Chem 1310 Fall, 2004 T. F. Block

Quiz 5

Quizzes are not graded. The questions on this quiz are intended to illustrate the type of test questions that might be based on OFB, Chapter 5 (Gas Laws)

1. Which change should cause the greatest increase in the volume of a gas?
   a. raising the pressure on the gas from 340 torr to 770 torr (n, T fixed)
   b. increasing the temperature of the gas from 27 °C to 54 °C (n, P fixed)
   c. lowering the pressure on the gas from 1.00 atm to 480 torr (n, T fixed)
   d. introducing 0.10 mol of extra gas into a container that already contains 2.0 mol of gas (P, T fixed)

   b. since V ∝ kT
      \[ \frac{2.73 + 54}{770} = \frac{3.28}{300} \approx 1.07 \]

   c. since V ∝ kT
      \[ \frac{760}{480} \approx 1.587 \]

   d. since V ∝ kT
      \[ \frac{2.1}{3} \approx 0.7 \]

2. Which contains the smallest mass of oxygen?
   a. 44.8 mL of ozone, O₃, measured at STP
      \[ 2 \text{ mmol } O_3 \Rightarrow 6 \text{ mmol } O \]
   b. 50.0 mL of liquid water
      \[ 50 \text{ g H}_2O \Rightarrow 3 \text{ mmol } O \]
   c. 100.0 mL water vapor (at 373 °C and 2.00 atm)
      \[ 1 \text{ mmol } O \]
   d. 0.00 μL of elemental oxygen (30 K and 1520 torr)
      \[ 1 \text{ mmol } \text{ occupies } 22.4 \text{ mL } \left( \frac{64 \text{ g K}}{273 \text{ K}} \right) \text{ under these conditions} \]

   d. \[ 6 \times 10^{-6} \text{ L } \Rightarrow 1 \text{ mmol } \]

3. Which statement is true?
   a. All samples of gas contain approximately the same mass of gas at STP.
   b. There are more oxygen atoms contained in 22.4 L of ozone than in 22.4 L of oxygen gas (both volumes measured under the same conditions of T and P).
   c. Heavy gas particles, such as SF₆ molecules, exert more pressure on the walls of their containers than do light particles, such as neon atoms. More force per impact, but fewer.
   d. Particles in gases are closer to each other, on the average, than they would be in the liquid or solid phase. Much farther apart, most of time in empty space.

   \[ \text{Ozone } O_3 \text{ (see above) versus oxygen } O_2 \]
4. What volume of dry carbon dioxide should be produced in the complete combustion of 144 mg of pentane, C₅H₁₂? \( \text{f} = 27 \degree \text{C and P = 1.0 atm} \)  
\[ \text{C}_5\text{H}_{12} + \text{8 O}_2 \rightarrow \text{5 CO}_2 + \text{6 H}_2\text{O} \]  
\[ 144 \text{ mg } \quad \rightarrow \quad 10.0 \text{ mmol CO}_2 \rightarrow \quad 2.24 \text{ mL at STP} \]

5. What is the total pressure exerted by 70.9 g of chlorine (g), 40.0 g of argon (g), and 28.0 g of nitrogen (g) when all three are confined to a 44.8 L flask at a temperature of 273 °C?

\[ \begin{align*} 
\text{a. } & \text{1.50 atm} \\
\text{b. } & \text{3.00 atm} \\
\text{c. } & \text{2.50 atm} \\
\text{d. } & \text{5.00 atm} \end{align*} \]

\[ P(44.8 \text{ L}) = \left[ \frac{? \text{ mmol}}{0.082 \text{ L atm/mol K}} \right] \]

6. What is the partial pressure of the argon gas described in Question 5?

\[ \begin{align*} 
\text{a. } & \text{1.00 atm} \\
\text{b. } & \text{0.500 atm} \\
\text{c. } & \text{1.67 atm} \\
\text{d. } & \text{0.600 atm} \end{align*} \]

\[ \frac{1.00 \text{ mmol Ar}}{3.00 \text{ mmol total}} = 0.33 \]

\[ P_{\text{Ar}} = \frac{X_{\text{Ar}}}{X_{\text{Ar}} + X_{\text{other}}} \]