AICE CHEMISTRY SUMMER PACKET 2014

INSTRUCTOR: MR. STEWART

Introduction:

I am glad you have decided to take AICE Chemistry! This course is designed to give you a more complete experience of chemistry that will prepare you for both the AICE Chem exam in the spring of next year and for introductory chemistry in college.

The only way to complete all the topics in this course is to move at a very rapid pace. I will try to finish the lecture portion of the course shortly after the end of the third quarter so we can begin reviewing for the exam. Therefore, it is critical for all students to complete the Summer Assignment to be ready to get after it in the fall.

Course Overview:

The course is taught through a series of lectures and laboratories with homework problems, practice exams/quizzes, and worksheets. Exams comprise the bulk of the grading criteria. It is very important that you stay on top of your homework assignments (i.e. worksheets, packets, etc) in order for you to succeed on your quizzes & tests. Please do not copy, as this will severely hurt you when it comes time to take a test.

Why take AICE 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 AICE Chem Exam (A-level) next May/June 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 AICE 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 AICE 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.
- AICE 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.
- AICE Chem will teach you to think at higher levels. In AICE 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.
- At SAHS, you will find it can be easier to learn chemistry than in college because of the small class sizes and individual time and help that I can give you. Freshman college chemistry is usually taught in large lecture halls (up to 250 students) where individual assistance is difficult to find.

Tips for achieving success in AICE Chemistry:

- Study AICE Chem every day for at least 30min. This means that if there are no formal assignments, you should be using this time to review your class notes, read the text, give yourself a practice quiz, make note cards (this is very helpful), etc. 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. Get together at regularly scheduled times for study and homework. DO NOT begin "splitting up" the work, as this will ultimately hurt you.
- Purchase a study guide and use it for each chapter studied. Sites such as **chemguide.co.uk** are very helpful
- Avoid getting behind in this course. If you get stuck on a concept or H/W set, get help immediately.
- Come early in the mornings for extra help if you need it. I'm also available during lunch if you let me know beforehand.

The Commitment:

If you taking this course, you have already enjoyed success in your academic career. Taking a course such as AICE 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 AICE 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 AICE 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 AICE Test in May/June. 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 on the **1st day of class**. 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. I cannot promise to check it every day, but I will get back to you as soon as I can.

Remember your summer assignment and 1st day test, and I'll see you in the fall!

TOPICS TO KNOW FOR THE 1ST DAY TEST:

a) **IONS**
b) **SOLUBILITY RULES**
c) **OXIDATION NUMBERS**
d) **NAMING / WRITING FORMULAS**

AICE 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.**

- You must be ready to be tested on this material on the **1ST day of class**.

- Some of the material is review from Pre-AICE Chem. Some of the material will be new and may seem strange. Nonetheless, you need to know it all and know it well.

- 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 (beach ☺). Make yourself notecards. Learn a little at a time. There are also some excellent reviews online.

- Putting this off until right before school starts will lead to undo stress. Make some note cards, 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!

Memorize the following items. Know name, formula (or symbol) and charges:

Positive Ions (Cations)

1+	2+	3+	4+
ammonium NH_4^+ cesium Cs^+ copper(I) Cu^+ gold(I) Au^+ hydrogen H^+ lithium Li^+ potassium K^+ rubidium Rb^+ silver Ag^+ sodium Na^+	barium Ba^{2+} beryllium Be^{2+} cadmium(II) Cd^{2+} calcium Ca^{2+} chromium(II) Cr^{2+} cobalt(II) Co^{2+} copper(II) Cu^{2+} iron(II) Fe^{2+} lead(II) Pb^{2+} magnesium Mg^{2+} manganese(II)Mn^{2+} mercury(I) Hg_2^{2+} mercury(II) Hg^{2+} nickel(II) Ni^{2+} strontium Sr^{2+} tin(II) Sn^{2+} zinc Zn^{2+}	aluminum Al^{3+} antimony(III) Sb^{3+} bismuth(III) Bi^{3+} chromium(III) Cr^{3+} cobalt(III) Co^{3+} gallium Ga^{3+} gold(III) Au^{3+} manganese(III) Mn^{3+} nickel(III) Ni^{3+} iron(III) Fe^{3+}	carbon C^{4+} lead(IV) Pb^{4+} silicon Si^{4+} tin(IV) Sn^{4+}
			5+
			antimony(V) Sb^{5+} bismuth(V) Bi^{5+}

