AP Chemistry

Summer Assignment

- Read the letter on the next page.
- Complete the 12 worksheets in this packet.

THEY ARE DUE ON THE FIRST DAY OF SCHOOL!

- Buy AP Chemistry Test Prep book (like from the Princeton Review or 5 step to 5) and start looking through it.
- Email me with questions.
- Come to the help sessions if needed!

Welcome to AP Chemistry! ☺

I'm glad that after taking one year of Chemistry, you have decided it's a subject that you'd like to learn more about. The class will be challenging, but the biggest factor in determining your success will be the amount of effort you put into the class. If you do the reading assignments and homework, you can definitely be successful in the class and ultimately on the AP exam.

We have a lot of material to cover in this class, so we will start off by making sure that we all have the basics down. **Over the summer, you are responsible for doing the worksheets in this review packet. They are due on the first day of school and will be your first grade! You will have a test on this material at the end of the first week of school.** The material in this packet should be mostly review from your first year of Chemistry. You will find that much of the AP Chemistry curriculum consists of the same topics that you covered last year, but in more depth.

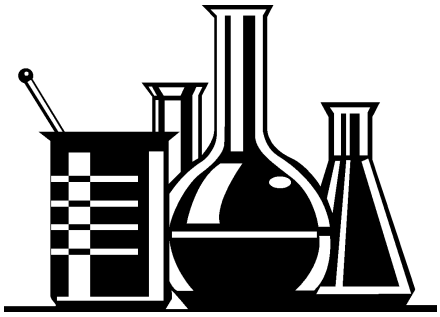
If you get stuck on a problem or a certain type of problem, try moving on to the next part. These problems cover a wide variety of topics, so you might be able to do the next part and then go back to the previous ones later. I am also including a copy of your new periodic table. This is the version that is provided on the AP exam, so you should start getting used to it. You might notice that there is no list of polyatomic ions on the back. That is because you are expected to know them!

I would also recommend that you buy an AP Chemistry test prep book. There are several available, and they are all good. (Last year's class recommended 5 steps to 5 and the Princeton Review.) Read the introduction, and take the diagnostic test in it. This will give you an idea of where you are starting. You could also read and highlight the chapters on the basics and stoichiometry. These books are valuable because they provide many sample questions to get you read for the exam.

I hope that you will work on this homework assignment throughout the summer, and not put it all off until the last minute! In order to encourage you to start early, **I will be available in our classroom at the school. I will post the dates and times on Haiku.** These sessions are designed to answer questions and help you through any homework problems. Hopefully this way you can get started and get any questions answered, and not have any excuses for not having your work done on the first day of school!

If you would like to check out a book at one of those help sessions, that is one way you can get help with the material. There are also many helpful websites where you can find any chemistry information or help you might need. In addition, please feel free to email me at any point during the summer if you have questions or concerns, or just need help on a homework problem. My email address is **Harshal.patolia@lsaintjosephprep.org.** I am really looking forward to this class, and I hope you are too. Good luck, and have fun with that stoichiometry! Email me with any questions, or I'll see you at the help sessions!

Mr. Patolia



PERIODIC TABLE OF THE ELEMENTS

1 H 1.008																	2 He 4.00
3 Li 6.94	4 Be 9.01											5 B 10.81	6 C 12.01	7 N 14.01	8 O 16.00	9 F 19.00	10 Ne 20.18
11 Na 22.99	12 Mg 24.30											13 Al 26.98	14 Si 28.09	15 P 30.97	16 S 32.06	17 Cl 35.45	18 Ar 39.95
19 K 39.10	20 Ca 40.08	21 Sc 44.96	22 Ti 47.90	23 V 50.94	24 Cr 52.00	25 Mn 54.94	26 Fe 55.85	27 Co 58.93	28 Ni 58.69	29 Cu 63.55	30 Zn 65.39	31 Ga 69.72	32 Ge 72.59	33 As 74.92	34 Se 78.96	35 Br 79.90	36 Kr 83.80
37 Rb 85.47	38 Sr 87.62	39 Y 88.91	40 Zr 91.22	41 Nb 92.91	42 Mo 95.94	43 Tc (98)	44 Ru 101.1	45 Rh 102.91	46 Pd 106.42	47 Ag 107.87	48 Cd 112.41	49 In 114.82	50 Sn 118.71	51 Sb 121.75	52 Te 127.60	53 I 126.91	54 Xe 131.29
55 Cs 132.91	56 Ba 137.33	57 *La 138.91	72 Hf 178.49	73 Ta 180.95	74 W 183.85	75 Re 186.21	76 Os 190.2	77 Ir 192.2	78 Pt 195.08	79 Au 196.97	80 Hg 200.59	81 Tl 204.38	82 Pb 207.2	83 Bi 208.98	84 Po (209)	85 At (210)	86 Rn (222)
87 Fr (223)	88 Ra 226.02	89 †Ac 227.03	104 Rf (261)	105 Db (262)	106 Sg (266)	107 Bh (264)	108 Hs (277)	109 Mt (268)	110 Ds (271)	111 Rg (272)							

