CHM151 Quiz 5 25 Pts Fall 2017 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, O 16.00

1. (5 Pts) A sample of a gas occupies 1.70×10^3 mL at 25°C and 760 mmHg. What volume will it occupy at the same temperature and 480 mmHg?

$P_1V_1 \cancel{T_2} = P_2V_2 \cancel{T_2}$ cancel T's

$(760\ mm\ Hg)(1.70 \times 10^3\ mL) = (480\ mm\ Hg)\ V_2$

$V_2 = 2695\ mL$

2. (5 Pts) Calculate the volume occupied by 35.2 g of CO_2 gas at 25°C and 1.1 atm. R = 0.08206 L·atm/K·mol. $PV = nRT$

$n = 35.2\ g \left| \frac{mol}{44.01\ g} \right. = 0.7998\ mol$

$V = \frac{(0.7998\ mol)(0.08206\ L \cdot atm)(298\ K)}{mol \cdot K\ (1.1\ atm)}$

$V = 17.78\ L$

3. (5 Pts) Calculate the density, in g/L, of N_2 gas at 45°C and 0.95 atm pressure.

Density = g/L

use 1 mol N_2 = 28.02 g

$V = \frac{nRT}{P} = \frac{(1\ mol)(0.0821\ L \cdot atm)(318\ K)}{(mol \cdot K)\ (0.95\ atm)}$

$V = 27.48\ L$

$Density = \frac{28.02\ g}{27.48\ L} = 1.029\ g/L$

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

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

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.

$P_1V_1 \cancel{T_2} = P_2V_2 T_2$

$(748\ mm\ Hg)(0.328\ L) T_2 = (642\ mm\ Hg)(0.898\ L)(288\ K)$

$T_2 = 676.8\ K$ or $403.8\ °C$

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

Low temperature (as gas approaches liquid state)

high pressure

CHM151 Quiz 5B 25 Pts Fall 2017 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, O 16.00

1. (5 Pts) A sample of a gas occupies 1.70×10^3 mL at 25°C and 760 mmHg. What volume will it occupy at the same temperature and 580 mmHg?

$P_1V_1T_2 = P_2V_2T_1$ cancel T's

$(760 mm Hg)(1.70 \times 10^3 mL) = (580 mm Hg)(V_2)$

$V_2 = 2227 mL$

2. (5 Pts) Calculate the volume occupied by 45.2 g of CO_2 gas at 25°C and 1.1 atm. R = 0.08206 L·atm/K·mol.

$PV = nRT$

$n = \frac{45.2 g}{44.01 g/mol} = 1.027 mol CO_2$

$V = \frac{(1.027 mol)(0.08206 L \cdot atm / mol \cdot K)(298 K)}{(1.1 atm)}$

$V = 22.8 L$

3. (5 Pts) Calculate the density, in g/L, of N_2 gas at 55°C and 0.95 atm pressure.

Density = g/L

use 1 mol N_2 = 28.02 g

$V = \frac{nRT}{P} = \frac{(1 mol)(0.0821 L \cdot atm / mol \cdot K)(328 K)}{(0.95 atm)}$

$V = 28.35 L$

$Density = \frac{28.02 g}{28.35 L} = 0.988 g/L$

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

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

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.

$P_1V_1T_2 = P_2V_2T_1$

$(748 mm Hg)(0.328 L)T_2 = (642 mm Hg)(0.898 L)(288 K)$

$T_2 = 676.8 K$ or $403.8 °C$

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

Low temp. (as gas approaches liquid state)

High pressure