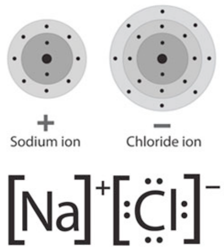
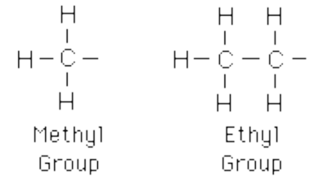


Nomenclature

(*The Naming of Chemical Compounds*)



Learning how to name chemical compounds may at first seem to be a little overwhelming; however, if you learn a few simple rules, then you will be able to follow a systematic method of naming the compounds.

First, we need to look at the elements. **Elements** are the fundamental building blocks of chemistry. They are substances that cannot be broken down into two or more simpler substances by chemical or physical means. The elements are most commonly displayed in the periodic table.

Each element can be represented in an abbreviated form as a chemical symbol. This chemical symbol is one or two letters which represent the given element. Some of the symbols used for chemical elements are obvious abbreviations of the chemical name (for example, hydrogen (**H**), helium (**He**), lithium (**Li**), etc.). Other symbols are not quite so obvious, for example Na is the symbol for sodium. These symbols, rather than being based on their English names, are derived from their Latin origins. They include the following elements: antimony (*stibium*, **Sb**), copper (*cuprum*, **Cu**), gold (*aurum*, **Au**), iron (*ferrum*, **Fe**), lead (*plumbum*, **Pb**), mercury (*hydrargyrum*, **Hg**), potassium (*kalium*, **K**), silver (*argentum*, **Ag**), sodium (*natrum*, **Na**), and tin (*stannum*, **Sn**). The symbol for the element tungsten is from the Greek word, *wolfram*, **W**.

The symbols for the elements are not only simpler to use than the whole name, but are convenient because they are internationally accepted. The International Union of Pure and Applied Chemistry (**IUPAC**) is composed of scientists from all over the world. They agreed on which symbol would represent each element. That way chemicals could be recognized by their symbols even in countries where English was not used.

The symbol is not the only way to identify an element. The other way to identify an element is by its **atomic number (Z)** which is the number of protons in the nucleus of each atom of an element. For example, carbon has six protons; likewise, a nucleus with exactly six protons would be carbon. The atomic number is shown above the chemical symbol in the cell for each element in the periodic table.

Protons are positively charged particles. So for neutral atoms there must be an equal number of negatively charged particles called **electrons**. Ions form when the number of electrons is different from the number or protons. An excess of electrons results in negatively charged ions called **anions**. A lack of electrons results in positively charged ions called cations.

Atoms are composed not only of protons and electrons, they also include neutrons. Neutrons, like protons, are found in the nucleus of the atom. (Note: Both of these particles are referred to as nucleons and are important in nuclear reactions.) The neutrons have no effect on the charge, hence their name implies their neutrality.

While the number of neutrons has no effect on the chemical reactivity of an element, it does effect the mass of the element. The mass of an electron is insignificant compared to that of a proton and a neutron. So the **mass number (A)** is the number of protons plus the number of neutrons for an element. The name **isotope** is given to atoms with the same atomic number, but with different mass numbers. For example cabon has isotopes with 6 neutrons, 7 neutrons and 8 neutrons which are called carbon-12, carbon-13 and carbon-14, respectively. The **weighted average of the masses** of the isotopes are recorded beneath the elemental symbol in the periodic table.

