

PSKEY #9 CHEM 111 Gas Laws
Additional Problems

- How many moles of $O_2(g)$ is present, if it is trapped in a 550 mL container at $25.0^\circ C$ and a pressure of 750 mmHg?
- A tank of He gas has a volume of 15.0 L and is pressurized to 10.0 atm at $30^\circ C$. What volume would a balloon be if it were to contain all this gas at 755 mmHg at $22^\circ C$?
- What is the density of O_2 gas at $25^\circ C$ and 750 mmHg?
- Fill in the missing quantity:

To be worked in class.

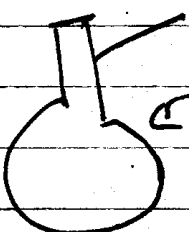
$T = 273 K, P = 1 \text{ atm}$

Sam ple No	Pressure P	Volume V	Number of moles n (mol)	Temp.. T	Mass g	Molar Mass (g/mol)	Density g/L	Volume this Sample would have at STP
1	1.00 atm	1.11 L	4.45×10^{-2}	$25.0^\circ C$	2.00 g	44.0	1.80	1.02 L
2	0.547 atm	3.00 L	0.0500	400.0 K	7.30 g	146	2.43	1.12 L
3	1.57 atm	1.00 L	0.0700	$0.00^\circ C$	6.44 g	92.0	2.87	1.57 L
4	608 torr	7.00 L	0.223	306 K	14.3 g	64.0	2.04	5.00 L
5	380 torr	15.0 L	0.307	298 K	1.23 g	4.00	0.082	6.88 L

- A volume of 2.0 L of He at $46^\circ C$, and 1.2 atm pressure, was added to a vessel that contained 4.5 L of N_2 at STP. Assume final volume = 4.5 L and final Temp = 273 K)
 - Calculate the **total pressure** of the gas mixture ~~at STP~~ after the He was added.
 - Calculate the **partial pressure** of each gas in the mixture.
 - Calculate the **moles** of each gas in the mixture.
 - Calculate the **mole fraction** of each gas in the mixture.

(see attached page.)

* Your answers may differ in the last digit depending on rounding!

#5  4.5 L container at 273 K, N_2 at 1 atm
 add 2.0 L He originally at 46°C (319 K)
 and 1.2 atm.

First find moles of each: $n = PV/RT$

$$n_{He} = \frac{(1.2 \text{ atm})(2.0 \text{ L})}{(0.0821 \text{ L atm}) / (\text{mole K}) (319 \text{ K})} = \boxed{0.0916 \text{ mole}} \text{ He}$$

$$n_{N_2} = \frac{(1.0 \text{ atm})(4.5 \text{ L})}{(0.0821 \text{ L atm}) / (\text{mole K}) (273 \text{ K})} = \boxed{0.2008 \text{ mole}} \text{ } N_2$$

$$n_{\text{TOTAL}} = \underline{\underline{0.2924 \text{ mole}}}$$

a)
$$P_{\text{Total}} = \frac{n_{\text{TOTAL}} RT}{V} = \frac{(0.2924 \text{ mole})(0.0821 \text{ L atm}) / (\text{mole K}) (273 \text{ K})}{4.50 \text{ L}} = \boxed{1.456 \text{ atm}}$$

T (final)

b)
$$P_{He} = \frac{n_{He} RT}{V} = \frac{0.0916 \text{ mol} (0.0821 \text{ L atm}) / (\text{mole K}) (273 \text{ K})}{4.5 \text{ L}} =$$

$$P_{He} = 0.456 \text{ atm}$$

$$P_{N_2} = \frac{n_{N_2} RT}{V} = \frac{(0.2008)(0.0821)(273)}{(4.5)} = \boxed{1.00 \text{ atm}}$$

Note $P_T = P_{He} + P_{N_2}$

5 continued.

$$c.) n_{\text{He}} = \cancel{0.0916} 0.0916 \text{ mole}$$

$$n_{\text{N}_2} = 0.2008 \text{ mole}$$

see above!

$$d. X_{\text{He}} = \frac{n_{\text{He}}}{n_{\text{T}}} \quad \text{or} \quad \frac{P_{\text{He}}}{P_{\text{T}}}$$

$$= \frac{0.0916}{0.2924} = \boxed{0.313}$$

$$X_{\text{N}_2} = \frac{n_{\text{N}_2}}{n_{\text{T}}} \quad \text{or} \quad \frac{P_{\text{N}_2}}{P_{\text{T}}}$$

$$= \frac{0.2008}{0.2924} = \boxed{0.687}$$

Note: $X_{\text{He}} + X_{\text{N}_2} = 1$