CHM151 Quiz 4 25 Pts Fall 2016 Name: Key

Show all work to receive credit. $P_1V_1T_2 = P_2V_2T_1$ $PV = nRT$ $\frac{P_1V_1}{T_1} = \frac{P_2V_2}{T_2}$

$R = 0.0821 L \cdot atm/mol \cdot K = 62.4 L \cdot torr/mol \cdot K$ Molar masses: C 12.01, H 1.008, N 14.01

1. (5 Pts) A sample of a gas occupies 1.40×10^3 mL at 25°C and 760 mmHg. What volume will it occupy at the same temperature and 380 mmHg?

$P_1 V_1 T_2 = P_2 V_2 T_1$

$V_2 = \frac{P_1 V_1}{P_2} = \frac{(760\ mmHg)(1.40 \times 10^3\ mL)}{(380\ mmHg)} = 2800\ mL$ or $2.8\ L$

2. (5 Pts) Calculate the volume occupied by 35.2 g of methane gas (CH_4) at 25°C and 1.0 atm. R = 0.08206 L·atm/K·mol.

$35.2\ g\ CH_4 \left| \frac{mol}{16.04\ g} \right. = 2.195\ mol$

$PV = nRT$

$V = \frac{nRT}{P} = \frac{(2.195\ mol)(0.08206\ L \cdot atm/mol \cdot K)(298\ K)}{1.0\ atm} = 53.7\ L$

3. (5 Pts) Calculate the density, in g/L, of N_2 gas at 35°C and 0.98 atm pressure.

$PV = nRT$

$P = 0.98\ atm$

$V =$

Assume $n = 1\ mol\ (28.02\ g\ N_2)$

$R = 0.0821 \frac{L \cdot atm}{mol \cdot K}$

$T = 308\ K$

$V = \frac{nRT}{P} = \frac{(1\ mol)(0.0821\ L \cdot atm/mol \cdot K)(308\ K)}{(0.98\ atm)} = 25.8\ L$

$Density = \frac{28.02\ g}{25.8\ L} = 1.09\ g/L$

4. (4 Pts) Determine the oxidation number of each of the elements in $BaNaPO_4$?

$\underset{Ba}{(+2)} + \underset{Na}{(+1)} + \underset{P}{?} + \underset{O}{(4)(-2)} = 0$ $P = +5$

Ba +2 Na +1 O −2

5. (4 Pts) At what temperature will a sample of nitrogen gas with a volume of 328 mL at 15°C and 748 mmHg occupy a volume of 0.898 L at a pressure of 642 mm Hg? Assume the amount of the nitrogen gas does not change.

$P_1 V_1 T_2 = P_2 V_2 T_1$

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

$T_2 = \frac{(642\ mmHg)(0.898\ L)(288\ K)}{(748\ mmHg)(0.328\ L)}$

$T_2 = 677\ K$ or $404\ °C$

6. (2 Pts) Under what temperature and pressure conditions (high or low for each) does the ideal gas law fail?

The ideal gas law breaks down as gas approaches the liquid state.

High Pressure

Low Temperature