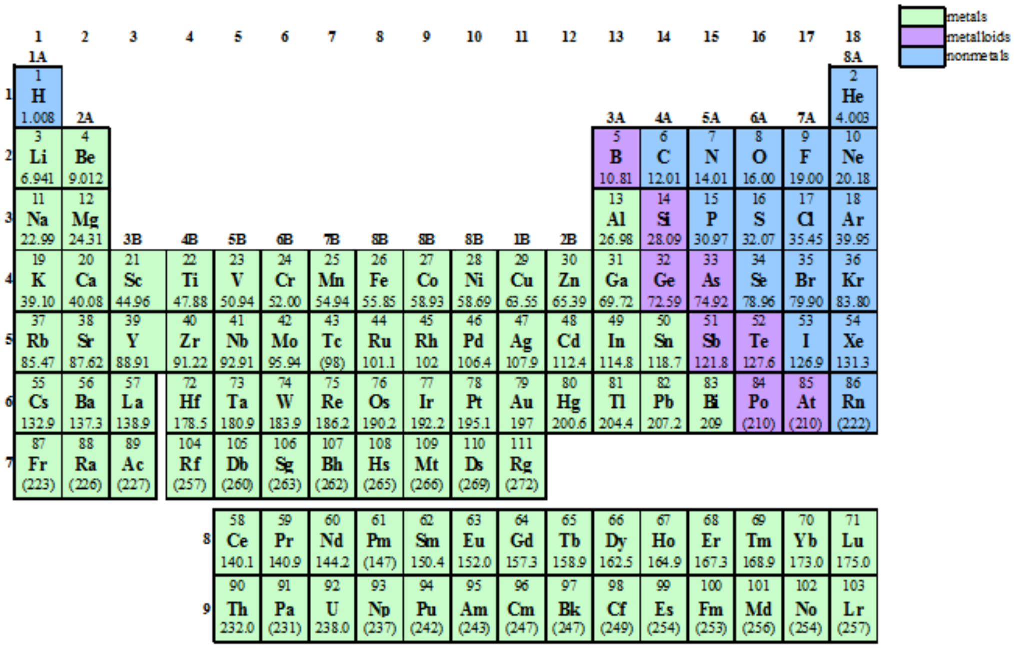


Fig. 1. The Periodic Table.

In the periodic table, the *horizontal rows* are called **periods** and the *vertical columns* are called **groups** or **families**. Some of the groups have been given special names. **Group 1A** elements (Li, Na, K, Rb, Cs & Fr) are called *alkali metals*. **Group 2A** elements (Be, Mg, Ca, Sr, Ba, & Ra) are called *alkaline earth metals*. **Group 7A** elements (F, Cl, Br, I, & At) are called *halogens*. **Group 8A** (He, Ne, Ar, Kr, Xe & Rn) are called the *noble gases*.

The elements in the periodic table can be separated into three categories: nonmetals, metalloids, and metals. Nonmetals are poor conductors of heat and electricity. Metals are good conductors of heat and electricity. Metalloids then have properties inbetween metals and nonmetals.

The nonmetals are hydrogen, helium, carbon, nitrogen, oxygen, fluorine, neon, phosphorus, sulfur, chlorine, argon, selenium, bromine, krypton, iodine, xenon and radon. The metalloids are boron, silicon, germanium, arsenic, antimony, tellurium, polonium, and astanine. All other elements are considered metals.

The similarity in the chemical properties of the members of a given family is due to the fact that they have the same number of electrons in their outermost shell, or valence shell. For example, the noble gases are all odorless, colorless, monatomic gases, with little chemical reactivity. They are also nonflammable under standard conditions. This lack of reactivity is due to the fact that the noble gases have closed shells so they tend not to bond with other elements.

Before you begin, it is important to understand valence electrons and closed shells. Valence numbers can be assigned to atoms and radicals. Radicals are groups of atoms that behave as a single atom (e.g., NH_4^+ and CN^-). The valence number allows you to determine how the atom (or radical) will combine with other atoms (or radicals) to form compounds.

As mentioned, the properties of the noble gases can be explained by modern theories of atomic structure. That is, the outer shell of valence electrons for noble gases is considered to be "full". But what is meant by “full”? **Valence electrons** are the outermost electrons of an atom and are normally the only electrons that participate in chemical bonding. (***Note:*** *For the main group elements only the outermost electrons are involved in chemical reactions. In transition metals, though, some inner-shell electrons also participate*.) Atoms with full valence electron shells then are extremely stable and therefore do not tend to form chemical bonds.

The number of valence electrons of an element is determined by its group (column) in the periodic table. With the exception of the transition metals, the number at the top of a column identifies how many valence electrons are present in a given element.

