AP CHEMISTRY SUMMER PACKET 2017

Mrs. Joy Whitbred (whitbred@cbhs.edu)

Introduction:

I am glad you have decided to take Advanced Placement Chemistry! This course is designed to give you a more complete experience of chemistry that will prepare you for both the AP Chemistry exam in the spring of next year and for introductory chemistry in college. Please remember: If you are looking to start your college experience here at Benedictine, this course also offers dual-credit through Notre Dame College as a full-year Chemistry 1 college course.

The only way to complete all the topics in this course is to move at a very rapid pace. Therefore, it is critical for all students to complete the Summer Assignment to be ready to go in the fall. The completed questions at the end of this packet will be **due the first day of class in the fall and are worth 75 pts.**

Course Overview:

The course is taught through a series of lectures and laboratories with homework problems and practice tests to prepare you for Unit exams. The course is split into 2 graded components. The lecture portion consists of lecture materials, homework assignments, practice tests, and Unit Exams. Homework should be accomplished within one to two days after the material is covered in class and will be due to me prior to the practice test. Homework will not be accepted after the practice test on that material. The Unit Exams will be structured like the AP Exam and will include old practice exam questions. The laboratory portion of the course will consist of a series of structured experiments and guided inquiry labs based on the materials covered in lecture. Laboratory experiments that are not inquiry will be due the next day after the lab is completed. Guided-inquiry labs require a lab write-up, in which case the formal lab write-up will be due 1 week after the completion of the lab. The laboratory portion will also have a quarterly exam structured in AP format that will include materials from all the labs that have been completed during that period as well as applications of the concepts learned throughout the labs. Late work will result in grade penalties, **20% off for each day** the assignment is late, and **will not be accepted after 1 week**. If you participate in extracurricular activities, it is YOUR RESPONSIBILITY to get the work in on time, not late. Due dates for labs will be posted in Google Classroom and on the board in class.

Why take AP Chemistry?

You have probably decided to take this course for several reasons. Here are some of the reasons why this course is beneficial:

- The most obvious answer is that students who successfully pass the AP Chem Exam next May (a score of 3 or better is considered passing) are eligible to receive college credit at most colleges and universities in the United States. This can represent a considerable savings in time and money.
- Some students, regardless of whether or not they passed the AP Chem Exam, elect to take freshman chemistry in college anyway. For most students freshman college chemistry is an extremely difficult course. Students who have taken AP Chem do immensely better than if they had not taken the course. If you planning on majoring in any science or medical field, you will take college chemistry and this course will prepare you extremely well.
- AP Chem credit looks really good on your transcript. While you should not take a course mainly because the grade is "weighted", you should take challenging courses that show you pushed yourself in difficult courses.
- AP Chem will teach you to think at higher levels. In AP Chem, you will be encouraged and taught how to analyze deeply, synthesize concepts and evaluate approaches to problems, often in novel situations, sometimes even deriving your own techniques from application. This is exactly the type of thinking you will be expected to use in college.
- If you choose to take the dual credit option, you will find it can be easier to learn chemistry in high school because of the small class size and individual time and help that I can give you. Freshman college chemistry is usually taught in large lecture halls where individual assistance is difficult to find.

Tips for achieving success in AP Chemistry:

- Study AP Chem daily for at least one hour. On most days there will be either homework or studying for a quiz or test or a lab report that you should be working on. However, even if there are no formal assignments, you should be using this time to review your materials and read the textbook. You must budget this time carefully. If you have a job or are involved in sports, your study time must take priority.
- Choose a study partner that you can also use as a lab partner. **This class is very difficult if done alone.** Pairs are better than larger groups. However, avoid "splitting up" the work and remember that each student will be responsible for **all** the work assigned. Working with others looks different than plagiarizing; we will have a discussion on Plagiarism at the beginning of the year.
- Avoid getting behind in this course. If you get stuck on a concept or HW set, get help immediately.
- I will be available before school every day at 7:30 am, and I am usually available after school several days per week.