*Lanthanide Series	58 Ce 140.12	59 Pr 140.91	60 Nd 144.24	61 Pm (145)	62 Sm 150.4	63 Eu 151.97	64 Gd 157.25	65 Tb 158.93	66 Dy 162.50	67 Ho 164.93	68 Er 167.26	69 Tm 168.93	70 Yb 173.04	71 Lu 174.97
†Actinide Series	90 Th 232.04	91 Pa 231.04	92 U 238.03	93 Np (237)	94 Pu (244)	95 Am (243)	96 Cm (247)	97 Bk (247)	98 Cf (251)	99 Es (252)	100 Fm (257)	101 Md (258)	102 No (259)	103 Lr (262)

Name: _____

AP Chemistry Worksheet 1: ***Significant Figures and Dimensional Analysis***

For each problem below, write the equation and show your work. Always use units and box your final answer.

1. Round each of the following numbers to four significant figures, and express the result in scientific notation:

   a. 300.235800 _____

   b. 456,500 _____

   c. 0.006543210 _____

   d. 0.000957830 _____

   e. – 0.035000 _____

2. Carry out the following operations, and express the answers with the appropriate number of significant figures:

   a. 1.24056 + 75.80 _____

   b. 23/67 - 75 _____

   c. 890,000 x 112.3 _____

   d. 78,132 / 2.50 _____

3. Perform the following conversions: (You need to go online to look up some conversion factors between metric and English units.)

   a. 8.60 mi to m _____

   b. 3.00 days to s _____

   c. $1.55/gal to dollars per liter _____

   d. 75.00 mi/hr to m/s _____

   e. 55.35 ft^3 to cm^3 _____

4. The density of pure silver is 10.5 g/cm^3 at 20^{o}C. If 5.25 g of pure silver pellets are added to a graduated cylinder containing 11.2 mL of water, to what volume level will the water in the cylinder rise?

5. The density of air at ordinary atmospheric pressure and 25^{o}C is 1.19 g/L. What is the mass, in kilograms, of the air in a room that measures 12.5 x 15.5 x 8.0 ft?

AP Chemistry Worksheet 2: ***Structure of the Atom and the Periodic Table***

For each problem below, write the equation and show your work. Always use units and box in your final answer.

1. What were the main points of Dalton's Atomic Theory? Which of these points are still accepted today? Which ones do we no longer accept, and why?

2. Summarize the evidence used by J.J. Thomson to argue that cathode rays consist of negatively charged particles.

3. Let's pretend you are holding two atoms of carbon that are isotopes. Describe what the two atoms have in common and what they have different.

4. Fill in the gaps in the following table, assuming each column represents a neutral atom:

Symbol	$^{39}_{19}K$				
Protons		25			82
Neutrons		30	64		
Electrons			48	56	
Mass #				137	207

5. Write the correct symbol, with both superscripts and subscripts, for each of the following :

   (a) the isotope of sodium with mass 23 _____

   (b) the atom of vanadium that contains 28 neutrons _____

   (c) the isotope of chlorine with mass 37 _____

   (d) an atom of magnesium that has an equal number of protons and neutrons

   _____

6. Give the name and the common charge for elements

   (a) Group 1

   (b) Group 2

   (c) Group 17

   (d) Group 18

7. Describe where each type of element
   found in each of these groups of the Periodic Table: is found on the Periodic Table.

   (a) Metals

   (b) Non-metals

   (c) Transition metals

   (d) Lanthanides

   (e) Actinides

AP Chemistry Worksheet 3: ***Naming Inorganic Compounds***

For each problem below, write the equation and show your work. Always use units and box in your final answer.