The number of valence electrons that an element has directs its bonding behavior. So elements with the same number of valence electrons have been placed in groups (columns) in the periodic table. In general, atoms in the main group (1A-8A) tend to react to form a "closed" or "full" shell. This tendency is called **the octet rule** because the bonded atom has or shares eight valence electrons. The exceptions to this rule are hydrogen and helium which have two electrons in their full valence shell.

The outer valence electrons then of one atom combine with valence electrons of other atoms to form chemical bonds. Atoms on the far left side of the periodic table have one or two valence electrons more than a closed shell, the alkali metals and alkaline earth metals, respectively. These groups are highly reactive because the extra electrons can easily be removed to form positive ions. The positive ions are called **cations**.

The atoms on the right side of the periodic table, just to the left of the noble gases, are also highly reactive. This is because they have one or two valence electrons less than a closed shell. These groups then can either gain the missing electrons to form negative ions (anions) or share electrons to form **covalent bonds**. In a single covalent bond both atoms contribute one valence electron to form a shared pair. Likewise, double bonds occur when two electrons from each are shared; and triple bonds when three electrons from each are shared.

There are **two types of chemical bonds**: ionic and covalent. **Ionic bonds** result from the transfer of one or more valence electrons from one atom to another. **Covalent bonds** occur when the valence electrons are shared between two atoms. Covalent bonds form whenever the sum of the valence electrons of two atoms is insufficient to complete a separate octet for each one. Covalent bonds tend to occur in molecules that are formed from like atoms (for example, H_2, S_8, etc.).

The chemical reactivity of atoms tends to be based on one or more of the following: 1.) electrons tend to pair; 2.) atoms of metals tend to give up one or more electrons such that they form positive ions which have octet structure of the next lower noble gas; and, 3.) atoms of nonmetals tend to acquire one or more electrons to form negative ions which have the octet structure of the next higher noble gas.

A **molecule** is an electrically neutral group that contains at least two atoms held together by covalent chemical bonds. Molecules are distinguished from ions by the electrical charge of the latter.

Diatomic molecules are composed of only 2 atoms. There are only seven elements that form diatomic molecules with themselves. These are hydrogen, nitrogen, oxygen, fluoride, chloride, bromide and iodide. The mnemonic for this sounds something like a cross between a cough and a sneeze: *Ha-Noff-club-ree!* The response: *God bless you!* Anyway, it's how one would pronounce the symbols HNOFClBrI for the diatomics: H_2, N_2, O_2, F_2, Cl_2, Br_2, I_2. There are other diatomic molecules formed from two elements. Examples are carbon monoxide, CO, and hydrogen chloride, HCl.

Polyatomic molecules contain more than two atoms. They may be composed of one kind of atom like ozone, O_3, or different kinds as in water H_2O, ammonia, NH_3, and sulfur hexafluoride SF_6.

Ionic Compounds

Ionic compounds are those with a charge. Positive ions are called cations and negative ions are called anions.

Hydrogen generally loses an electron, leaving a proton or forming the cation, H^+. However, sometimes hydrogen gains an electron to form the anion, hydride H^-.

Cations are derived from metal atoms, the main exception being the ammonium ion, NH_4^+. The elements in the first column of the periodic table are called alkali metals. They have one electron more than the Noble gases. In order to become more like the Noble gases then, the **alkali metals** must lose an electron leaving them with a closed shell and a +1 charge. These are also called "univalent".

The elements in the second column of the periodic table are called alkaline earth metals. They have two electrons more than the Noble gases, so they must lose 2 electrons. This results in a +2 charge. They are called "bivalent".

Aluminum is considered "trivalent" because it has 3 extra electrons and results in a +3 charge when it loses those electrons.

Binary compounds are those that are composed of only two elements. There are three types of binary compounds: binary covalent compounds, binary ionic compounds and binary acids.

Examples of binary covalent compounds include water (H_2O), carbon monoxide (CO), and carbon dioxide CO_2. The naming convention for binary covalent compounds is as follows:

(prefix)-nonmetal + (prefix)-nonmetal root + "-ide."

