

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 $\text{Cr}_2\text{O}_7^{2-}$ oxalate $\text{C}_2\text{O}_4^{2-}$ 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 <u>DO NOT MEMORIZE</u>
<p>As₂ arsenic At₂ astatine Br₂ bromine Cl₂ chlorine F₂ fluorine H₂ hydrogen I₂ iodine N₂ nitrogen O₂ oxygen P₄ phosphorus S₈ sulfur Sb₄ antimony Se₈ selenium</p>	<p>CH₃COOH or C₂H₄O₂ acetic(vinegar) HBr hydrobromic H₂CO₃ carbonic H₂C₂O₄ oxalic HCl hydrochloric (muriatic) HClO hypochlorous HClO₂ chlorous HClO₃ chloric HClO₄ perchloric HF hydrofluoric HI hydroiodic HNO₂ nitrous HNO₃ nitric H₂SO₃ sulfurous H₂SO₄ sulfuric</p>	<p>AlK(SO₄)₂·12H₂O alum CH₄ methane C₆H₆ benzene C₁₀H₈ naphthalene (moth balls) CHCl₃ chloroform CH₃OH methyl alcohol or methanol (wood alcohol) C₂H₅OH ethyl alcohol or ethanol (drinking alcohol) CH₃COCH₃ acetone C₃H₅(OH)₃ glycerin C₆H₈O₆ L-ascorbic acid (vitamin C) C₆H₁₂O₆ monosaccharide (simple sugar) C₁₂H₂₂O₁₁ disaccharide (double sugar) CaCO₃ chalk, marble, limestone CaO quicklime Ca(OH)₂ slaked lime (lime water) CaSO₄ gypsum, plaster of paris Fe₃O₄ or Fe₂O₃ rust HCHO formaldehyde H₂O water Hg quicksilver K₂CO₃ potash MgO magnesia MgSO₄ epsom salts NH₃ ammonia N₂O laughing gas Na₂CO₃ soda ash NaCl table salt NaHCO₃ baking soda NaNO₃ saltpeter NaOCl bleach NaOH caustic soda or lye Na₂SO₄ Glauber's salt Na₂S₂O₃ hypo SiO₂ sand, quartz</p>

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 $\text{C}_2\text{H}_3\text{O}_2^-$ 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.
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OXIDATION NUMBER RULES