Memorize the following items. Know name, formula (or symbol) and charges:

Negative Ions (Anions)

-1	-2	-3	-4
acetate CH_3COO^- bromide Br^- chlorate ClO_3^- chloride Cl^- chlorite ClO_2^- cyanide CN^- dihydrogen phosphate $H_2PO_4^-$ fluoride F^- hydride H^- hydroxide OH^- hypochlorite ClO^- iodide I^- nitrate NO_3^- perchlorate ClO_4^- permanganate MnO_4^-	carbonate CO_3^{2-} chromate CrO_4^{2-} dichromate $Cr_2O_7^{2-}$ oxalate $C_2O_4^{2-}$ oxide O^{2-} peroxide O_2^{2-} selenide Se^{2-} silicate SiO_3^{2-} sulfate SO_4^{2-} sulfide S^{2-} sulfite SO_3^{2-}	arsenide As^{3-} nitride N^{3-} phosphate PO_4^{3-} phosphide P^{3-} phosphite PO_3^{3-}	carbide C^{4-}

Memorize the following items. Know names and formulas:

POLYATOMIC ELEMENTS, ACIDS and COMMON COMPOUNDS

Polyatomic Elements	Acids	Common Compounds DO NOT MEMORIZE
As_2 arsenic	CH_3COOH or $C_2H_4O_2$	$AlK(SO_4)_2 \cdot 12H_2O$ alum
At_2 astatine	acetic(vinegar)	CH_4 methane
Br_2 bromine	HBr hydrobromic	C_6H_6 benzene
Cl_2 chlorine	H_2CO_3 carbonic	$C_{10}H_8$ naphthalene (moth balls)
F_2 fluorine	$H_2C_2O_4$ oxalic	$CHCl_3$ chloroform
H_2 hydrogen	HCl hydrochloric (muriatic)	CH_3OH methyl alcohol or methanol (wood alcohol)
I_2 iodine	HClO hypochlorous	C_2H_5OH ethyl alcohol or ethanol (drinking alcohol)
N_2 nitrogen	$HClO_2$ chlorous	CH_3COCH_3 acetone
O_2 oxygen	$HClO_3$ chloric	$C_3H_5(OH)_3$ glycerin
P_4 phosphorus	$HClO_4$ perchloric	$C_6H_8O_6$ L-ascorbic acid (vitamin C)
S_8 sulfur	HF hydrofluoric	$C_6H_{12}O_6$ monosaccharide (simple sugar)
Sb_4 antimony	HI hydroiodic	$C_{12}H_{22}O_{11}$ disaccharide (double sugar)
Se_8 selenium	HNO_2 nitrous	$CaCO_3$ chalk, marble, limestone
	HNO_3 nitric	CaO quicklime
	H_2SO_3 sulfurous	$Ca(OH)_2$ slaked lime (lime water)
	H_2SO_4 sufuric	$CaSO_4$ gypsum, plaster of paris
		Fe_3O_4 or Fe_2O_3 rust
		HCHO formaldehyde
		H_2O water
		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

Memorize the following items:

THE SOLUBILITY RULES

1. All compounds containing alkali metal cations and the ammonium ion are soluble.
2. All compounds containing NO_3^-, ClO_4^-, ClO_3^-, and $C_2H_3O_2^-$ anions are soluble.
3. All chlorides, bromides, and iodides are soluble except those containing Ag^+, Pb^{2+}, or Hg_2^{2+}.
4. All sulfates are soluble except those containing Hg_2^{2+}, Hg^{2+}, Ag^+, Pb^{2+}, Sr^{2+}, Ca^{2+}, or Ba^{2+}.
5. All hydroxides are insoluble except compounds of the alkali metals, Ca^{2+}, Sr^{2+} and Ba^{2+}.
6. All compounds containing PO_4^{3-}, S^{2-}, CO_3^{2-}, and SO_3^{2-} ions are insoluble except those that also contain alkali metals or NH_4^+.
7. Rules above take precedent over rules below.