1. Give the name for each of the following ionic compounds:

    a. AlF_3

    b. $Fe(OH)_2$

    c. $Cu(NO_3)_2$

    d. $Ba(ClO_4)_2$

    e. Li_3PO_4

    f. Hg_2S

    g. $Ca(C_2H_3O_2)_2$

    h. $Cr_2(CO_3)_3$

    i. K_2CrO_4

    j. $(NH_4)_2SO_4$

2. Write the chemical formula for each of the following compounds:

    a. copper (I) oxide

    b. potassium peroxide

    c. aluminum hydroxide

    d. zinc nitrate

    e. mercury (I) bromide

    f. iron (III) carbonate

    g. sodium hypobromite

3. Give the name or chemical formula, as appropriate, for each of the following acids:

    a. $HBrO_3$

    b. HBr

    c. H_3PO_4

    d. hypochlorous acid

    e. iodic acid

    f. sulfurous acid

4. Give the name or chemical formula, as appropriate, for each of the following molecular substances:

    a. SF_6
    b. IF_5
    c. XeO_3
    d. dinitrogen tetroxide
    e. hydrogen cyanide
    f. tetraphosphorous hexasulfide

5. Write the balanced chemical equation for each reaction given below.

    a. Zinc carbonate can be heated to form zinc oxide and carbon dioxide

    b. On treatment with hydrofluoric acid, silicon dioxide forms silicon tetrafluoride and water.

    c. Sulfur dioxide reacts with water to form sulfurous acid.

    d. Liquid butane fuel (C_4H_{10}) burns in the presence of oxygen gas.

    e. Perchloric acid reacts with cadmium to form cadmium perchlorate and a gas.

    f. A solution of sodium bromide reactions with a solution of vanadium (III) nitrate to form a brightly colored precipitate.

AP Chemistry Worksheet 4: ***Atomic and Molecular Masses***

For each problem below, write the equation and show your work. Always use units and box in your final answer.

1. What isotope is used as the standard in establishing the atomic mass scale?

2. The atomic weight of magnesium is reported as 24.3, yet no atom of magnesium has the mass of 24.3 amu. Explain.

3. Only two isotopes of copper occur naturally, Cu-63 (abundance 69.09 percent) and Cu-65 (abundance 30.91 percent). Calculate the average atomic mass of copper.

4. Determine the molar mass of each of the following compounds:

    a. N_2O_5

    b. $FeCO_3$

    c. $Ca(C_2H_3O_2)_2$

    d. $(NH_4)_3PO_4$

    e. sodium nitrate

    f. copper (II) sulfate

    g. disilicon hexabromide

5. Calculate the percentage by mass of oxygen in the following compounds:

   a. NO_2

   b. CH_3COOCH_3

   c. $Cr(NO_3)_3$

   d. $(NH_4)_2CO_3$

AP Chemistry Worksheet 5: ***Balancing Equations & Patterns of Reactivity***

For each problem below, write the equation and show your work. Always use units and box in your final answer.

1. Balance the following equations:

   a. $CO\,(g) + O_2(g) \rightarrow CO_2\,(g)$

   b. $N_2O_5\,(g) + H_2O\,(l) \rightarrow HNO_3\,(aq)$

   c. $PCl_5\,(l) + H_2O\,(l) \rightarrow H_3PO_4\,(aq) + HCl\,(aq)$

   d. $CH_4\,(g) + Br_2\,(g) \rightarrow CBr_4\,(l) + HBr\,(g)$

   e. $C_5H_{10}O_2\,(l) + O_2\,(g) \rightarrow CO_2\,(g) + H_2O\,(l)$

   f. $Cr(OH)_3\,(s) + HClO_4\,(aq) \rightarrow Cr(ClO_4)_3\,(aq) + H_2O\,(l)$

2. Write balanced chemical equations to correspond to each of the following descriptions:

   a. Solid calcium carbide, CaC_2, reacts with water to form an aqueous solution of calcium hydroxide and acetylene gas, C_2H_2.

   b. When solid potassium chlorate is heated, it decomposes to form solid potassium chloride and oxygen gas.

   c. Solid zinc metal reacts with sulfuric acid to form hydrogen gas and an aqueous solution of zinc sulfate.

   d. When liquid phosphorous trichloride is added to water, it reacts to form a solution of phosphorous acid and hydrochloric acid.

e. When hydrogen sulfide gas is passes over solid hot iron (III) hydroxide, the reaction produces solid iron (III) sulfide and gaseous water.

