

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, §5-2, §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_2 greater than, smaller than or the same as that of SO_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^3 .
 - h. The density of a gas is inversely related to its molecular weight at any given P and T.
 - i. 16 g of $\text{O}_2(32)$ in a 10.0 L container will have the same pressure as 14 g of $\text{N}_2(28)$ in a 10.0 L container at constant T.
 - ii.
 - 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, $\text{N}_2 + 3\text{H}_2 \rightleftharpoons 2\text{NH}_3$, 6.0 L of N_2 would react with 18.0 L of H_2 if both gases are at the same T and P.
 - o. 2.0 moles of $\text{O}_2(32)$ and 2.0 moles of $\text{H}_2(2)$ 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 $\text{CO}_2(44.0 \text{ g/mole})$ occupy at 380 torr and 27.0°C ?
9. Given the equation, $\text{N}_2(\text{g}) + 3\text{H}_2(\text{g}) \rightleftharpoons 2\text{NH}_3(\text{g})$
 - a. How many L of N_2 at STP would be required to produce 10.0 L of ammonia under the same
 - b. conditions of P and T?
 - c. How many grams of $\text{H}_2(2.0)$ would be required to react with 2.00 L of $\text{N}_2(\text{g})$ at a pressure of 152
 - d. 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?