OXIDATION NUMBER RULES

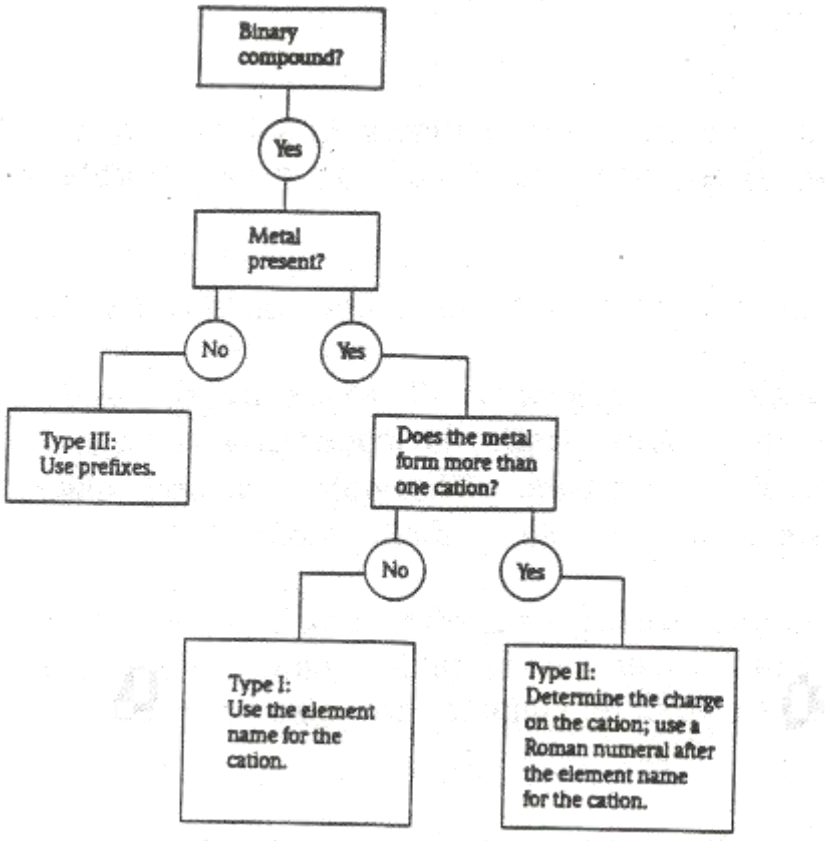
Oxidation Number: A number assigned to an atom in a molecular compound or molecular ion that indicates the general distribution of electrons among the bonded atoms. In some cases it is an actual charge of the atom while in other cases it is a "perceived" charge if shared electrons were "given to" one atom or the other. Which atom would "get" the electrons is based on electronegativity values.

1. The oxidation number of **any uncombined element** is 0 (zero). For example, the charge on elements iron, Fe, is 0. The charge on each hydrogen in H_2, a diatomic element, is also 0.
2. The oxidation number of **a monatomic ion** equals the charge on the ion.
3. **The more electronegative element in a binary compound** is assigned the number equal to the charge it would have if it were an ion.
4. The oxidation number of **fluorine** in a compound is always –1
5. **Oxygen** has an oxidation number of –2 unless it is combined with F, when it is +2, or it is in a peroxide, when it is –1.
6. The oxidation state of **hydrogen** is+1when combined with a nonmetal and is -1 when combined with a metal.
7. In compounds, the elements of **groups 1 and 2 as well as aluminum** have oxidation numbers of +1, +2, and +3, respectively
8. The sum of the oxidation numbers of all atoms in a neutral compound is 0 (zero).
9. The sum of the oxidation number of all atoms in a polyatomic ion equals the charge of the ion.

