General Chemistry I
PLI #17
June 29, 2021

1. **A particular balloon is designed by its manufacturer to be inflated to a volume of no more than 2.50 L. If the balloon is filled with 2.00 L helium at sea level, is released, and rises to an altitude at which the atmospheric pressure is only 500. mm Hg, will the balloon burst?**

2. **A mixture of NH_3 (g) and N_2H_4 (g) is placed in a sealed container at 300 K. The total pressure is 0.50 atm. The container is heated to 1200 K at which time both substances decompose completely according to the following unbalanced equations:**

$$\boldsymbol{NH_3(g) \rightarrow N_2(g) + H_2(g)}$$

$$\boldsymbol{N_2H_4(g) \rightarrow N_2(g) + H_2(g)}$$

After decomposition is complete, the total pressure at 1200 K is found to be 4.5 atm. Find the percent of N_2H_4 (g) in the original mixture. Assume two significant figures for the temperature.

3. **5.00 g of solid calcium carbonate reacts with 100.0 mL of 0.200 M hydrochloric acid, represented by the following unbalanced equation.**

$$CaCO_3 + HCl \rightarrow CaCl_2 + H_2O + CO_2$$

What volume of carbon dioxide gas is produced at a pressure of 750.0 mm Hg and a temperature of 22.0°C?

4. **Using the molecular orbital model, describe the bonding, magnetism, and relative bond orders in the following species:**

O_2, O_2^-, O_2^{2-}

5. **A quantity of N_2 gas originally held at 5.25 atm pressure in a 1.00-L container at 26°C is transferred to a 12.5-L container at 20°C. A quantity of O_2 gas originally at 5.25 atm and 26°C in a 5.00-L container is transferred to this same container. What is the total pressure in the new container?**

6. **6.3 mg of a boron hydride is contained in a flask of 385 mL at 25.0°C and a pressure of 11 torr.**
    a. **Determine the molar mass of the hydride. (1 atm is equal to 760 torr)**

    b. **Which of the following hydrides is contained in the flask, BH_3, B_2H_6, or B_4H_{10}?**

7. Draw a likely spatial orientation of a single water molecule with a single molecule of NaCl