The Commitment:

- If you are taking this course, you have already enjoyed success in your academic career. Taking a course such as AP Chem will be very different than courses you have taken in the past. It will involve a level of work and commitment that you may not have experienced before. Below is list of realities that you must face:
- Straight-A students often get their first B in AP Chem and other students receive their first C. An A in this course will take tremendous effort.
- Missing class for sports, vacations, activities, etc, will result in falling behind and extreme difficulty in getting caught up. You may have been able to manage missing more than a few days each quarter in the past. In this course multiple missed days will be very hard to make up.
- Regardless of who teaches this course, it always follows the same pace, has the same workload, and the same difficulty level. There is a very specific amount of material that must be covered for the AP Test and there is no time to re-teach or slow down if some students are falling behind. We absolutely must be ready for the AP Test in May. You must accept the fact that you will have significant work outside of class and will need to get help on assignments and lab work.
- You must complete the summer assignment that follows. We will have a test on this material in the second week of school. In order for us to save some valuable time later in the course, everyone needs to be ready to go. Carefully read the information on the summer packet on the pages that follow.

We are going to have an exciting, challenging and fun year. I look forward working with you all next year. I hope you have a great summer. If you do have any questions please feel free to email me this summer.

AP CHEM SUMMER ASSIGNMENT

Before you arrive on the first day of class, you will need to have memorized or learned the following items or concepts. **You will be responsible for everything on the pages to follow**.

We will go through matter and measurement and then briefly touch on this material which is Chapters 2-3 in the book. You will have a unit test on this material in the second week of class.

This is the material from Chemistry/Honors Chemistry. It is expected that you remember this material, as on the AP Chem test, it is the basics that they expect all students to have memorized.
Glance through the pages now and notice those areas likely to require effort on your part. Keep this folder handy and take it with you into situations this summer where you are likely to find yourself with periods of free time. Learn a little at a time. There are also some excellent reviews online.
Putting this off until right before school starts will lead to high stress. Make some flashcards, get your parents to quiz you or get together with a buddy. Study it in small chunks rather than trying to learn it all at once. Good Luck!

Periodic Table – This is the periodic table on the AP test. Note: there are NO element names. Learn them, memorize them.

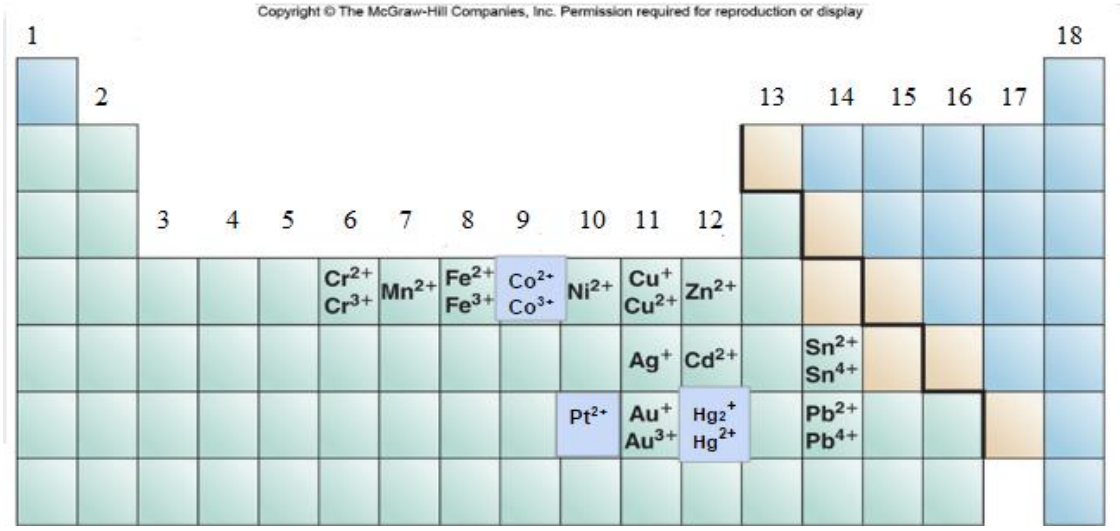
DO NOT DETACH FROM BOOK.