KNOW HOW TO NAME AND WRITE FORMULAS!!!

NAMING RULES

A flow chart for naming binary compounds



Prefixes Used to Indicate Numbers in Chemical Names

Prefix	Number Indicated
mono-	1
di-	2
tri-	3
tetra-	4
penta-	5
hexa-	6
hepta-	7
octa-	8

Rules for Naming Binary Cov. Compounds

1. The first element in the formula is named first, and the full element name is used.
2. The second element is named as though it were an anion.
3. Prefixes are used to denote the numbers of atoms present. These prefixes are given to the left.
4. The prefix *mono-* is never used for naming the first element. For example, CO is called carbon monoxide, *not* monocarbon monoxide.

RULES FOR NAMING IONIC COMPOUNDS

1. Balance Charges (charges should equal zero)
2. Cation is always written first (in name and in formula)
3. Change the ending of the anion to –ide
4. If cation has more than one oxidation number, use a Roman Numeral to indicate its charge
5. If anion is a polyatomic ion, name it.

NOMENCLATURE PRACTICE

Naming Review (this isn't due, but it would help if you completed it)

$AlCl_3$_____
CH_4_____
N_3O_5_____
CaO_____
VO_2_____
$Fe(OH)_2$_____
CrO_2_____
$CuCl_2$_____
SI_6_____
HOH_____
SrO_____
$Ba(NO_3)_2$_____
Ag_2O_____
FeI_3_____
Ni_2O_3_____
KBr_____
Na_2O_____
Li_3N_____
Al_2O_3_____
CuO_____
CuO_2_____
Cu_2O_____
$SnBr_4$_____
P_2O_5_____
NH_4OH_____
$(NH_4)_2S$_____
$PbCO_3$_____
$Sn(NO_3)_4$_____
$Sn(NO_2)_4$_____
$Pb(SO_4)_2$_____
$NaHCO_3$_____

sodium carbonate_____
tin (II) iodide_____
sulfur trioxide_____
lithium nitride_____
sodium hydroxide_____
copper (II) bromide_____
copper (I) bromide_____
lead (II) phosphate_____
lead (IV) oxide_____
tetracarbon octahydride_____
ammonium oxide_____
dinitrogen tetroxide_____
cadmium (III) phosphide_____
hydrogen hydroxide_____
dihydrogen monoxide_____
iron (III) hydride_____
mercury (II) sulfate_____
mercury (I) sulfate_____
lead (II) carbonate_____
lead (IV) carbonate_____
diphosphorous pentoxide_____
calcium hydroxide_____
aluminum nitride_____
cobalt (III) oxide_____
calcium phosphate_____
trinitrogen tetroxide_____
iron (II) nitrate_____
acetic acid_____
hydrosulfuric acid_____
silver nitrate_____
phosphoric acid_____

CONCEPTS YOU **MUST** BE COMFORTABLE WITH:

Prerequisite Objectives: The following are a list of objectives you are expected to know, and will not be taught but can be necessary to solve problems or explain fundamental concepts in chemistry.

- I can convert between SI units (m → km)
- I can, given the formula of a compound, calculate any compound's molar mass
- I can apply the rules of significant figures to round answers to appropriate number of digits
- I can apply the formula for percent error to a set of data
- I can find the percent composition of a compound
- I can balance a chemical equation
- I can determine the number of protons, neutrons, and electrons in an isotope
- I can determine the charge of an ion from its location on the periodic table
- I can use the periodic table to determine if a compound is ionic or covalent
- I can recall the common diatomic molecules and know when to apply them (H,O,F,Br,I,N,Cl all should be written as H_2, O_2, etc.)
- I can recall the formula and name of a polyatomic ion from a list (see below) of common polyatomic ions
- I can use Avogadro's number, 6.02×10^{23}, to convert between particles and moles
- I can use dimensional analysis, aka conversion factors, to convert between units (especially grams → mol)

Chemistry Fundamentals Objectives (Subject to Change):

