 3 \text{ atm}$$

Answer _____

9] What is the molar mass of a gas if its density is 2.95×10^{-3} g/ml at STP?

$$2.95 \times 10^{-3} g/ml \times \frac{1ml}{10^{-3}} \times \frac{22.4L}{1mol} = 66.1 \text{ g/mol}$$

Answer _____

10] Calculate the number of grams of 32 L of ethane, C_2H_6, at -12.5^{o}C and 695 mm Hg pressure.

$$P = 695mm \times \frac{1atm}{760mm} = 0.914 \text{ atm}$$

$$n_{C_2H_6} = \frac{(0.914 \text{ atm}) \times (32L)}{(0.0821 \frac{L\text{-}atm}{mol\text{-}K}) \times (273 - 12.5)K} = 1.37 \text{ mol } C_2H_6$$

$$\text{grams } C_2H_6 = 1.37 \text{ mol} \times \frac{30.0g \ C_2H_6}{1mol} = 41.1 \text{ g } C_2H_6$$

Answer _____

11] 5.5 mol of a gas occupies 44 mls at 19 ^{o}C. What is the pressure of the system?

$$P = \frac{(5.5 \text{ mol}) \times (273 + 19)K \times (0.0821 \frac{L\text{-}atm}{mol\text{-}K})}{0.044L} = 3.0 \times 10^{3} \text{ atm}$$

Answer _____

12] What volume will a mixture of 6.00 moles of argon gas and 5.00 moles of nitrogen gas occupy at 45^{o}C and 0.798 atm?

$$V = \frac{(11.00 \text{ mol gas}) \times (273 + 45)K \times (0.0821 \frac{L\text{-}atm}{mol\text{-}K})}{0.798 \text{ atm}} = 3.60 \times 10^{2} \text{ L}$$

Answer _____

13] What is the density of chlorine gas at 1.0 atm and 0 ^{o}C?

$$\text{Density}_{Cl_2} = \frac{70.1g \ Cl_2}{mol} \times \frac{1mol}{22.4L} = 3.13 \text{ g/L}$$

Answer _____

14] What is the molar mass of a gas if 1.15 g occupies 0.125 L at 1.62 atm and 31^{o}C

$$n_{gas} = \frac{(1.62atm) \times (0.125L)}{(0.0821 \frac{L\text{-}atm}{mol\text{-}K}) \times (273 + 31)K} = 8.11 \times 10^{-3} \text{ mol gas}$$

$$MM_{gas} = \frac{1.15g}{8.11 \times 10^{-3} mol} = 142 \text{ g/mol}$$

Answer _____