3. a. What products form when a hydrocarbon is completely combusted in air?

b. Write a balanced chemical equation for the combustion of octane, C_8H_{18} (l), in air.

c. How can you determine the chemical formula of the product formed when the metallic element calcium combines with the nonmetallic element oxygen, O_2?

d. Write the balanced chemical equation for the reaction described in (c).

4. Write a balanced chemical equation for the reaction that occurs when

a. the hydrocarbon heptane, C_7H_{16} (l), is combusted in air

b. the gasoline additive MTBE (methyl tertiary-butyl ether), $C_5H_{12}O$ (l), burns in air

c. Rb (s) reacts with water

d. Mg(s) reacts with Cl_2 (g)

5. Balance the following equations, and indicate what type of reaction each one is:

a. $Al\ (s) + Cl_2\ (g) \rightarrow AlCl_3\ (s)$ _____

b. $C_2H_4\ (g) + O_2\ (g) \rightarrow CO_2\ (g) + H_2O\ (l)$ _____

c. $Li(s) + N_2\ (g) \rightarrow Li_3N\ (s)$ _____

d. $PbCO_3\ (s) \rightarrow PbO\ (s) + CO_2\ (g)$ _____

e. $C_7H_8O_2\ (l) + O_2\ (g) \rightarrow CO_2\ (g) + H_2O\ (l)$ _____

AP Chemistry Worksheet 6: *The Mole*

For each problem below, write the equation and show your work. Always use units and box in your final answer.

1. The molecular formula of aspartame, the artificial sweetener marketed as NutraSweet, is $C_{14}H_{18}N_2O_5$.
    a. What is the molar mass of aspartame?

    b. How many moles of aspartame are present in 1.00 mg of aspartame? (1000 mg = 1g)

    c. How many molecules of aspartame are present in 1.00 mg of aspartame?

    d. How many hydrogen atoms are present in 1.00 mg of aspartame?

2. A sample of glucose, $C_6H_{12}O_6$, contains 2.03×10^{21} atoms of carbon.
    a. How many atoms of hydrogen does it contain?

    b. How many molecules of glucose does it contain?

    c. How many moles of glucose does it contain?

d. What is the mass of the sample in grams?

3. Calculate the following amounts:

   a. How many moles of chloride ions are in 0.0750 g of magnesium chloride?

   b. What is the mass, in grams, of 3.50×10^{-3} mol of aluminum sulfate?

   c. What is the mass, in grams, of 1.75×10^{20} molecules of caffeine, $C_8H_{10}N_4O_2$?

   d. What is the molar mass of cholesterol if 0.00105 mol weigh 0.406 g?

4. Calculate the number of molecules in:
   a. 0.0666 mol propane, C_3H_8, a hydrocarbon fuel

   b. A 50.0 mg tablet of acetaminophen, $C_8H_9O_2N$, an analgesic solid under the name of Tylenol

c. A tablespoon of table sugar, $C_{12}H_{22}O_{11}$, weighing 10.5 g

5. The allowable concentration level of vinyl chloride, C_2H_3Cl, in the atmosphere in a chemical plant is 2.0×10^{-6} g/L.
   a. How many moles of vinyl chloride in each liter does this represent?

   b. How many molecules per liter is this?

AP Chemistry Worksheet 7: ***Empirical and Molecular Formulas***

For each problem below, write the equation and show your work. Always use units and box in your final answer.

1. Determine the empirical formula of each of the following compounds if a sample contains
    a. 0.104 mol K, 0.052 mol C, and 0.156 mol O

    b. 5.28 g Sn and 3.37 g F

    c. 87.5 percent N and 12.5 percent H by mass

2. Determine the empirical formulas of the compounds with the following compositions by mass
    a. 10.4 percent C, 27.8 percent S, and 61.7 percent Cl

    b. 21.7 percent C, 9.6 percent O, and 68.7 percent F

3. What is the molecular formula of each of the following compounds?
    a. empirical formula CH_2, molar mass = 84 g/mol

    b. empirical formula NH_2Cl, molar mass = 51.5 g/mol

4. Determine the empirical and molecular formulas of each of the following substances:
    a. Ibuprofen, a headache remedy contains 75.69 percent C, 8.80 percent H, and 15.51 percent O by mass; molar mass about 206 g

    b. Benzene contains only carbon and hydrogen and is 7.74% hydrogen by mass. The molar mass of benzene is 78.1 g/mol.