- I can recall and explain the significant experiments which led to the discovery of the current model of the atom
- I can write the formula and name of ionic and covalent compounds
- I can write the formula and name of binary and oxyacids
- I can name hydrated ionic compounds
- I can determine the atomic mass of an element given a list of isotopes and their abundances.
- I can calculate the empirical formula of a compound given percent by mass, or given masses of all elements in the compound
- I can calculate the percent yield of a reaction given experimental data
- I can determine the molecular formula of a compound from its empirical formula and its molar mass
- I can evaluate hydrate analysis data to determine the formula of a hydrate.
- I can evaluate combustion analysis data to determine the formula of a hydrocarbon.
- I can use stoichiometric calculations to determine the following: amount of product produced, the limiting and excess reactant, amount of excess reactant remaining

I. Chemical Formulas: [Never can do enough of these]

1. Write formulas for the following:

a. barium sulfate _____

b. ammonium chloride _____

c. chlorine monoxide _____

d. silicon tetrachloride _____

e. magnesium fluoride _____

f. sodium oxide _____

g. sodium peroxide _____

h. copper(I) oxide _____

i. zinc sulfide _____

j. potassium carbonate _____

k. hydrobromic acid _____

l. perchloric acid _____

m. lead(II) acetate _____

n. sodium permanganate _____

o. lithium oxalate _____

p. potassium cyanide _____

q. iron (III) hydroxide _____

r. silicon dioxide _____

s. nitrogen trifluoride _____

t. chromium(III) oxide _____

u. calcium chlorate _____

v. sodium thiocyanate _____

w. nitrous acid _____

2. Name each of the following:

a. $CuSO_4$ _____

b. PCl_3 _____

c. Li_3N _____

d. $BaSO_3$ _____

e. N_2F_4 _____

f. $KClO_4$ _____

g. NaH _____

h. $(NH_4)_2Cr_2O_7$ _____

i. HNO_2* _____

j. Sr_3P_2 _____

k. $Mg(OH)_2$ _____

l. Al_2S_3 _____

m. $AgBr$ _____

n. P_4O_{10} _____

o. $HC_2H_3O_2$* _____

p. CaI_2 _____

q. MnO_2 _____

r. Li_2O _____

s. FeI_3 _____

t. Cu_3PO_4 _____

u. PCl_5 _____

v. $NaCN$ _____

w. HF* _____

*Name as acids.

II. Stoichiometry: Show all of your work for the following problems:
You may find the following websites helpful:
http://www.chemtutor.com/mols.htm
http://www.chem.tamu.edu/class/majors/tutorialnotefiles/limiting.htm
http://www.ausetute.com.au/idealgas.html

1. Find the mass percent of nitrogen in each of the following compounds:

   a. NO

   b. NO_2

   c. N_2O_4

   d. N_2O

2. Benzene contains only carbon and hydrogen and has a molar mass of 78.1 g/mol. Analysis shows the compound to be 7.74 % hydrogen by mass. Find the empirical and molecular formulas of benzene.

3. Calcium carbonate decomposes upon heating, producing calcium oxide and carbon dioxide.
   a. Write a balanced chemical equation for this reaction.

   b. How many grams of calcium oxide will be produced after 12.25 grams of calcium carbonate are completely decomposed?

   c. What is the volume of carbon dioxide gas produced 12.25 grams of calcium carbonate at STP?

d. What is the volume of carbon dioxide in L if the pressure is pressure is 785mm Hg and the temperature is 30°C? (R =62.4 mm x L/mol x K)

4. Hydrogen gas and bromine gas react to form hydrogen bromide gas.
   a. Write a balanced equation for this reaction.

   b. 3.2 grams of hydrogen react with 9.5 grams of bromine. Which is the limiting reagent?

   c. How many grams of hydrogen bromide gas can be produced using the amounts in (b)?

   d. How many grams of excess reactant are left unreacted?

   e. What volume of HBr, measured at STP is produced in (b)?