The prefixes are only added when appropriate. They denote the number of atoms of each element present in a molecule of the compound. The prefixes are derived from Greek and Latin and are listed in the table below.

Prefix	meaning
mono-	one
di-	two
tri-	three
tetra-	four
penta-	five
hexa-	six
hepta-	seven
octa-	eight
nona-	nine
deca-	ten

So the steps for determning the name of P_4O_6:

P_4, four phosphorus atoms would be "tetra"phosphorus

O_6, the root for oxygen is simply : "ox", so six oxygen atoms would be "hexa"ox+ide

– however the "a" is dropped when followed by a root word that starts with a vowel, so it becomes "hex"oxide

tetraphosphorus hexoxide

(**Note:** Other prefixes also change by dropping their final vowel when followed by elements that begin with vowels. Using oxygen, then mono + oxide = monoxide, tetra + oxide = tetroxide, penta + oxide = pentoxide, etc. The exceptions are di and tri, which are simply dioxide and trioxide.)

It is also important to note that the method for naming covalent compounds is generally not used with ionic compounds. That is, K_2O would not be called dipotassium monoxide; but rather it would simply be called potassium oxide.

A **binary ionic compound** is a salt consisting of only two elements in which both elements are ions, a metal cation and an anion. Examples of binary ionic compounds include sodium chloride (NaCl), calcium fluoride (CaF_2), and magnesium oxide (MgO).

There are two types of binary ionic compounds. **Type 1 binary ionic compounds** are ones where the metal cation has only one form. That is the cations formed from alkali metals, alkaline earth metals, aluminum, zinc, and silver: Li^+, Na^+, K^+, Rb^+, Cs^+, Fr^+, Be^{2+}, Mg^{2+}, Ca^{2+}, Sr^{2+}, Ba^{2+}, Ra^{2+}, Al^{3+}, Zn^{2+}, and Ag^+.

The steps for determining the name of a **Type 1 binary ionic compound**, NaBr:

1.) The cation is listed first and the anion second.

2.) The cation takes the name of its elemental form.

So, Na^+ would be called "Sodium".

3.) The anion name uses the root of its elemental name, and the suffix "-ide".

So, the root for Br or bromine would be “brom” then by adding “ide”
“brom” + “ide” becomes "bromide".

sodium bromide

Type 2 binary ionic compounds are ones where the cation can have multiple forms. That is the cations which are formed from transition metals. Since transition metals can take on multiple charges, it is necessary to indicate the value of the charge. Traditionally, when naming atoms whose valence numbers vary, you add the suffix *–ous* to the one with the lower valence state and *–ic* to the one with the higher valence state. Using this method, Fe^{2+} would be ferrous and Fe^{3+} would be ferric. The IUPAC method for naming transition metal cations however gives more information than the traditional method in that it indicates the actual charge on the cation. With this method, the value is written as a Roman numeral within parentheses following the name of the metal cation. Using this method, Fe^{2+} would be iron (II) and Fe^{3+} would be iron (III).

The **transition metal cation names** are shown in the table below:

IUPAC	**Traditional**		
	Root	***-ous***	***-ic***
copper (I) & copper (II)	cupr-	Cu^{+}	Cu^{2+}
gold (I) & gold (III)	aur-	Au^{+}	Au^{3+}
mercury (I) & mercury (II)	mercur-	Hg_2^{2+}	Hg^{2+}
chromium (II) & chromium (III)	chrom-	Cr^{2+}	Cr^{3+}
manganese (II) & manganese (III)	mangan-	Mn^{2+}	Mn^{3+}
iron (II) & iron (III)	ferr-	Fe^{2+}	Fe^{3+}
cobalt (II) & cobalt (III)	cobalt-	Co^{2+}	Co^{3+}
nickel(II) & nickel (III)	nickel-	Ni^{2+}	Ni^{3+}
tin (II) & tin (IV)	stann-	Sn^{2+}	Sn^{4+}
lead (II) & lead (IV)	plumb-	Pb^{2+}	Pb^{4+}
cerium (III) & cerium (IV)	cer-	Ce^{3+}	Ce^{4+}
arsenic (III) & arsenic (V)	arsen-	As^{3+}	As^{5+}
antimony (III) & antimony (V)	antimon-	Sb^{3+}	Sb^{5+}
bismuth (III) & bismuth (V)	bismuth-	Bi^{3+}	Bi^{5+}

