Honors Chemistry

Chapter 5 Study Questions

NOTE: Vapor Pressure of Water Chart is on the back of this page.

1. A sample of air collected at STP contains 0.039 moles of N_2, 0.010 moles of O_2, and 0.001 moles of Ar. (Assume no other gases are present.)
   a) Find the partial pressure of O_2.
   b) What is the volume of the container?

2. A sample of hydrogen gas (H_2) is collected over water at 19°C.
   a) What are the partial pressures of H_2 and water vapor if the total pressure is 756 mm Hg?
   b) What is the partial pressure of hydrogen gas in atmospheres?

3. If 600**.** cm^3 of H_2 at 25°C and 750**.** mm Hg is compressed to a volume of 480**.** cm^3 at 41°C, what does the pressure become?

4. Find the density of helium gas at STP.

5. a) Write a balanced chemical equation for the reaction of butane gas with oxygen gas to form carbon dioxide and water vapor.
   b) How many liters of oxygen are required to produce 2.0 liters of CO_2?
   c) How many liters of CO_2 are produced from 11.6 g of butane at STP?
   d) How many molecules of water vapor are produced from 5.6 liters of butane gas at STP?

6. Find the molar volume of a gas at 68°C and 2.00 atmospheres pressure.

7. How many liters of methane are there in 8.00 grams at STP?

8. Calculate the density of carbon dioxide at 546 K and 4.00 atmospheres pressure.

9. What volume of O_2 at 710**.** mm Hg pressure and 36°C is required to react with 6.52 g of CuS?

$$CuS(s) + 2\,O_2(g) \rightarrow CuSO_4(s)$$

10. What is the molar mass of a gas if 7.00 grams occupy 6.20 liters at 29°C and 760**.** mm Hg pressure?

11. At a particular temperature and pressure, 15.0 g of CO_2 occupy 7.16 liters. What is the volume of 12.0 g of CH_4 at the same temperature and pressure?

12. To prepare a sample of hydrogen gas, a student reacts 7.78 grams of zinc with acid:

$$Zn(s) + 2\,H^+(aq) \rightarrow Zn^{2+}(aq) + H_2(g)$$

The hydrogen is collected over water at 22°C and the total pressure of gas collected is 750**.** mm Hg. What is the partial pressure of H_2? What volume of wet hydrogen gas is collected?

Summary of Chapter 5: Gases

Kinetic-molecular theory
- pressure
  - barometer, manometer
- temperature

absolute zero temperature
relationship between pressure, volume, temperature
- Boyle's Law
- Charles' Law

Ideal Gas Law
R = 0.08206 L atm/mol K
molar volume
STP
molar volume @ STP = 22.4 L
molar mass and density of a gas
gas stoichiometry
partial pressure

formulas:

$P_{total} = P_x + P_y + \ldots$

$$\frac{P_1V_1}{T_1} = \frac{P_2V_2}{T_2}$$

$PV = nRT$

$$d = \frac{mm}{mV}$$

$$P_1 = \left(\frac{n_1}{n_T}\right) P_T$$

Vapor Pressure of Water

Temp (°C)	15	16	17	18	19	20	21	22	23	24	25
P_{H_2O}(mm Hg)	13	14	15	15	16	18	19	20	21	22	24