5. When ammonia gas, oxygen gas and methane gas (CH_4) are combined, the products are hydrogen cyanide gas and water.

   a. Write a balanced chemical equation for this reaction.

   b. Calculate the mass of each product produced when 225 grams of oxygen gas is reacted with an excess of the other two reactants.

   c. If the actual yield of the experiment in (b) is 105 grams of HCN, calculate the percent yield.

III. Chemical Reactions

In AP Chemistry, most of the reaction we write are called "net ionic." But before we can do that, you need to review and memorize some basic reaction types. For some basic review, go to the following website:
http://misterguch.brinkster.net/6typesofchemicalrxn.html

Now try these sample problems from the website:

Give the type for each of the following reactions:

1) $NaOH + KNO_3 \rightarrow NaNO_3 + KOH$ _____

2) $CH_4 + 2\ O_2 \rightarrow CO_2 + 2\ H_2O$ _____

3) $2\ Fe + 6\ NaBr \rightarrow 2\ FeBr_3 + 6\ Na$ _____

4) $CaSO_4 + Mg(OH)_2 \rightarrow Ca(OH)_2 + MgSO_4$ _____

5) $NH_4OH + HBr \rightarrow H_2O + NH_4Br$ _____

6) $Pb + O_2 \rightarrow PbO_2$ _____

7) $Na_2CO_3 \rightarrow Na_2O + CO_2$ _____

You will also need to learn which acids and bases are strong and which are weak. See this document online:
http://spiepho.sbc.edu/worksheets/Gen_Chem_2/Chp15,Acids_and_Bases.doc
It takes awhile to read, but it is very complete! A simple way to remember acids: all binary acids, except HF are strong. Oxyacids (contain polyatomic ions) are strong if there are two more oxygen atoms than hydrogen atoms:
H_2SO_4 = strong H_2SO_3 = weak

Learn these types of decomposition reactions:

1. Metallic carbonates, when heated, form metallic oxides and $CO_{2(g)}$.

   EX. $CaCO_{3(s)} \rightarrow CaO_{(s)} + CO_{2(g)}$

2. Most metallic hydroxides, when heated, decompose into metallic oxides and water.

   EX. $Ca(OH)_{2(s)} \rightarrow CaO_{(s)} + H_2O_{(g)}$

3. Metallic chlorates, when heated, decompose into metallic chlorides and oxygen.

   EX. $2KClO_{3(s)} \rightarrow 2KCl_{(s)} + 3O_{2(g)}$

4. Some acids, when heated, decompose into nonmetallic oxides and water.

   EX. $H_2SO_4 \rightarrow H_2O_{(l)} + SO_{3(g)}$

5. Some oxides, when heated, decompose.

   EX. $2HgO_{(s)} \rightarrow 2Hg_{(l)} + O_{2(g)}$

6. Some decomposition reactions are produced by electricity.

   EX. $2H_2O_{(l)} \rightarrow 2H_{2(g)} + O_{2(g)}$

   EX. $2NaCl_{(l)} \rightarrow 2Na_{(s)} + Cl_{2(g)}$

Now try these: (Rewrite as a balanced equation with the products predicted):

1. barium hydroxide (heated)

_____

2. sodium carbonate (heated)

_____

3. lithium chlorate (heated)

_____

4. electrolysis of aluminum oxide

_____

5. sulfuric acid heated gently

_____

Learn these types of synthesis reactions:

1. Metal + oxygen → metal oxide

   EX. $2Mg_{(s)} + O_{2(g)} \rightarrow 2MgO_{(s)}$

2. Nonmetal + oxygen → nonmetallic oxide

   EX. $C_{(s)} + O_{2(g)} \rightarrow CO_{2(g)}$

3. Metal oxide + water → metallic hydroxide

   EX. $MgO_{(s)} + H_2O_{(l)} \rightarrow Mg(OH)_{2(s)}$

4. Nonmetallic oxide + water → acid

   EX. $CO_{2(g)} + H_2O_{(l)} \rightarrow \ ; H_2CO_{3(aq)}$

5. Metal + nonmetal → salt

   EX. $2\,Na_{(s)} + Cl_{2(g)} \rightarrow 2NaCl_{(s)}$

6. A few nonmetals combine with each other.

   EX. $2P_{(s)} + 3Cl_{2(g)} \rightarrow 2PCl_{3(g)}$

Now try these: (Rewrite as a balanced equation with the products predicted):

