CHM151 Quiz5b 25 Pts Spring 2015 Name: Key

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$\frac{P_1V_1}{T_1} = \frac{P_2V_2}{T_2}$ $P_1V_1T_2 = P_2V_2T_1$ $PV = nRT$ $R = \frac{62.37 L\cdot Torr}{mol\cdot K} = \frac{0.0821 L\cdot atm}{mol\cdot K} = \frac{8.314 J}{mol\cdot K}$

Molar masses: He = 4.00, K = 39.01, Mn = 54.94, O = 16.00, S = 32.06

1. (4 Pts) A mixture of three gases has a total pressure of 1,380 mmHg at 298 K. The mixture is analyzed and is found to contain 2.27 mol CO_2, 3.04 mol CO, and 2.50 mol Ar. What is the partial pressure of Ar?

$\frac{2.50}{(2.27 + 3.04 + 2.50)} \times 1380 \text{ mmHg} = 442 \text{ mm Hg}$

2. (5 Pts) Calculate the density of SO_2 gas, in grams per liter, at 65°C and 1.5 atm.

Density = g ÷ L
P = 1.5 atm
V = ?
n = use 1 mol (SO_2 = 64.06 g)
R = $0.0821 \frac{L\cdot atm}{mol\cdot K}$
T = 65 + 273 = 338K

$V = \frac{nRT}{P} = \frac{(1 mol)(0.0821 \frac{L\cdot atm}{mol\cdot K})(338 K)}{(1.5 atm)}$

V = 18.5 L

$\text{Density} = \frac{64.06 g}{18.5 L} = 3.46 \frac{g}{L}$

3. (3 Pts) A spacecraft is filled with 0.500 atm of O_2 and 0.500 atm of He. If there is a very small hole in the side of this craft such that gas is lost slowly into outer space,

A) He is lost 2.8 times faster than O_2 is lost.
B) He is lost 8 times faster than O_2 is lost.
C) He is lost twice as fast as O_2 is lost.
D) O_2 is lost 2.8 times faster than He is lost.
E) O_2 is lost 2.8 times faster than He is lost.

$\frac{r_{1\,He}}{r_{2\,O_2}} = \sqrt{\frac{M_{2\,O_2}}{M_{1\,He}}}$

$2.8 = \sqrt{\frac{32}{4}}$

4. (4 Pts) The following data describes an initial and final state for an ideal gas. Given that the amount of gas does not change in the process, what is the final temperature (°C) of the gas?

	P	V	T
initial:	1.10 atm	1.30 L	25 °C
final:	1.25 atm	1.30 L	?

$T_2 = \frac{1.25 atm (298 K)}{1.10 atm} = 339 K$

66 °C

5. (5 Pts) A convenient way to produce very high purity oxygen in the laboratory is to decompose $KMnO_4(s)$ at high temperature according to the following chemical equation:

$2KMnO_4(s) \rightarrow K_2MnO_4(s) + MnO_2(s) + O_2(g)$

If 3.50 L of $O_2(g)$ is needed at 1.00 atm and 20.°C, what mass (in grams) of $KMnO_4(s)$ should be decomposed? Assume the decomposition of $KMnO_4(s)$ goes to completion.

1st: $n = \frac{PV}{RT} = \frac{(1.00 atm)(3.50 L)}{(293 K)} \frac{mol\cdot K}{(0.0821 L\cdot atm)} = 0.145 \text{ moles } O_2$

then: $0.145 \text{ mol } O_2 \left| \frac{2 \text{ mol } KMnO_4}{1 \text{ mol } O_2} \right| \frac{157.95 g\ KMnO_4}{mol\ KMnO_4} = 45.96 g\ KMnO_4$

6. (4 Pts) The following data describes an initial and final state for an ideal gas. Given that the amount of gas does not change in the process, what was the initial volume (L) of the gas?

	P	V	T
initial:	830 mmHg	?	35 °C
final:	720 mmHg	1.2 L	58 °C

$V = \frac{(720 mmHg)(1.2 L)(35+273 K)}{(830 mmHg)(58+273 K)} = 0.97 L$