Problem Set 8: Partial Pressures and Kinetic Molecular Theory

HCHE 111L: Introduction to Elementary Inorganic Chemistry

Due Date: Friday October 27$^{\text{th}}$, 2017

Problem 1

a) Calculate the root mean square velocity of CH_4 at 273 K.

b) Calculate the root mean square velocity of N_2 at 546 K

c) Calculate the root mean sqaure velocity of UF_6 at 500 K

Problem 2

The partial pressure of $O_2(g)$ is 0.623 atm and that of $Ne(g)$ is 0.210 atm in a mixture of the two gases.

a) Calculate the mole fraction of each gas in the mixture

b) If the mixture occupies 20.3 L at 70°C, calculate the total number of moles of gas in the mixture.

c) Calculate the number of grams of each gas.

Problem 3

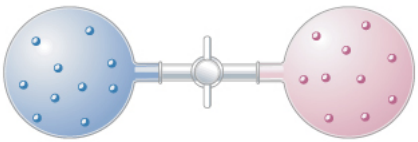
A study of the effects of certain gases on plant growth requires a synthetic atmosphere composed of 1.5 mol percent CO2, 18.0 mol percent O2, and 80.5 mol percent Ar.

a) Calculate the partial pressure of O2 in the mixture if the total pressure of the atmosphere is to be 745 torr.

b) If this atmosphere is to be held in a 120-L space at 295 K, how many moles of O2 are needed?

Problem 4

The figure below shows flasks connected by a stopcock such that the gases inside initially do not interact. The left side contains 2.00 L H_2 at a pressure of 360 torr and the right side contains 1.70 L of N_2 at an unknown pressure. If the total pressure in the flasks is 320 torr after the stopcock is opened, determine the initial pressure of N_2 in the 1.70 L flask



Problem 5

The density of an unknown gas is 2.3 g L^{-1} at STP. Calculate the root mean square velocity of this unknown gas.

Problem 6

A steel cylinder contains 5.00 moles of solid carbon ($C(s)$) and 5.00 moles of O_2 gas. The mixture is ignited and all the carbon reacts completely. This combustion produces a mixture of CO gas and CO_2 gas. The final gas mixture in the cylinder will include the two products as well as the excess O_2 that is left unreacted.

a) Write a balanced chemical equation to describe this process.

b) Determine the amount of O_2 left unreacted in the container.

c) Calculate the mole fractions of CO, CO_2, and O_2 left in the container.

d) The steel cylinder is originally at a pressure of 6.76 bar. After the ignition, the cylinder is cooled back down to its original temperature and the pressure is found to have dropped by 17%. Calculate the partial pressure of each of the gases in the mixture after this pressure drop.