Chem 1104 - 2018 Summer Problem Set #4

1. The pressure needed to make synthetic diamonds from graphite is 80,000 atm. Convert this pressure to a) kilobars, b) pascals, c) torr, d) cm Hg

2. Determine the final pressure when a) 1.0 mL of krypton at 105 kPa is transferred to a 1.0 L vessel; b) 30.0 cm^3 of $O_2(g)$ at 600. Torr is compressed to 5.0 cm^3. Assume constant temperature.

3. A chemist had prepared a sample of hydrogen bromide and found it occupied 255 mL at 85°C and 600 Torr.a) What volume would it occupy at 0.00°C at the same pressure? b) What volume would it occupy at STP?

4.a) A 100. mL flask contains argon at 1.3 atm and 77°C. What amount of Ar is present(in grams)?
b) A 120. mL flask contains 2.7 μg of O_2 at 17°C. What is the pressure in Torr?
c) A 16.7 g sample of krypton exerts a pressure of 100. mTorr at 44 °C. What is the volume of the container in litres?
d) A 6000. m^3 storage tank contains methane at 129 kPa and 15°C. What amount of CH_4 is present in kilograms?

5. Record the volume of a room in your home. Calculate the total number of gas molecules that are present in that room under normal ambient conditions of 728 mm Hg atm and 74°F. Assume the volume occupied by furniture and other items is negligible.

6. Nitroglycerin is a shock sensitive liquid that detonates by the reaction

$$4C_3H_5(NO_3)_3(l) \rightarrow 6N_2(g) + 10H_2O(g) + 12CO_2(g) + O_2(g)$$

Calculate the total volume of product gases at 150. kPa and 100.°C from the detonation of 1.00 g of nitroglycerin.

7. Urea, $CO(NH_2)_2$, is used as a fertilizer and is made by the reaction of ammonia and carbon dioxide:

$$CO_2(g) + 2NH_3(g) \rightarrow CO(NH_2)_2(s) + H_2O(g)$$

What volumes of CO_2 and NH_3 at 200. atm and 450°C are needed to produce 2.50 kg of urea?

8. A sample of gas with a mass of 21.3 g is confined to a vessel of volume 7.73 L at 0.880 atm and 30°C. a) What is the molar mass of the gas? b) What is the density of the gas at 1.00 atm and 298 K.

9. Calculate the partial pressure of each gas and the total pressure of the following mixtures, each of which occupies a 500. mL vessel at 0.00°C. a) 0.020 mol N_2 and 2.33 g of O_2, b) 0.015 mol H_2, 4.22 mg of He, and 0.030 mol NH_3.

10. Calculate the rms speeds of a) H_2 molecules at 0°C; b) Xe atoms at 25°C.

Answer Set for Chem 1104-2018 Summer Problem Set #4

1.a) 80 kbar, b) 8.1×10^{9} Pa, c) 6.1×10^{7} Torr, d) 6.1×10^{6} cm Hg

2.a) 1.0×10^{2} Pa; b) 3600 Torr

3.a) 194 mL, b) 154 mL

4.a) 0.180 g Ar, b) 1.3×10^{-2} Torr, c) 3.94×10^{4} L, d) 5190 kg

5. Answers will vary depending on the volume. Convert the volume to liters, pressure to 0.958 atm and the temperature to 296 K. Use the ideal gas law.

6. V = 0.660 L

7. 12.3 L CO_2, 24.7 L NH_3

8.a) 77.9 g/mole, b) 3.18 g/L

9.a) 0.90 atm N_2, 3.26 atm O_2, 4.16 atm total; b) 0.67 atm H_2, 1.3 atm NH_3, 0.047 atm He, 2.0 atm total.

10.a) 1.84×10^{3} m/s, b) 238 m/s