5. Many homes in rural America are heated by propane gas, a compound that contains only carbon and hydrogen. Complete combustion of a sample of propane produced 2.641 g of carbon dioxide and 1.442 g of water as the only products. Find the empirical formula of propane. (Hint: Figure out how many moles of C and H were produced. They all came from the fuel.)

6. (This is probably the hardest problem in the whole packet!) Menthol, the substance we can smell in mentholated cough drops, is composed of C, H, and O. A 0.1005 g sample of menthol is combusted, producing 0.2829 g of CO_2 and 0.1159 g of H_2O.
    a. What is the empirical formula for menthol?

    b. If the compound has a molar mass of 156 g/mol, what is its molecular formula?

AP Chemistry Worksheet 8: *Stoichiometry*

Prior to solving worksheet 8 and 9 - watch videos using the links below. **Type the link** (you will not be able to click on it) **in chrome or safari.**

Youtube links:
Part 1 - http://youtu.be/VHX9MauM8sM
Part 2 - http://youtu.be/Oaw9yREEs2Y
Part 2a - http://youtu.be/JxELYaiKHss
Part 3 - http://youtu.be/vJX1f1YTiCg
Part 3a - http://youtu.be/sGZ10SfzE3I
Part 4 – http://youtu.be/hnzu6kLNIpA
Part 4a - http://youtu.be/SC5_kvXPXAw
Part 5 - http://youtu.be/2vofw_6VsOk
Part 5a - http://youtu.be/x71ViHWvH9M

For each problem below, write the equation and show your work. Always use units and box in your final answer.

1. Why is it essential to use balanced chemical equations in solving stoichiometry problems?

2. The fermentation of glucose, $C_6H_{12}O_6$, produces ethyl alcohol, C_2H_5OH, and CO_2 as shown here:

$$C_6H_{12}O_6\,(aq) \;\text{-->}\; 2\,C_2H_5OH(aq) + 2\,CO_2\,(g)$$

   a. How many moles of CO_2 are produced when 0.300 mol of $C_6H_{12}O_6$ reacts in this fashion?

   b. How many grams of $C_6H_{12}O_6$ are needed to form 2.00 g of C_2H_5OH?

c. How many molecules of CO_2 form when 2.00 g of C_2H_5OH are produced?

3. Aluminum sulfide reacts with water to form aluminum hydroxide and hydrogen sulfide.
   a. Write the balanced chemical equation for this reaction.

   b. How many grams of aluminum hydroxide are obtained from 10.5 g of aluminum sulfide?

4. Automotive air bags inflate when sodium azide, NaN_3, rapidly decomposes to its component elements:

$$2\ NaN_3\ (s)\ \text{-->}\ \ Na(s)\ \ +\ \ 3\ N_2\ (g)$$

   a. How many moles of N_2 are produced by the decomposition of 1.50 moles of NaN_3?

b. How many grams of NaN_3 are required to form 5.00 g of nitrogen gas?

c. How many grams of NaN_3 are required to produce 10.0 L of nitrogen gas if the gas has a density of 1.25 g/L?

5. A piece of aluminum foil 0.550 mm thick and 1.00 cm square is allowed to react with bromine to form aluminum bromide.
   a. How many moles of aluminum were used? (The density of aluminum is 2.699 g/cm^3.)

   b. How many grams of aluminum bromide form, assuming that the aluminum reacts completely?

AP Chemistry Worksheet 9: ***Limiting Reactants & Theoretical Yield***

For each problem below, write the equation and show your work. Always use units and box in your final answer.

1. A manufacturer of bicycles has 50 wheels, 30 frames, and 24 seats.
    a. How many bicycles can be manufactured using these parts?

    b. How many parts of each kind are left over?

    c. Which part is like a limiting reactant in that it limits the production of bicycles?

