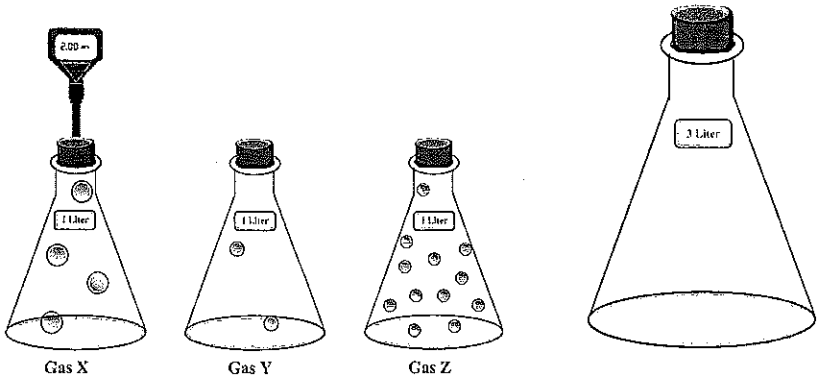
AP Chemistry - Unit 3 - Gases - TEST

Question 1 and 2 refer to the following Scenario



1. Equal masses of three different idea gases, X, Y, and Z are mixed in a sealed rigid container. If the temperature of the system remains constant, which of the following statements about the partial pressure of gas X is correct?

    a. It is equal to 1/3 the total pressure
    b. It depends on the intermolecular forces of attraction between molecules of X, Y, and Z
    c. It depends on the relative molecular masses of X, Y, and Z
    d. It depends on the average distance traveled between molecular collisions

2. Each one liter flask pictured above is sealed and contains a different noble gas at 298K. The pressure of Gas X in the first flask is 2.0 atm. The ratio of the numbers of X, Y, and Z atoms in the flasks is 2:1:6, respectively. A student then combines all the gases into a previously evacuated 3.0 L flask. What is the total pressure of the gases in 298 k?

    a. 3.0 atm
    b. 4.5 atm
    c. 9.0 atm
    d. 18 atm

3. The density of an unknown gas is 2.00 grams per liter at 3.00 atmopsheres pressure and 127°C. What is the molecular mass of this gas?

    a. 254/3 R
    b. 188 R
    c. 800/3 R
    d. 800 R

4. A sample of 3.0 grams of an ideal gas at 127°C and 1.0 atm has a volume of 1.5 liters. Which of the following expressions is correct for the molar mass of the gas? The ideal gas constant R = 0.08 (L atm)/(mole K)

   a. $\frac{(0.08)(400)}{(3.0)(1.0)(1.5)}$

   b. $\frac{(1.0)(1.5)}{(3.0)(0.08)(400)}$

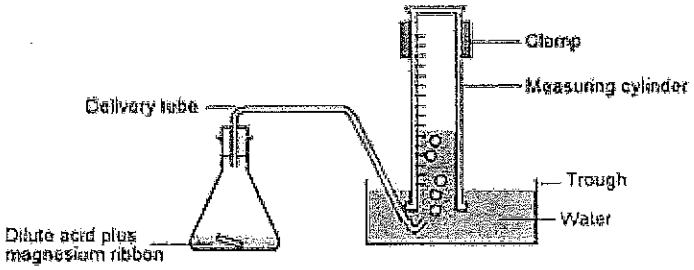
   c. $\frac{(3.0)(0.08)(400)}{(1.0)(1.5)}$

   d. $\frac{(3.0)(0.08)(1.5)}{(1.0)(400)}$

5. Each of the following pure substances are gases at 25°C and 1 atm. Which of the following is the slowest to effuse through a small opening?

   a. NH_4
   b. BH_3
   c. H_2S
   d. HBr

Questions 6 and 7 refer to the following lab experiment



A piece of magnesium ribbons is massed and placed into a sealed flask containing dilute HCl as shown above. Once the reaction is complete, the tube is adjusted so that the water in the tube is level with the water in the trough and the volume of gas is recorded at 25.50 mL. The atmospheric pressure in the room is recorded as 765.5 mm Hg at a temperature of 23°C.

Vapor Pressure of H_2O			
20°C	17.5 mm Hg	23°C	21.1 mm Hg
21°C	18.7 mm Hg	24°C	22.4 mm Hg
22°C	19.8 mm Hg	25°C	23.8 mm Hg

6. What is the pressure of the dry hydrogen gas collected at 23.0°C
   a. 723.3 mm Hg
   b. 744.4 mm Hg
   c. 765.5 mm Hg
   d. 786.6 mm Hg

7. What is the purpose of adjusting the gas measuring tube up or down while still in the trough until the water level inside the tube is even with the water level in the trough?

   a. To contain gas molecules within the tube
   b. To determine the volume of the gas at the experimental temperature
   c. To decrease the amount of evaporation of water molecules within the tube
   d. To be certain that the pressure of the H_2 gas within the tube is equal to barometric pressure

8. Samples of F_2 gas and Xe gas are mixed in a container of fixed volume. The initial partial pressure of the F_2 gas is 8.0 atm and that of the Xe gas is 1.7 atm. When all of the Xe gas reacted, forming a solid compound, the pressure of the unreacted F_2 gas was 4.6 atm. The temperature remained constant. What is the formula of the compound?

   a. XeF
   b. XeF_4
   c. XeF_6
   d. XeF_8

9. A rigid metal tank contains oxygen gas. Which of the following applies to the gas in the tank when additional oxygen is added at constant temperature?