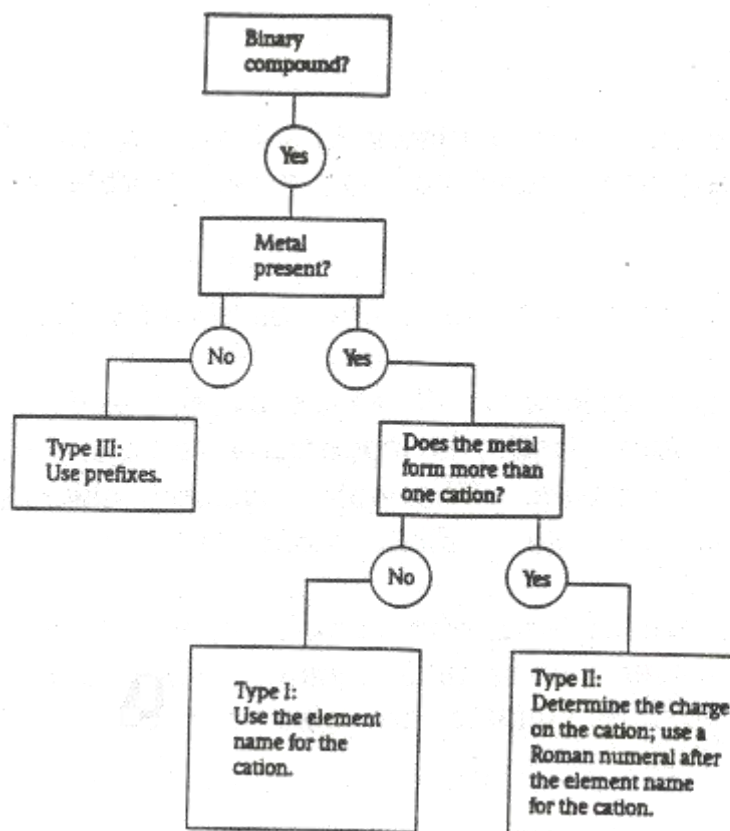
Oxidation Number: A number assigned to an atom in a molecular compound or molecular ion that indicates the general distribution of electrons among the bonded atoms. In some cases it is an actual charge of the atom while in other cases it is a “perceived” charge if shared electrons were “given to” one 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 $+1$ when 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
<i>mono-</i>	1
<i>di-</i>	2
<i>tri-</i>	3
<i>tetra-</i>	4
<i>penta-</i>	5
<i>hexa-</i>	6
<i>hepta-</i>	7
<i>octa-</i>	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 _____	sodium carbonate _____
CH_4 _____	tin (II) iodide _____
N_3O_5 _____	sulfur trioxide _____
CaO _____	lithium nitride _____
VO_2 _____	sodium hydroxide _____
$\text{Fe}(\text{OH})_2$ _____	copper (II) bromide _____
CrO_2 _____	copper (I) bromide _____
CuCl_2 _____	lead (II) phosphate _____
SI_6 _____	lead (IV) oxide _____
HOH _____	tetracarbon octahydride _____
SrO _____	ammonium oxide _____
$\text{Ba}(\text{NO}_3)_2$ _____	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 _____
$(\text{NH}_4)_2\text{S}$ _____	trinitrogen tetroxide _____
PbCO_3 _____	iron (II) nitrate _____
$\text{Sn}(\text{NO}_3)_4$ _____	acetic acid _____
$\text{Sn}(\text{NO}_2)_4$ _____	hydrosulfuric acid _____
$\text{Pb}(\text{SO}_4)_2$ _____	silver nitrate _____
NaHCO_3 _____	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 H₂, O₂, 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. Ti_2N _____
- d. BaSO_3 _____
- e. N_2F_4 _____
- f. KClO_4 _____
- g. NaH _____
- h. $(\text{NH}_4)_2\text{Cr}_2\text{O}_7$ _____
- i. HNO_2^* _____
- j. Sr_3P_2 _____
- k. $\text{Mg}(\text{OH})_2$ _____
- l. Al_2S_3 _____
- m. AgBr _____
- n. P_4O_{10} _____
- o. $\text{HC}_2\text{H}_3\text{O}_2^*$ _____
- 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.

- d. What is the volume of carbon dioxide in L if the pressure is pressure is 785mm Hg and the temperature is 30°C? ($R = 62.4 \text{ mm} \times \text{L/mol} \times \text{K}$)
4. Hydrogen gas and bromine gas react to form hydrogen bromide gas.
- Write a balanced equation for this reaction.
 - 3.2 grams of hydrogen react with 9.5 grams of bromine. Which is the limiting reagent?
 - How many grams of hydrogen bromide gas can be produced using the amounts in (b)?
 - How many grams of excess reactant are left unreacted?
 - 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.
- Write a balanced chemical equation for this reaction.
 - Calculate the mass of each product produced when 225 grams of oxygen gas is reacted with an excess of the other two reactants.
 - If the actual yield of the experiment in (b) is 105 grams of HCN, calculate the percent yield.

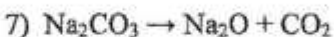
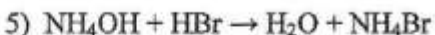
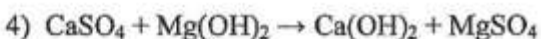
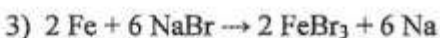
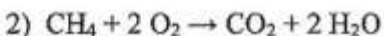
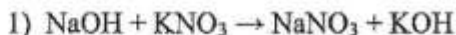
III. Chemical Reactions

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:



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:

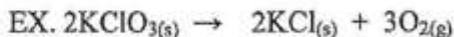
1. Metallic carbonates, when heated, form metallic oxides and $\text{CO}_2(\text{g})$.