1. magnesium burned in oxygen

_____

2. hydrogen gas + nitrogen gas

_____

3. sulfur burned (complete combustion)

_____

4. calcium oxide added to water

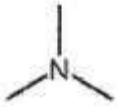
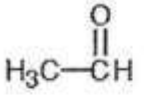
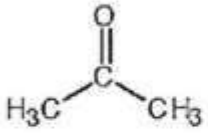
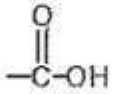
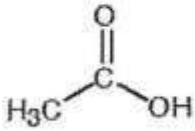
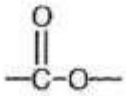
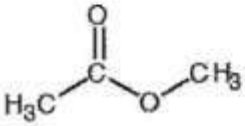
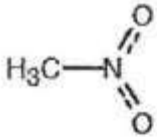
_____

Organic Chemistry-Just the basics:
http://www.visionlearning.com/library/module_viewer.php?mid=60

Hydrocarbon prefix	# of carbon atoms
Meth	1
Eth	2
Prop	3
But	4
Pent	5
Hex	6
Hept	7
Oct	8
Non	9
Dec	10

Hydrocarbons Containing Functional Groups

The basic types of hydrocarbon compounds outlined above may have one or more of their hydrogen atoms replaced by a **functional group**. The substituted benzenes earlier illustrated a number of functionalities (-CH_3, -OH, etc.) attached to the aromatic ring. Additional examples are shown in the table below.

Functional Group	Class of Compound	Example	Name
-OH	alcohol	$H_3C—CH_2—OH$	ethanol (ethyl alcohol)
-O-	ether	$H_3C—O—CH_3$	dimethyl ether
	amine	$H_2N—CH_3$	methylamine
	aldehyde		ethanal (acetaldehyde)
	ketone		propanone (acetone)
	carboxylic acid		ethanoic acid (acetic acid)
	ester		methyl acetate
$-NO_2$	nitro		nitromethane
-X (X = F, Cl, Br, I)	haloalkane	$H_3C—CH_2—Cl$	chloroethane (ethyl chloride)

[WORK ON SEPARATE PAPER PLEASE]

1. Predict whether each of the following compounds is molecular or ionic (a)B_2H_6 (b)CH_3OH (c)$LiNO_3$ (d)Sc_2O_3 (e)CsBr (f)NOCl (g)NF_3 (h)Ag_2SO_4

2. Write the correct chemical formulas to distinguish between each of the following pairs of chemicals. (a) calcium sulfide and calcium hydrogen sulfide (b) hydrobromic acid and bromic acid (c) aluminum nitride and aluminum nitrate (d) ammonia and ammonium ion (e) iron(II)oxide and Iron(III)oxide (f) potassium sulfate and potassium thiosulfate (g) magnesium chloride and manganese(II)chloride

3. How many protons, neutrons and electrons are in each of the following (a)^{55}Mn (b)^{40}Ar (c) $^{65}Zn^{2+}$(d)$^{79}Se^{2-}$ (e)^{184}W (f)^{235}U

4. Convert the following temperatures (a) 1000K to °C (b) 273°C to K

5. The element oxygen has three naturally occurring isotopes: oxygen-16, oxygen-17 and oxygen-18. Discuss the similarities and differences between these three types of atoms.

