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CHM151 Quiz 5a 25 Pts Fall 2014 Name: Key

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R = 62.4 L·torr/mol·K R = 0.0821 L·atm/mol·K PV = nRT $P_1V_1T_2 = P_2V_2T_1$

1 (5 Pts) Calculate the number of moles of gas contained in a 10.0 L tank at 22°C and 105 atm.

$PV = nRT$

$n = \frac{PV}{RT}$

$n = \frac{(105\ atm)(10.0\ L)}{} \cdot \frac{mol \cdot K}{0.0821\ L \cdot atm} \cdot \frac{}{295\ K} = 43.4\ moles$

2 (5 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
(1) initial:	1.10 atm	1.30 L	25 °C → 298 K
(2) final:	1.25 atm	1.30 L	?

$T_2 = \frac{P_2 V_2 T_1}{P_1 V_1} = \frac{(1.25\ atm)(1.30\ L)(298\ K)}{(1.10\ atm)(1.30\ L)} = 339\ K$

$-273\ K$

$66\ °C$

3 (5 Pts) A gas-filled balloon with a volume of 12.5 L at 0.90 atm and 21°C is allowed to rise to the stratosphere where the temperature is –5°C and the pressure is 0.75 atm. What is the final volume of the balloon in Liters?

$P_1 = 0.90\ atm$ $P_2 = 0.75\ atm$

$V_1 = 12.5\ L$ $V_2 = ?$

$T_1 = 294\ K$ $T_2 = 268\ K$

$V_2 = \frac{P_1 V_1 T_2}{P_2 T_1}$

$V_2 = \frac{(0.90\ atm)(12.5\ L)(268\ K)}{(0.75\ atm)(294\ K)} = 13.7\ L$

14 L

4 (5 Pts) Calculate the density of SO_2 gas, in grams per liter, at 55°C and 1.5 atm. (**Molar masses: S 32.06, O 16.00**)

$D = g \div L$ $PV = nRT$

$P = 1.5\ atm$

$V =$

$n = 1\ mol\ (64.06\ g)$

$R = 0.0821\ L \cdot atm/mol \cdot K$

$T = 328\ K$

$V = \frac{(1\ mol)(0.0821\ L \cdot atm)(328\ K)}{(mol \cdot K)(1.5\ atm)} = 17.95\ L$

$\frac{64.06\ g}{17.95\ L} = 3.57\ g/L$

3.6 g/L

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 2.50 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. (Molar Masses: K 39.01, Mn 54.94, O 16.00)

$n = \frac{PV}{RT} = \frac{(1.00\ atm)(2.50\ L)}{} \cdot \frac{mol \cdot K}{0.0821\ L \cdot atm} \cdot \frac{}{293\ K} = 0.104\ mol\ O_2$

$\frac{0.104\ mol\ O_2}{} \cdot \frac{2\ mol\ KMnO_4}{1\ mol\ O_2} \cdot \frac{157.95\ g\ KMnO_4}{mol\ KMnO_4} = 32.9\ g\ KMnO_4$