19

Chemistry Exam Review Part III

Mole Concept and Stoichiometry

1. - In order to make 12.0 L of 0.250 M HCl
   a) How many moles must be used?

$$\frac{.25\text{mol}}{1\text{L}} = \frac{x\text{ mol}}{12\text{L}} \qquad 3\text{mol}$$

   b) How many molecules of HCl must be used?

$$\frac{3\text{mol HCl}}{1\text{mol}} \left| \frac{6.02\times10^{23}\text{ molecules}}{1\text{mol}} \right. = 1.81\times10^{24}\text{ molec.}$$

   c) How many grams of HCl must be used?

$$3\text{mol HCl} \left| \frac{36.5\text{g}}{1\text{mol}} \right. = 109.5\text{g HCl}$$

2. Given 44.8 L of O_2 at STP calculate $1\text{mol} = 22.4\text{L}$
   a) The number of moles

$$44.8\text{L} \left| \frac{1\text{mol}}{22.4\text{L}} \right. = 2\text{mol } O_2$$

   b) The mass in grams

$$2\text{mol } O_2 \left| \frac{32}{1\text{mol}} \right. = 64\text{g } O_2$$

   c) The number of molecules

$$2\text{mol} \left| \frac{6.02\times10^{23}}{} \right. = 1.2\times10^{24}\text{ molecules}$$

3. Given 73.0 g of hydrochloric acid and excess zinc, how many liters of hydrogen gas will form at STP?

$$2HCl + Zn \rightarrow ZnCl_2 + H_{2(g)}$$

$$73\text{g HCl} \left| \frac{1\text{mol HCl}}{36.5\text{g HCl}} \right| \frac{1\text{mol } H_2}{2\text{mol HCl}} \left| \frac{22.4\text{L } H_2}{1\text{mol } H_2} \right. = 22.4\text{L } H_2$$

4. What is the empirical formula for a compound that is 92.3% C and 7.7% H?

$$92.3\text{g C}/12\text{g} = 7.69 = 1 \qquad CH$$

$$7.7\text{g H}/1\text{g} = 7.7 = 1$$

5. What is the empirical formula for a compound that has 36.5 g of sodium, 25.4 g of sulfur, and 38.1 g of oxygen?

23	32.1	16
1.59/.791	.791/.791	2.38/.791
2	1	3

Na_2SO_3

6. What is the molecular formula for a compound with an empirical formula of CoC_4O_4 and the molecular weight 341.94 g/mol?

$$n = \frac{341.94}{170.9} = 2 \qquad Co_2C_8O_8$$

7. Determine the percent composition of tin in tin (IV) oxide.

SnO_2 $\quad \frac{118.7}{150.7}$

78.7%

Gas Laws

1. What is the volume (in liters) of a gas with the pressure of 0.980 atm, a temperature of 68°C, and 0.120 mol?

$$PV = nRT \qquad V = \frac{(.12\text{mol})(.0821\frac{\text{L·atm}}{\text{mol·K}})(341)}{.98\text{ atm}} = 3.43\text{ L}$$

2. How many grams of nitrogen dioxide are necessary to produce 0.119 mL of gas at -15°C and 500 kPa of pressure?

NO_2 $\quad .00127\text{g}$

$$n = \frac{(500\text{kPa})(.000119\text{L})}{(8.314\frac{\text{kPa·L}}{\text{mol·K}})(258)} \quad 2.77\times10^{-5}\text{mol}$$

1mol of gas = 22.4 L at STP

3. 43.5 L CO_2 = 1.94 mol CO_2

4. 8.23 g of NO = 6.15 L NO

$$\frac{8.23\text{g}}{30} \qquad .274\text{mol} \left| \frac{22.4\text{L}}{1\text{mol}} \right.$$

According to Avogadro's Law, the number of moles of gas are proportional to the volume of a gas. Therefore, as the number of moles ↑, the volume ↑.

If given 22.4 L = 1mole, then 44.8 L = 2 moles.

5. A scientist has a sample of gas collected several days ago. The final volume of the gas is 392 mL at a pressure of 0.977 atm and a temperature of 21°C. Its initial temperature was 13°C and had a pressure of 0.992 atm. What was the initial volume of the gas?

P_2 T_2 T_1 P_1 V_1

$$\frac{P_1V_1}{T_1} = \frac{P_2V_2}{T_2} \qquad V_1 = \frac{P_2V_2T_1}{T_2P_1} = \frac{(.977\text{atm})(392\text{mL})(286\text{K})}{294\text{K}(.992)} = 375.6\text{mL}$$

6. Oxygen gas is collected over water at a temperature of 10°C and a pressure of 1.02 atm. The volume of gas plus water vapor collected is 293 mL. ~~What volume of oxygen at STP was collected?~~ $\frac{1.02\text{atm}}{1} \left| \frac{760}{} \right.$ 775.2 mL

V_2 $\quad P_{H_2O} = 9.2$

$$P_{O_2} = 775.2 - 9.2 = 766$$

V_1

7. A sample of nitrogen gas is collected over water, yielding a total volume of 62.25 mL at a temperature of 22°C and a total pressure of 97.7 kPa. At what temperature will the nitrogen end at if the volume is 50.00 mL at the same pressure? $P_{H_2O} = 2.64\text{ kPa}$ $\quad P_{N_2} = 95.06\text{ kPa}$ $\quad P_2 = \frac{P_1V_1}{V_2} = \frac{95.06(62.25)}{50} = 11$

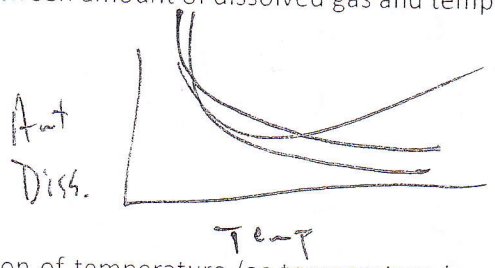
8. Dalton's law is defined as each individual gas pressure added together to give you the total pressure. The formula for Dalton's law is: $P_T = P_1 + P_2 + P_3$

9. Some chlorine gas is collected over water with a pressure of 153.5 kPa. The total pressure of the sample is 156.5 kPa. What is the pressure of the water vapor?

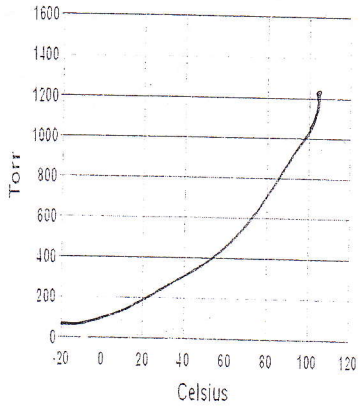
$P_{H_2O} = 3 kPa$

10. Does the solubility of a gas increase or decrease with temperature? decrease in liquid

11. Draw a graph and describe the relationship between amount of dissolved gas and temperature.



- Know that vapor pressure of water is a function of temperature (as temperature increases the vapor pressure increases)



There is a direct relationship between vapor pressure and temperature. As the temperature goes up, the vapor pressure goes up.