6. Consider the elements Ar, H, Ga, Al, Ca, Br, Ge, K and O. Pick the one that best fits each of the following descriptions. (a) an alkali metal (b) an alkaline earth metal (c) a noble gas (d) a halogen (e) a metalloid (f) a nonmetal listed in group 1 (g) a metal that forms a +3 ion (h) an element that resembles aluminum

7. An asthma drug dose is 6.0 mg/kg of body mass. What should the dose be for a 175lb person?

8. Write the empirical formula to each of the follow molecular formulas. (a) S_4N_4 (b) C_7H_{14} (c) $C_6H_{10}O_2$(d)P_4O_6 (e) $C_6H_{10}F_8$ (f)Si_3O_9

9. Each of the following elements can form an ion in a chemical reaction. By referring to the periodic table or other references, predict the charge of the most stable ion of each. (a) Al (b) Ca (c) S (d) I (e) Cs

10. Surgeons removed 10. Kg of fat from a patient by a procedure called liposuction. One fat cell has a mass of 0.80 μg. How many fat cells where removed?

11. What is the number of significant figures in the following measured quantities? 1282 kg (b) 0.00296 s (c) 8.070 mm (d) 8,070 mm (e) 0.0105 L (f) 9.7750×10^{-4} cm (g) 1.689×10^{-3} km (h) 0.0234 m^2 (i) 7,194,300 cm (j) 435.983 K (k) 204.080 g

12. Round each of the following numbers to three significant figures and express each in scientific notation (a) 143700 (b) 0.09750 (c) 890,000 (d) 6.764×10^4 (e) 33,987.22 (f) -6.5559

13. Carry out the following operations, and express the answer with the appropriate number of significant figures. (a) 1.24056 + 75.80 (b) 23.67 -75 (c) 8900 x 112.3 (d) 78,132/2.50

14. Classify each of the following as to pure substances or mixtures. If an item is a mixture, specify if it is heterogeneous or homogeneous. (a) concrete (b) seawater (c) magnesium (d) gasoline (e) air (f) tomato juice (g) iodine crystals (h) a nickel

15. Write the number 1200 three ways: to 2, 3, and 4 significant figures

16. A container has a volume of 1.05×10^3 cm^3. When filled with gas, the mass of the container + gas is 837.6 g. The mass of the container alone is 836.2 g. To the correct number of significant figures, what is the density of the gas?

17. Perform the following conversion: What is the cost of gasoline in US$ per gallon for fuel in London that costs £0.75 per liter? (1£= 2.03$)

18. Describe how you would separate and recover into four separate containers the following four components of a mixture: liquid water ($H_2O(l)$) + iron filings ($Fe(s)$) + sodium chloride dissolved in water ($NaCl(aq)$) + beach sand grains ($SiO_2(s)$).

19. How would you separate a mixture of granulated sugar and beach sand of comparable grain size?

20. Name the following elements H, Mg, Pb, Si, F, Sn, Cu, Ca, Ba, Cf, Mo, Se, Tl, V, Au, Zr

21. A solid white substance A is heated strongly in the absence of air. It decomposes to form a new white solid substance B and a gas C. The gas has exactly the same properties as the product obtained when carbon is burned with excess oxygen. What can you say about whether solids A and B and the gas C are elements or compounds?

22. In the process of attempting to characterize a substance, a chemist makes the following observation: The substance is a silvery white, lustrous metal. It burns in air, producing an intense white light. It reacts with chlorine to give a brittle white solid. The substance can be pounded into thin sheets or down into wires. It is a good conductor of electricity. Which of these characteristics are physical and which are chemical properties?

23. Fill in all the gaps in the table assuming all the atoms are neutral

Symbol	^{39}K				
Protons		25			82
Neutrons		30	64		
Electron			48	56	
Mass #				137	207

24. Fill in the gaps of the table

Symbol	$^{52}Cr^{3+}$	$^{131}I^-$			
Protons			47		33
Neutrons			60	69	42
Electron			46	48	
Net Charge				2+	3-

25. Write the symbol for each of the following elements and indicate whether it is a metal, metalloid, or nonmetal. (a)silver (b)helium (c) phosphorous(d) aluminum (e) cadmium (f)calcium (g) bromine (h) arsenic

26. How many hydrogen atoms are there in the following? (a) C_2H_5OH (b) $Ca(C_2H_3COO)_2$ (c)$(NH_4)_2HPO_4$