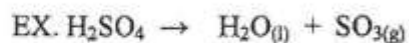
2. Most metallic hydroxides, when heated, decompose into metallic oxides and water.



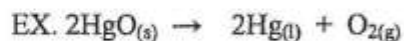
3. Metallic chlorates, when heated, decompose into metallic chlorides and oxygen.



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



5. Some oxides, when heated, decompose.



6. Some decomposition reactions are produced by electricity.



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

1. barium hydroxide (heated)

2. sodium carbonate (heated)

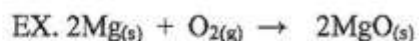
3. lithium chlorate (heated)

4. electrolysis of aluminum oxide

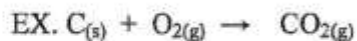
5. sulfuric acid heated gently

Learn these types of synthesis reactions:

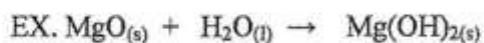
1. Metal + oxygen \rightarrow metal oxide



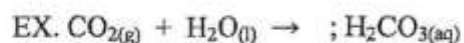
2. Nonmetal + oxygen \rightarrow nonmetallic oxide



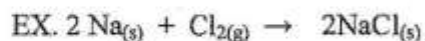
3. Metal oxide + water \rightarrow metallic hydroxide



4. Nonmetallic oxide + water \rightarrow acid



5. Metal + nonmetal \rightarrow salt



6. A few nonmetals combine with each other.



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

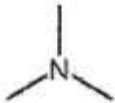


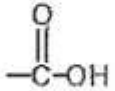
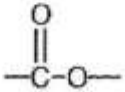
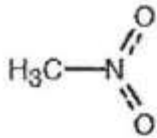
Organic Chemistry-Just the basics:

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 (-CH₃, -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 ₃ C-CH ₂ -OH	ethanol (ethyl alcohol)
-O-	ether	H ₃ C-O-CH ₃	dimethyl ether
	amine	H ₂ N-CH ₃	methylamine
	aldehyde	H ₃ C-C(=O)H	ethanal (acetaldehyde)
	ketone	H ₃ C-C(=O)-CH ₃	propanone (acetone)
	carboxylic acid	H ₃ C-C(=O)OH	ethanoic acid (acetic acid)
	ester	H ₃ C-C(=O)O-CH ₃	methyl acetate
-NO ₂	nitro		nitromethane
-X (X = F, Cl, Br, I)	haloalkane	H ₃ C-CH ₂ -Cl	chloroethane (ethyl chloride)

• [WORK ON SEPARATE PAPER PLEASE]

- 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
- 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
- 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
- Convert the following temperatures (a) 1000K to $^{\circ}C$ (b) $273^{\circ}C$ to K
- 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.
- 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
- An asthma drug dose is 6.0 mg/kg of body mass. What should the dose be for a 175lb person?
- 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_8 (e) $C_6H_{10}F_8$ (f) Si_3O_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
- 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 were removed?
- 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
- 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
- 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) 8900×112.3 (d) $78,132/2.50$
- 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 $1.05 \times 10^3 \text{ cm}^3$. 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 ($\text{H}_2\text{O}(\text{l})$) + iron filings ($\text{Fe}(\text{s})$) + sodium chloride dissolved in water ($\text{NaCl}(\text{aq})$) + beach sand grains ($\text{SiO}_2(\text{s})$).

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 drawn into wires. It is a good conductor of electricity. Which of these characteristics are physical and which are chemical properties?

2.3. 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

2.4. Fill in the gaps of the table

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

2.5. 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

2.6. How many hydrogen atoms are there in the following? (a) $\text{C}_2\text{H}_5\text{OH}$ (b) $\text{Ca}(\text{C}_2\text{H}_3\text{COO})_2$ (c) $(\text{NH}_4)_2\text{HPO}_4$