

## CH301 2008 Worksheet 9 on Gases

1. What are the assumptions of Kinetic Molecular Theory?
2. For the following variable pairs, tell if they have directly proportional or inversely proportional relationships:
  - a. V & T
  - b. P & T
  - c. n & P
  - d. P & V
3. The ideal gas law can be used to solve for the molecular weight of an unknown gas. If 1 g of a hypothetical molecule at STP takes up 1 L of volume, what is the molecular weight of that molecule?
4. You should know that many gases do not behave ideally and therefore do not obey the ideal gas law. How do we correct for this in real life calculations when we need more accurate answers?
5. Describe the relationship between diffusion, effusion, and gas speed.
6. If two gas molecules have the same kinetic energy, which will move faster, the larger molecule or the smaller molecule? WHY?
7. As temperature increases, what happens to the average kinetic energy of the molecules in a gas? What would you expect to happen to the rate of diffusion and effusion?
8. Balloons will change size depending on room temperature. Explain why.
9. Explain, in terms of collisions, why you expect a balloon with more gas in it to be larger than a less filled balloon?
10. Which do you think behaves more ideally, water vapor or difluorine gas? On what do you base your considerations?
11. If we completely combust 6 moles of glucose ( $C_6H_{12}O_6$ ) in the presence of excess oxygen. The reaction occurs in a 22 liter container at standard temperature, what would be the total final pressure of the system in atmospheres?  
$$C_6H_{12}O_6 + 6O_2 \rightarrow 6CO_2(g) + 6H_2O(l)$$

12. A sample of sulfur vapor at  $100^{\circ}\text{C}$  exerts a pressure of 0.75 atm on the walls of its container. If a researcher raises the temperature in the container to  $200^{\circ}\text{C}$  while holding all other factors constant, what will be the resulting pressure in the container due to the sulfur vapor?
13. In an industrial process, nitrogen is heated to 500K in a vessel of constant volume. If it enters the vessel at 100 atm and 300 K, what pressure would it exert at the working temperature if it behaved like an ideal gas?
14. If 56g of liquid nitrogen ( $\text{N}_2$ ) to evaporate at standard temperature and pressure, what is the final volume of the gaseous nitrogen?
15. If 56g of liquid nitrogen ( $\text{N}_2$ ) to evaporate at standard temperature in a 2 L container, what is the final pressure of the gaseous nitrogen?
16. Explain diffusion in terms of molecular movement.
17. What is the density of  $\text{CO}_2$  gas maintained at a pressure of 1 atm and temperature of 300 K?
18. Considering the oxygen molecule ( $\text{O}_2$ ) and the much smaller hydrogen molecule ( $\text{H}_2$ ), which one has a greater kinetic energy?
19. Considering the nitrogen molecule ( $\text{N}_2$ ) and the much smaller hydrogen molecule ( $\text{H}_2$ ). If at a given temperature,  $\text{N}_2$  travels at the rate of 100m/s, what is the speed of  $\text{H}_2$ ? How would the two molecules compare in their rate of diffusion?
20. What are some factors that cause non-ideality in gases? What conditions would minimize these factors?