PERIODIC TABLE OF THE ELEMENTS

1																	18
1 **H** 1.008	2											13	14	15	16	17	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	3	4	5	6	7	8	9	10	11	12	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** 47.87	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** 65.38	31 **Ga** 69.72	32 **Ge** 72.63	33 **As** 74.92	34 **Se** 78.97	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** 95.95	43 **Tc** (97)	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** 121.76	52 **Te** 127.60	53 **I** 126.90	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** 183.84	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)	89 **†Ac** (227)	104 **Rf** (267)	105 **Db** (270)	106 **Sg** (271)	107 **Bh** (270)	108 **Hs** (277)	109 **Mt** (276)	110 **Ds** (281)	111 **Rg** (282)	112 **Cn** (285)	113 **Uut** (285)	114 **Fl** (289)	115 **Uup** (288)	116 **Lv** (293)	117 **Uus** (294)	118 **Uuo** (294)

*Lanthanoid 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** 173.05	71 **Lu** 174.97
†Actinoid 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)

The AP Chemistry class expects that the common ion charges of monoatomic and polyatomic ions be memorized:
The common **transition metal ions** are shown below:



This is the chart for **polyatomic ions**.

Table of Common Polyatomic Ions

Name	Chemical Formula	Charge
Acetate	$C_2H_3O_2$	-1
Ammonium	NH_4	+1
Bicarbonate	HCO_3	-1
Bromate	BrO_3	-1
Carbonate	CO_3	-2
Chlorate	ClO_3	-1
Chlorite	ClO_2	-1
Chromate	CrO_4	-2
Cyanide	CN	-1
Dichromate	Cr_2O_7	-2
Hydroxide	OH	-1
Hypoiodite	IO	-1

Name	Chemical Formula	Charge
Iodate	IO_3	-1
Nitrate	NO_3	-1
Nitrite	NO_2	-1
Oxalate	C_2O_4	-2
Perchlorate	ClO_4	-1
Permanganate	MnO_4	-1
Peroxide	O_2	-2
Phosphate	PO_4	-3
Phosphite	PO_3	-3
Sulfate	SO_4	-2
Sulfite	SO_3	-2
Thiosulfate	S_2O_3	-2

Covalent Compounds

The AP Chemistry test expects basic and advanced understanding of the periodic table.
Know the following
1) How to calculate protons, neutrons, electrons: in both neutral atoms and ions
2) How to recognize ions and isotopes
3) How to calculate the average atomic mass given the isotopes of an element
4) Describe the following periodic trends, both in terms of groups and periods
    a. Atomic number
    b. Atomic mass
    c. Ionization energy
    d. Electronegativity

Chemical Prefixes

Prefix	Meaning
Mono-	1
Di-	2
Tri-	3
Tetra-	4
Penta-	5
Hexa-	6
Hepta-	7
Octa-	8
Nona-	9
Deca-	10

POLYATOMIC ELEMENTS, ACIDS and COMMON COMPOUNDS

Memorize the following items. Know names and formulas:

Polyatomic Elements	Acids	Common Compounds
As_2 arsenic	CH_3COOH or $C_2H_4O_2$	$AlK(SO_4)_2 \cdot 12H_2O$ alum
At_2 astatine	acetic(vinegar) $HC_2H_3O_2$	CH_4 methane
Br_2 bromine	$C_{18}H_{34}O_2$ oleic	C_6H_6 benzene
Cl_2 chlorine	Cl_3CCOOH trichloroacetic	$C_{10}H_8$ naphthalene (moth balls)
F_2 fluorine	H_3BO_3 boric	$CHCl_3$ chloroform
H_2 hydrogen	HBr hydrobromic	CH_3OH methyl alcohol or methanol (wood alcohol)
I_2 iodine	HCOOH formic	C_2H_5OH ethyl alcohol or ethanol (drinking alcohol)
N_2 nitrogen	H_2CO_3 carbonic	CH_3COCH_3 acetone
O_2 oxygen	$H_2C_2O_4$ oxalic	$C_3H_5(OH)_3$ glycerin
P_4 phosphorus	HCl hydrochloric (muriatic)	$C_6H_8O_6$ L-ascorbic acid (vitamin C)
S_8 sulfur	HClO hypochlorous	$C_6H_{12}O_6$ monosaccharide (simple sugar)
Sb_4 antimony	$HClO_2$ chlorous	$C_{12}H_{22}O_{11}$ disaccharide (double sugar)
Se_8 selenium	$HClO_3$ chloric	$CaCO_3$ chalk, marble, limestone
	$HClO_4$ perchloric	CaO quicklime
	HF hydrofluoric	$Ca(OH)_2$ slaked lime (lime water)
	HI hydroiodic	$CaSO_4$ gypsum, plaster of paris
	HNO_2 nitrous	Fe_3O_4 or Fe_2O_3 rust
	HNO_3 nitric	HCHO formaldehyde
	H_2SO_3 sulfurous	H_2O water
	H_2SO_4 sufuric	Hg quicksilver
		K_2CO_3 potash
		MgO magnesia
		$MgSO_4$ epsom salts
		NH_3 ammonia
		N_2O laughing gas
		Na_2CO_3 soda ash
		NaCl table salt
		$NaHCO_3$ baking soda
		$NaNO_3$ saltpeter
		NaOCl bleach
		NaOH caustic soda or lye
		Na_2SO_4 Glauber's salt
		$Na_2S_2O_3$ hypo
		SiO_2 sand,quartz

Besides knowing the names of common chemicals, you are expected to be able to translate and recognize compounds.

Compounds (0.3 pts each, 21 pts total)

For each of the given compounds,

a) Write either the English or chemistry equivalent

b) Write the type of compound (Ionic or Covalent)--technically electronegativity >1.9 is considered ionic but in general a compound between a metal or polyatomic cation and nonmetal or polyatomic anion is considered ionic and is named differently than covalent compounds which use the prefixes on the previous page. Covalent compounds have bonds between nonmetals or between nonmetals and metalloids.

$AlCl_3$_____ sodium carbonate_____

CH_4_____ tin (II) iodide_____

N_3O_5_____ sulfur trioxide_____

CaO_____lithium nitride_____

VO_2_____ sodium hydroxide_____

$Fe(OH)_2$_____ copper (II) bromide_____

CrO_2_____ copper (I) bromide_____

$CuCl_2$_____ lead (II) phosphate_____

SI_6_____ lead (IV) oxide_____

HOH_____ tetracarbon octahydride_____

SrO_____ ammonium oxide_____

$Ba(NO_3)_2$_____ dinitrogen tetroxide_____

Ag_2O_____ cadmium (III) phosphide_____

FeI_3_____ hydrogen hydroxide_____

Ni_2O_3_____ dihydrogen monoxide_____

KBr_____ iron (III) hydride_____

Na_2O_____ mercury (II) sulfate_____

Li_3N_____ mercury (I) sulfate_____

Al_2O_3_____ lead (II) carbonate_____

CuO_____ lead (IV) carbonate_____

CuO_2_____ diphosphorous pentoxide_____

Cu_2O_____ calcium hydroxide_____

$SnBr_4$_____ aluminum nitride_____

P_2O_5_____ cobalt (III) oxide_____

NH_4OH_____ calcium phosphate_____

$(NH_4)_2S$_____ trinitrogen tetroxide_____

$PbCO_3$_____ iron (II) nitrate_____

$Sn(NO_3)_4$_____ acetic acid_____

$Sn(NO_2)_4$_____ hydrosulfuric acid (hydrogen sulfide)_____

$Pb(SO_4)_2$_____ silver nitrate_____

$NaHCO_3$_____ phosphoric acid_____

$Fe(IO_4)_3$_____ calcium nitrate_____

CsF_____ ammonium dichromate_____

$Ca(HSO_3)_2$_____ potassium chlorate_____

NiS_____ beryllium oxide_____

Chemical reactions (1 pt each)

