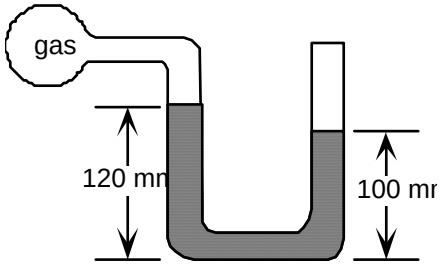
Introduction to Natural Science, Spring 2007
Chemistry Workshop – Week 2

1. A diagram of a manometer is shown below. What is the pressure of the gas inside the flask in mm Hg (the liquid in the manometer is mercury), psi, torr and Pascals?



2. How would you graphically represent Boyle's law, Charle's law, and Avogadro's hypothesis? If you can draw more than one graph for each law, include them all. What variables are held constant in each case?

3. The universal gas constant (R) is 0.08205 atm L K^{-1} mol^{-1}. Convert this to J K^{-1} mol^{-1} units and cal K^{-1} mol^{-1} units.

4. A balloon is filled to a volume of 7.00 x 10^2 mL at a temperature of 20 °C. It is then cooled at a constant pressure to a temperature of 1.00 x 10^2 K. what is the final volume of the balloon?

5. Consider the following chemical equation. $2\ NO_2\ (g) \rightarrow N_2O_4\ (g)$ If 25.0 mL of NO_2 gas is completely converted to N_2O_4 under STP conditions, what volume will the N_2O_4 gas occupy?

6. A gas sample containing 1.50 mol at 25 °C exerts a pressure of 400.0 torr. Some more gas is added to the same constant volume container and the temperature is increased to 50 °C. If the pressure increases to 800.0 torr, how many moles of gas were added to the container?

7. Consider the following reaction. $2\ Al\ (s) + 3\ O_2\ (g) \rightarrow 2\ Al_2O_3\ (s)$ It takes 2.00 L of pure oxygen gas at STP to react completely with a certain sample of aluminum. What is the mass of aluminum reacted?

8. Consider the reaction between 50.0 mL of liquid methyl alcohol, CH_3OH (density = 0.850 g/mL), and 22.8 L of O_2 at 27 °C and a pressure of 2.00 atm. The products of the reaction are CO_2 (g) and H_2O (g). Calculate the number of moles of H_2O formed if the reaction goes to completion.

9. Helium gas is collected over water at 25 °C and 1.00 atm total pressure. What total volume of gas must be collected to obtain 0.586 g of helium? (At 25 °C the vapor pressure of water is 23.8 torr).

10. Ammonia gas is prepared by the Bosch-Haber process according to the following reaction.

$$N_2\ (g) + 3\ H_2\ (g) \rightarrow 2\ NH_3\ (g)$$

If 3.00 L of N_2 gas at 0.98 atm was mixed with 5.00 L of H_2 gas at 1.25 atm at 25.0 °C and the resulting ammonia gas was collected at atmospheric pressure at the same temperature, how many liters of ammonia will be collected?