   a. The volume of the gas increase
   b. The pressure of the gas decreases
   c. The average speed of the gas molecules remains the same
   d. The total number of gas molecules remains the same

10. Equal numbers of moles of $He_{(g)}$, $Ar_{(g)}$, and $Ne_{(g)}$ are placed in a glass vessel at room temperature. If the vessel has pinhole-sized leak, which of the following will be true regarding the relative values of the partial pressures of the gases remaining in the vessel after some of the gas mixture has effused?

    a. $P_{He} < P_{Ne} < P_{Ar}$
    b. $P_{He} < P_{Ar} < P_{Ne}$
    c. $P_{Ne} < P_{Ar} < P_{He}$
    d. $P_{Ar} < P_{He} < P_{Ne}$

Questions 11 and 12 refer to the following gas contained in identical rigid cylinders under the conditions given in the table below

Container	A	B	C
Gas	Methane	Ethane	Butane
Chemical Formula	CH4	C2H6	C4H10
Molar Mass (g/mol)	16	30	58
Temperature (°C)	25	25	25
Pressure (atm)	4.0	2.0	2.0

11. The KE_{avg} of the gas molecules is
    a. Greatest in Container A
    b. Greatest in Container B
    c. Greatest in Container C
    d. Identical in all three containers

12. The density of the gas is g/L, is

    a. Least in Container A
    b. Least in Container B
    c. Least in Container C
    d. Identical in all three containers

13. Under which of the following conditions of temperature and pressure would 1.0 mol of the real gas $CO_{2(g)}$ behave most like an ideal gas?

	Temp (K)	Pressure (atm)
a.	100	0.1
b.	100	100
c.	800	0.1
d.	800	100

14. At standard temperature and pressure, a 0.5 mole sample of H_2 gas and separate 1.0 mole sample of O_2 gas have the same

    a. average molecular kinetic energy
    b. average molecular speed
    c. effusion rate
    d. density

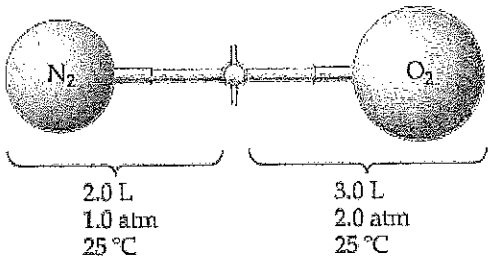
AP Chemistry - Unit 3 - Gases - Test FR Questions

1. Answer the following questions related to hydrocarbons

   a) Determine the empirical formula of hydrocarbon that contains 66.50% percent carbon by mass.

   b) The density of in part (a) is 2.0 g/L at 50°C and 0.948 atm
      i) Calculate the molar mass of the hydrocarbon
      ii) Determine the molecular formula of the hydrocarbon

   c) Two flask are connected by a stopcock as shown below. Calculate the total pressure of the system after the stopcock is opened. Assume the temperature remains constant.



   d) Octane, $C_8H_{18(l)}$, has a density of 0.703 g/ml at 20°C. A 355ml sample of octane, measured at 20°C reacts completely with excess oxygen as represented by the equation below. Calculate the total number of moles of gaseous products formed.

$$2C_8H_{18} + 25O_{2(g)} \rightarrow 16CO_{2(g)} + 18H_20_{(g)}$$

2. A student was assigned the task of determining the molar mass of an unknown gas. The student measured the mass of a sealed 843 mL rigid flask that contained dry air. The student then flushed the flask with the unknown gas, resealed it, and measured the mass again. Both the air and the unknown gas were at 23.0°C and 750. torr. The data for the experiment are shown in the table below.

Volume of sealed flask	843 mL
Mass of sealed flask and dry air	157.70 g
Mass of sealed flask and unknown gas	158.08 g

(a) Calculate the mass, in grams, of the dry air that was in the sealed flask. (The density of dry air is 1.18 g L^{-1} at 23.0°C and 750. torr.)

(b) Calculate the mass, in grams, of the sealed flask itself (i.e., if it had no air in it).

(c) Calculate the mass, in grams, of the unknown gas that was added to the sealed flask.

(d) Using the information above, calculate the value of the molar mass of the unknown gas.

After the experiment was completed, the instructor informed the student that the unknown gas was carbon dioxide (44.0 g mol^{-1}).

(e) Calculate the percent error in the value of the molar mass calculated in part (d).

(f) For each of the following two possible occurrences, indicate whether it by itself could have been responsible for the error in the student's experimental result. You need not include any calculations with your answer. For each of the possible occurrences, justify your answer.

Occurrence 1: The flask was incompletely flushed with $CO_2(g)$, resulting in some dry air remaining in the flask.

Occurrence 2: The temperature of the air was 23.0°C, but the temperature of the $CO_2(g)$ was lower than the reported 23.0°C.

(g) Describe the steps of a laboratory method that the student could use to verify that the volume of the rigid flask is 843 mL at 23.0°C. You need not include any calculations with your answer.

3. Consider the hydrocarbon pentane, C_5H_{12} (molar mass 72.15 g)

a. Write the balanced equation for the combustion of pentane to yield carbon dioxide and water.

b. What volume of dry carbon dioxide, measured at 25°C and 785 mmHg, will result from the complete combustion of 2.50 g of pentane?