The AP test expects that students not only be able to balance a chemical reaction, but recognize the type of chemical reactions (we'll discuss many types of reactions such as combustion and oxidation-reduction later, for now-these can be called displacements) and construct chemical reactions given the reactants and the type of chemical reaction. Remember for the ease of balancing to leave the polyatomic ions together unless they are broken up!

synthesis (combination) reaction: A + B → AB
decomposition reaction: AB → A + B
single displacement reaction: A + BC → B + AC, usually also redox
double displacement reaction: AB + CD → AD + CB

Type of Reaction	Balanced equation
1. _____	____Fe(s) + ____O_2(g) → ____Fe_2O_3
2. _____	____Ca(s) + ____H_2O(l) → ____$Ca(OH)_2$(aq) + ____H_2(g)
3. _____	____Fe_2O_3(s) + ____Al(s) → ____Fe(l) + ____Al_2O_3(s)
4. _____	____FeS + ____HCl → ____$FeCl_2$ + ____H_2S
5. _____	____Cl_2 + ____NaI → ____NaCl + ____I_2
6. _____	____$Al(NO_3)_3$ + ____H_2SO_4 → ____$Al_2(SO_4)_3$ + ____HNO_3
7. _____	____Ag_2O → ____Ag + ____O_2
8. _____	____ $(NH_4)_3PO_4$ + ____Ba(OH)$_2$ → ____$Ba_3(PO_4)_2$ + ____NH_4OH
9. _____	____$Ca(OH)_2$ + ____HNO_3 → ____$Ca(NO_3)_2$ + ____H_2O
10. _____	____$KMnO_4$ → ____K_2O + ____MnO + ____O_2

Translate the following from English to Chemical Equation (1 pt each)

1. When one aqueous lead (II) nitrate is mixed with two aqueous potassium iodides, the results are a single solid lead (II) iodide and two aqueous potassium nitrates.

2. One solid aluminum is mixed with three aqueous silver (I) nitrates. This reaction yields three solid silvers and one aqueous aluminum nitrate.

3. Two aqueous potassium nitrates are heated to produce two aqueous potassium nitrites and an oxygen gas.

4. When two aqueous hydrochloric acids are mixed with one aqueous magnesium hydroxide, two liquid waters and one solid magnesium chloride is produced.

5. When two octanes (C_8H_{18}) are mixed with twenty-five oxygen gases and heated in a car, sixteen carbon dioxide and eighteen waters in a gaseous state are produced.

THE SOLUBILITY RULES

These will be applied to chemical reactions to determine if the reaction will even occur at all.

Memorize these rules and apply them to the reactions below

Ion	Solubility	Exceptions
NO_3^-	soluble	none
ClO_4^-	soluble	none
Cl^-	soluble	except Ag^+, Hg_2^{2+}, *Pb^{2+}
I^-	soluble	except Ag^+, Hg_2^{2+}, Pb^{2+}
SO_4^{2-}	soluble	except Ca^{2+}, Ba^{2+}, Sr^{2+}, Hg^{2+}, Pb^{2+}, Ag^+
CO_3^{2-}	insoluble	except Group IA and NH_4^+
PO_4^{3-}	insoluble	except Group IA and NH_4^+
^-OH	insoluble	except Group IA, *Ca^{2+}, Ba^{2+}, Sr^{2+}
S^{2-}	insoluble	except Group IA, IIA and NH_4^+
Na^+	soluble	none
NH_4^+	soluble	none
K^+	soluble	none