2. The fizz produced when an Alka-Seltzer tablet is dissolved in water is due to the reaction between sodium bicarbonate, $NaHCO_3$, and citric acid, $H_3C_6H_5O_7$:

$$3\ NaHCO_3\ (aq) + H_3C_6H_5O_7\ (aq) \rightarrow 3\ CO_2\ (g) + 3\ H_2O(l) + Na_3C_6H_5O_7\ (aq)$$

In a certain experiment 1.00 g of sodium bicarbonate and 1.00 g of citric acid are allowed to react.

   a. Which reactant is the limiting reactant? You must show work to support your answer.

   b. How many grams of carbon dioxide form?

   c. How much of the limiting reactant is left when the reaction is complete?

   d. How much of the excess reactant remains after the reaction is complete?

3. When hydrogen sulfide gas is bubbled into a solution of sodium hydroxide, the reaction forms sodium sulfide and water. How many grams of sodium sulfide are formed if 2.50 g of hydrogen sulfide is bubbled into a solution containing 1.85 g of sodium hydroxide, assuming that the limiting reagent is completely consumed?

4. Solutions of sulfuric acid and lead (II) acetate react to form solid lead (II) sulfate and a solution of acetic acid. If 10.0 g of sulfuric acid and 10.0 g of lead (II) acetate are mixed, calculate the number of grams of sulfuric acid, lead (II) acetate, lead (II) sulfate, and acetic acid present in the mixture after the reaction is complete.

5. A student reacts benzene, C_6H_6, with bromine, Br_2, to prepare bromobenzene, C_6H_5Br, and HBr.

    a. What is the theoretical yield of bromobenzene in this reaction when 30.0 g of benzene reacts with 65.0 g of bromine?

    b. If the actual yield of bromobenzene was 56.7 g, what was the percent yield?

AP Chemistry Worksheet 10: Gases

1. What are the postulates of Kinetic Molecular Theory (KMT)

2. Convert following pressure units:

   a. 3800 torr to atm

   b. 800 mmHg to Pa

   c. 2.7 atm to mmHg and KPa

   d. 55.3 Psi to atm

   e. 103.74 KPa to mmHg

3. Explain the following terms STP and Absolute temperature. Provide significance of both.

4. A gas is stored in a closed container at 2.7 atm. The container occupies the volume of 289 ml. If the gas is released out of the container into a new container with a volume of 900 ml, calculate the new pressure of the gas in atm.

5. A gas has a volume of 350 ml at 45^{o}C. If the volume changes to 400 ml, what is the new temperature?

6. Maybelline Cousteau's backup oxygen tank reads 900 mmHg while on her boat, where the temperature is 27°C. When she dives down to the bottom of an unexplored methane lake on a recently-discovered moon of Neptune, the temperature will drop down to –183°C. What will the pressure in her backup tank be at that temperature?

7. 400 ml of a gas is contained at 300 mm Hg and 0°C. What will its volume be in mL at 140 mm Hg and 10°C?

8. 100 g of oxygen(O_2) is added to the gas chamber. What is the volume of the gas at STP.

9. A metal tank contains three gases: oxygen, helium, and nitrogen. If the partial pressures of the three gases in the tank are 35 atm of O_2, 5 atm of N_2, and 25 atm of He, what is the total pressure inside of the tank?

10. If I have 72 liters of gas held at a pressure of 344.4kPa and a temperature of 225 K, how many moles of gas do I have?

11. Modern vacuum techniques make it possible to reach a pressure of 1.00×10^{-10} mm Hg in a laboratory system. What volume in **milliliters** would 1.00×10^{6} molecules of gas occupy at this pressure and standard temperature?

Please Note: This assignment is a requirement, and is NOT for extra credit!

1. **Purchase your own copy of 5 Steps to a 5 on the AP: Chemistry, John T Moore, McGraw Hill, Most Current Edition. (Amazon would be the best place to purchase it cheap – you can also buy it used from last years students)***
2. **Buy a few color highlighters. Familiarize yourself with the Test structure and Timings.**
3. **Take the diagnostic test in the prep book. (Go ahead and write in the book, I will make an additional copy of this test for you to take before the AP Exam.)**
4. **Take a look at the AP classroom and other websites. List the three most useful in the front cover of your book**
5. **Read and study (highlight, take notes in the margin, etc) for chapter for Chapter 5 (Gases) and Chapter 7 (Periodic Table and Energy)**
6. **Bring your highlighted book, notes and diagnostic test to school the first day of class. Points will be assigned to you and then the book will be returned to you for your further enjoyment.**