GAS LAWS SYLLABUS

I. MAJOR TOPICS:

A. Characteristics of Gases
B. Gas Pressure
C. The Gas Laws
D. The Ideal Gas Law
E. Further Applications of the Ideal Gas Law
F. Gas Stoichiometry
H. Partial Pressures
I. Kinetic Molecular Theory of Gases
J. Molecular Effusion & Diffusion
K. Deviations from Ideal Behavior

II. OBJECTIVES/GUIDELINES:

1. Understand the effects of atmospheric pressure. Be able to explain everyday observations such as why water boils at a lower temp at higher altitudes, etc.
2. Be able to explain why atmospheric pressure decreases as altitude increases?
3. Be able to make conversions between the many different units for measuring pressure. Needed conversions factors will be given. Understand what causes gas pressure. In other words, how does gas pressure relate to collisions of particles?
4. Understand how a barometer and a manometer works. Be able to interpret data from these instruments.
5. Understand and be able to do calculations with the Gas Laws: Boyle's, Charles', Gay-Lussac's and Avogadro's Law. Be sure to know what variables must be constant for each one of these relationships to hold true. Be able to explain each of these laws in terms of what the molecules are doing, or in terms of Kinetic Molecular Theory.
6. Know what STP refers to (units, differences from thermodynamic benchmarks).
7. Know and understand why 1 mole of any gas at STP takes up a volume of 22.4L.
8. Know and be able to perform calculations with the Combined Gas Law and the Ideal Gas Law equations. R, the ideal gas law constant, will be given (Make sure you know which R value to choose. Look at your units!).
9. Be able to derive an Ideal Gas Law expression incorporating both density and Molar mass. This is in your notes. Notice the relationship between density and Molar mass to the other variables. For example, as the density of the gas increases, what happens to the pressure?
10. Practice doing gas stoichiometry problems. Review the Gas Stoichiometry flow chart in your notes.
11. Understand and be able to do calculations with Dalton's Law of Partial Pressures. Just remember that if you have a mixture of gases, P_{TOTAL} equals the sum of the partial pressures of the gases making up the mixture.
12. Be able to use the mole fraction expression: $X_A = n_A/n_T = P_A/P_T$. What is a mole fraction and how is it used to determine the partial pressures of gases?
13. Practice partial pressure problems where water vapor is involved. Refer to your notes and homework. Look at the lab "Molar Volume of a Gas". In these cases, remember that $P_T = P_A + P_{H2O}$.
14. Know what 4 assumptions about gas behavior are made in the Kinetic Molecular Theory of Gases.
15. Understand why KE per gas particle is expressed $1/2mu^2$ as opposed to $1/2mv^2$. What does u^2 represent anyway?
16. Be able to explain how absolute temperature is a measurement of KE or molecular motion and understand that the average KE of any gas is the same at the same temperature.
17. Be able to interpret a Maxwell speed distribution curve. Why do the curves flatten out as temperature increases?
18. Understand the relationship between molecular speed and mass in terms of KE. As the mass increases, what does the root mean square speed of molecules do?
19. Be able to use the equation for root-mean-square speed u_{rms} to determine the speed of different gas particles. The equation will be given to you on the quiz. Know the units for each of the variables in order to come out with a u_{rms} speed in m/s.

20. Understand and be able to do calculations with Graham's Law which related rate or speed of diffusion/effusion and size of gas particle (or molar mass).
21. Understand under what conditions gases do not behave "ideally" (high pressure and low temperature) and what this has to do with attractive forces.
22. Be able to interpret and use van der Waals equation relating P, V, T, and n for a non-ideal gas.

Complete the following problems from your Brown, LeMay & Bursten chemistry text. Show all of your work! (No Work = No Credit). The answers to the odd numbered problems are in the back of your text. It is your responsibility to get yourself in an academic position to answer ALL of these problems. If needed – PLEASE ASK ME FOR HELP!

Problem Set #15: problems 10.1, 10.2, 10.6
In addition to the book problems, also complete the handout, *Pressure Conversions/Manometer Problems.* Work all problems on a separate sheet. Do NOT just scribble in the margins of the handout.

Due Date:_____

Problem Set #16: problems 10.18, 10.22, 10.26, 10.30, 10.43, 10.46, 10.52, 10.57.
Due Date:_____

Problem set #17: problems 10.63, 10.67, 10.71, 10.72, 10.79, 10.86. In addition to the book problems, also complete the handout, *Advanced Gas Laws.* Work all problems on a separate sheet. Do NOT just scribble in the margins of the handout.

Due Date:_____