*slightly soluble

1. The nitrates, nitrites, chlorates, and acetates of all metals are soluble in water. Silver acetate, silver nitrite, and potassium perchlorate are sparingly soluble.
2. All sodium, potassium, and ammonium salts are soluble in water. In general, all group 1 metal salts (Li^+, Na^+, K^+, Cs+, Rb^+) are soluble with very few exceptions.
3. The chlorides, bromides, and iodides of all metals except lead, silver, and mercury (I) are soluble in water. Hg2Br2 is moderately soluble. PbCl2, PbBr2, and PbI2 are soluble in hot water. The water-insoluble chlorides, bromides, and iodides are also insoluble in dilute acids.
4. The sulfates of all metals except lead, strontium, mercury (I), and barium are soluble in water. Silver sulfate and calcium sulfate are slightly soluble. The water-insoluble sulfates are also insoluble in dilute acids.
5. The carbonates, phosphates, borates, sulfites, chromates, and arsenates of all metals except sodium, potassium, and ammonium are insoluble in water, but soluble in dilute acids. MgCrO4 is soluble in water; $MgSO_3$ is slightly soluble in water.
6. The sulfides of all metals except lithium, barium, calcium, magnesium, potassium, sodium, and ammonium are insoluble in water. BaS, CaS, and MgS are sparingly soluble.
7. The hydroxides of lithium, sodium, potassium, and ammonium are very soluble in water. The oxides and OH^-s of calcium, strontium, and barium are moderately soluble. The oxides and OH^- of all other metals are insoluble.

Complete and balance the following chemical reactions (1.5 pts each)

(use the solubility rules to determine the composition (*s, l, g, aq*) of the products)

1) When iron (II) is mixed with hydrochloric acid

2) When copper (II) is mixed with iron (III) chloride

3) When hydrogen gas and oxygen gas are combined with fire

4) When potassium is added to water

5) When calcium is allowed to sit and react with the oxygen in the air

6) When sulfuric acid is mixed with sodium hydroxide

7) When silver chloride is mixed with sodium hydroxide

8) When lead (II) iodide is mixed with calcium sulfate

9) When propane (tricarbon octahydride) is burnt in air

10) When butane (tetracarbon decahydride) reacts with oxygen in the air through a combustion reaction

Stoichiometry (1.5 pts each)

AP Chemistry will expect this process to be understood intimately, as this is the root of all the math and logic. We will expand upon this topic constantly, but the process will always remain the same.

Solve the following

1. If aluminum is oxidized to form aluminum oxide, how many grams of aluminum oxide would form if 12.5 moles of aluminum burned?

2. If aluminum is oxidized to form aluminum oxide, how many moles of oxygen are needed to react with 7.5 moles of aluminum?

3. If aluminum is oxidized to form aluminum oxide, how many moles of oxygen are needed to react with 100.0 grams of aluminum?

4. If aluminum is oxidized to form aluminum oxide, how many grams of aluminum burned if 200.0 grams of aluminum oxide formed?

5. How many moles of carbon dioxide will form if 5.5 moles of C_3H_8 is burned?

6. If 30.0 moles of oxygen are used to burn C_3H_8, how many grams of water will form?

7. If 100.0 grams of C_3H_8 burns, how many moles of carbon dioxide will form?

8. How many grams of oxygen are needed to burn 5.0 moles of C_3H_8?

9. If magnesium is added to 10.0 mL of 6.0 M hydrochloric acid, how many liters of hydrogen gas are produced? Assume STP.

Use the following equation to answer questions 10-13:
$2\ C_6H_{10} + 17\ O_2 \rightarrow 12\ CO_2 + 10\ H_2O$

10. If I do this reaction with 35.0 grams of C_6H_{10} and 45.0 grams of oxygen, how many grams of carbon dioxide will be formed?

11. What is the limiting reagent for this problem?

12. How much of the excess reagent is left over after the reaction is finished?

13. If 35 grams of carbon dioxide are actually formed from the reaction, what is the percent yield of this reaction?

14. Determine the mass of aluminum acetate that can be made if 125 grams of acetic acid and 275 grams of aluminum hydroxide are mixed.

15. What is the limiting reagent in question #14?

16. What is the amount of excess reagent in question #14?