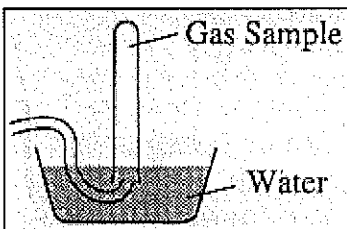


AP Chem - Unit 3 - GASES

wkst: FR problems

①



A student collected a sample of hydrogen gas by the displacement of water as shown by the diagram above. The relevant data are given in the following table.

GAS SAMPLE DATA	
Volume of sample	90.0 mL
Temperature	25° C
Atmospheric Pressure	745 mm Hg
Equilibrium Vapor Pressure of H ₂ O (25° C)	23.8 mm Hg

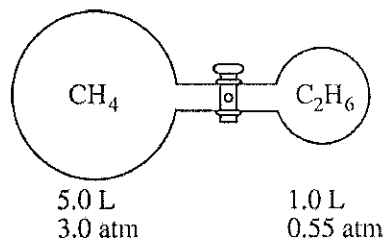
- Calculate the number of moles of hydrogen gas collected.
- Calculate the number of molecules of water vapor in the sample of gas.
- Calculate the ratio of the average speed of the hydrogen molecules to the average speed of the water vapor molecules in the sample.
- Which of the two gases, H₂ or H₂O, deviates more from ideal behavior? Explain your answer.

2004 AP[®] CHEMISTRY FREE-RESPONSE QUESTIONS (Form B)

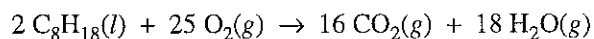
Answer EITHER Question 2 below OR Question 3 printed on page 8. Only one of these two questions will be graded. If you start both questions, be sure to cross out the question you do not want graded. The Section II score weighting for the question you choose is 20 percent.

2. Answer the following questions related to hydrocarbons.

- (a) Determine the empirical formula of a hydrocarbon that contains 85.7 percent carbon by mass.
- (b) The density of the hydrocarbon in part (a) is 2.0 g L^{-1} at 50°C and 0.948 atm .
- Calculate the molar mass of the hydrocarbon.
 - Determine the molecular formula of the hydrocarbon.
- (c) Two flasks are connected by a stopcock as shown below. The 5.0 L flask contains CH_4 at a pressure of 3.0 atm , and the 1.0 L flask contains C_2H_6 at a pressure of 0.55 atm . Calculate the total pressure of the system after the stopcock is opened. Assume that the temperature remains constant.

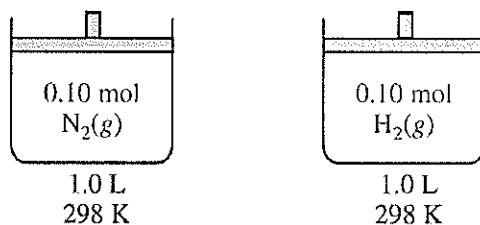


- (d) Octane, $\text{C}_8\text{H}_{18}(l)$, has a density of 0.703 g mL^{-1} at 20°C . A 255 mL sample of $\text{C}_8\text{H}_{18}(l)$ measured at 20°C reacts completely with excess oxygen as represented by the equation below.



Calculate the total number of moles of gaseous products formed.

2005 AP[®] CHEMISTRY FREE-RESPONSE QUESTIONS (Form B)



- 3 Consider two containers of volume 1.0 L at 298 K, as shown above. One container holds 0.10 mol $N_2(g)$ and the other holds 0.10 mol $H_2(g)$. The average kinetic energy of the $N_2(g)$ molecules is 6.2×10^{-21} J. Assume that the $N_2(g)$ and the $H_2(g)$ exhibit ideal behavior.
- Is the pressure in the container holding the $H_2(g)$ less than, greater than, or equal to the pressure in the container holding the $N_2(g)$? Justify your answer.
 - What is the average kinetic energy of the $H_2(g)$ molecules?
 - The molecules of which gas, N_2 or H_2 , have the greater average speed? Justify your answer.
 - What change could be made that would decrease the average kinetic energy of the $N_2(g)$ molecules in the container?
 - If the volume of the container holding the $H_2(g)$ was decreased to 0.50 L at 298 K, what would be the change in each of the following variables? In each case, justify your answer.
 - The pressure within the container
 - The average speed of the $H_2(g)$ molecules