Chapter10: The Behavior of Gases

1. Be able to convert between the common units of pressure.
2. Explain the operation of a mercury barometer, an open-end manometer, and a closed-end manometer and be able to use the data obtained with these devices.
3. Describes Boyle's Law, Charle's Law, Daltons Law, Gay Lusac Law, Avogadro's law both mathematically and graphically and be able to use it in calculations.
4. Discuss the significance of the absolute zero of temperature and be able to convert between Celsius and Kelvin temperatures.
5. State what STP and the STP molar volume mean, and be able to use the latter in calculations.
6. Solve PV= nRT for one of P, V, *n,* or T when given values of the other three for an ideal gas.
7. Use the combined gas law to solve for P, V, T, or n given the values of the other three for an ideal gas
8. Use the alternate versions of the ideal gas law for calculating molar masses of gases and determining gas densities.
9. Combine gas molar masses with empirical formulas to determine molecular formulas.
10. Solve stoichiometry problems involving gases.
11. Compute the pressure of gases collected over water.
12. State the postulates and the basic mathematical relationships of the kinetic molecular theory of gases.
13. Deduce the simple gas laws from the kinetic molecular theory.
14. Compute molecular velocities; know and apply Graham's law.
15. Explain why real gases differ from ideal gases and how the differences lead to the van der Waals equation. Know under what conditions gases are most nearly ideal.
16. State the ideas of the kinetic molecular theory of gases.
17. Calculate the average kinetic energy or average molecular speed for a gas at a specified temperature.
18. Describe vapor pressure. (Chapter 11)

Things to know:

Ways to describe the quantity of gas in a sample	State the mass of the sample or state its volume, temperature, and pressure
Pressure units: atmospheres (atm) torr mmHg Pascal (Pa)	 Pressure exerted by the earth's atmosphere at sea level Defined by 1 atm = 760 torr 760 mmHg is the height of a column of Hg that can be supported by the earth's atmosphere 760 mmHg = 1 atm = 760 torr 1 atm = 101 kPa
Avogadro's law	$V_1/V_2 = n_1/n_2$ at constant temperature and pressure
Boyle's law	$P_1V_1 = P_2V_2$ at constant moles and temperature.
Charles's law	$V_1/V_2 = T_1/T_2$ at constant n and P.
Combined gas law	$P_1V_1/n_1T_1 = P_2V_2/n_2T_2$. Temperature must be in K.
Ideal gas	Gas that behaves as the kinetic theory and the gas laws predict
Ideal gas equation, including meaning and units for each term	PV= nRT, P is pressure in atm; V is volume in L; n is quantity of gas in mol; R is gas constant, 0.0821 atm-L/mol-K; T in K.
STP	Standard temperature and pressure 273K and 1 atm.
Molar volume of and ideal gas	The volume, 22.4L, occupied by 1.00 mol of an ideal gas at STP.
Gas density	Gas density is inversely related to the gas temperature at constant pressure as the temperature increases, the volume increase, but the mass remains the same, the density must therefore decrease.
Daltons law	$P_1/P_2 = n_1/n_2$ at constant volume and temperature.
Implications of Dalton's law	The total pressure of gas in a system is the sum of each of the partial pressures in that system. The total moles of gas in a system are related to the sum of each of the moles in the system. $\Sigma\ nT = n_1 + n_2 + n_3.....$ $\Sigma\ pT = p_1 + p_2 + p_3.....$

Things to know:

- A gas consists of particles. The total volume of the particles in negligible compared with the total volume of the gas. The particles are in rapid, random motion, and they constantly collide with one another and with the walls of their container. The collisions are assumed to be elastic. The number of particles and their motion are responsible for the volume, temperature and pressure of the sample.
- The basis for using gas volumes in stoichiometry at STP: At constant T and P, the volume of a gas sample is directly proportional to the number of moles of gas in the sample, so the quantities of gases in a balanced chemical equation can be read either in moles or in any volume units
- Solving stoichiometry problems if the sample is not at STP: Solve for the moles of gas present, and then use the table for stoichiometry.