Lesson 15: Gas Laws

text: 179-200

what to know:
- nature of the gaseous state and examples of common gases, §5-1
- concept of pressure and methods of measuring and expressing it, §5-2
- relationships of the variables, P, T, V and n, §5-3
- derivation and use of the ideal gas law, §5-4
- concept of standard T and P, §5-2
- relationship of the density of a gas to P and T, §5-4
- stoichiometry of gaseous reactions, §5-5
- how an air bag works, p-181

questions:

1. Which elements exist as gases under normal atmospheric conditions? Li, B, Cl, S, Kr, Br, H, C, U, He.
2. If a balloon rises in the air, would its volume increase, decrease or remain the same if the T remained constant?
3. Does the pressure inside a basketball increase, decrease or remain the same when its temperature is increased?
4. Is the density of SO\textsubscript{2} greater than, smaller than or the same as that of SO\textsubscript{3} at the same T, P and moles of gas?
5. Explain why the density of HBr gas will be less at 733 mm Hg and 46 °C than at STP.
6. Which of the following statements are true?
   a. When the pressure of a gas is doubled at constant T and n, the volume is doubled.
   b. When the pressure of a gas is doubled at constant V and n, the temperature is doubled.
   c. When the pressure of a gas is doubled at constant V and T, the number of moles of gas is doubled.
   d. When the temperature of a gas is halved at constant P and n, the volume of a gas is halved.
   e. When the T of a gas is halved at constant P and V, the number of moles of gas is halved.
   f. When the volume of a gas is tripled at constant P and T, the number of moles of gas is tripled.
   g. Pressure is properly expressed in lb/in\textsuperscript{3}.
   h. The density of a gas is inversely related to its molecular weight at any given P and T.
   i. 16 g of O\textsubscript{2}(32) in a 10.0 L container will have the same pressure as 14 g of N\textsubscript{2}(28) in a 10.0 L container at constant T.
   j. When a gas sample is heated from 100 °C to 200 °C, its volume will double at constant P.
   k. 0.125 moles of a gas will occupy 2.80 L at a pressure of 1520 atm and 273 °C.
   l. If 20.0 g of a gas occupies 5.60 L at STP, its molar mass is 80.
   m. When a balloon filled with air is heated, the density of the air is increased.
   n. According to the balanced equation, N\textsubscript{2} + 3H\textsubscript{2} \rightarrow 2NH\textsubscript{3}, 6.0 L of N\textsubscript{2} would react with 18.0 L of H\textsubscript{2} if both gases are at the same T and P.
   o. 2.0 moles of O\textsubscript{2}(32) and 2.0 moles of H\textsubscript{2}(2) will each occupy the same V at constant T and P.
7. If the density of a gas is 4.87 g/L at 1.50 atm and 27.0 °C, what is the molar mass of the gas?
8. What volume would 2.20 g of CO\textsubscript{2} (44.0 g/mole) occupy at 380 torr and 27.0 °C?
9. Given the equation, N\textsubscript{2}(g) + 3H\textsubscript{2}(g) \rightarrow 2NH\textsubscript{3}(g)
   a. How many L of N\textsubscript{2} at STP would be required to produce 10.0 L of ammonia under the same conditions of P and T?
   b. How many grams of H\textsubscript{2}(2.0) would be required to react with 2.00 L of N\textsubscript{2}(g) at a pressure of 152 mm Hg and a T of 27 °C?
10. If a balloon contains 0.50 moles of a gas with a volume of V L, a pressure of P atm, and 27.0 °C, what would the temperature have to be so that 0.60 moles of the same gas would have the same V and P?
11. What is the pressure of the air in a tire if its gauge pressure is 28.0 psi?