With the **IUPAC method**, the steps for determining the name of a **Type 2 binary ionic compound** are similar to those of naming a Type 1 binary ionic compound. (Step 3* is an additional step.) For example, naming **Type 2 binary ionic compound**, Fe_2O_3:

1.) The cation is listed first and the anion second.
2.) The cation takes the name of its elemental form.
    So, Fe would be called "Iron".
3.)* To determine the charge of the cation, look at the subscript for the anion.
    The subscript is 3, so “Iron (III)”
4.) The anion name uses the root of its elemental name, and the suffix "-ide".
    So, oxygen would be “ox” + “ide” or "oxide".

iron (III) oxide

With the **traditional method**, you have to know both forms of the transition metal cation before you are able to name the **Type 2 binary ionic compound**. Also, depending on the metal, you might need to know the Latin name that corresponds to the element. The anion name is the same regardless of the method applied. Using our example, Fe_2O_3:

1.) The cation is listed first and the anion second.
2.)* Determine the charge of the cation, look at the subscript for the anion.

The subscript is 3, so the cation is Fe^{3+}

3.) Iron has two cation forms Fe^{2+} & Fe^{3+}. Since 2 < 3, then Fe^{3+} corresponds to the "ic" form.

4.) The root name for iron comes from its Latin name, ferrum. The root is "ferr".
So, Fe^{3+} would be called "ferr" + "ic" or "ferric".

5.) The anion name uses the root of its elemental name, and the suffix "-ide".
So, oxygen would be "ox" + "ide" or "oxide".

ferric oxide

Polyatomic ions then resemble molecules in that they contain at least two atoms bound together in a definite arrangement.

The steps for naming compounds with polyatomic ions:

1.) The cation is listed first and the anion second.
2.) The polyatomic ion names must be memorized.
3.) No extra prefixes or suffixes are added.

When reviewing the polyatomic ions, there seems to be an endless number of them with little hope of remembering all of them. The easiest way to tackle the list is to only memorize the "ates" and the exceptions. The rest can simply be determined from the "ates". The most common polyatomic anions are given in the table below:

	Symbol (*root*)	per-*root*-ate	*root*-ate	*root*-ite	hypo-*root*-ite
1	Cl (chlor)	ClO_4^-	ClO_3^-	ClO_2^-	ClO^-
2	Br (brom)	BrO_4^-	BrO_3^-	BrO_2^-	BrO^-
3	I (iod)	IO_4^-	IO_3^-	IO_2^-	IO^-
4	N (nitr)	xxx	NO_3^-	NO_2^-	xxx
5	C (carbon)	xxx	CO_3^{2-}	xxx	xxx
6	S (sulf)	*	SO_4^{2-}	SO_3^{2-}	xxx
7	Se (selen)	xxx	SeO_4^{2-}	SeO_3^{2-}	xxx
8	P (phosph)	xxx	PO_4^{3-}	PO_3^{3-}	xxx
9	As (Arsen)	xxx	AsO_4^{3-}	AsO_3^{3-}	xxx
10	Cr (Chrom)	**dichromate** $Cr_2O_7^{2-}$	CrO_4^{2-}	xxx	xxx
11	Mn (mangan)	MnO_4^-	xxx	xxx	xxx
12	Ti (titan)	xxx	TiO_3^{2-}	xxx	xxx
13	Acetate**	xxx	$C_2H_3O_2^-$	xxx	xxx
14	Formate**	xxx	CHO_2^-	xxx	xxx
15	Oxalate**	xxx	$C_2O_4^{2-}$	xxx	xxx
16	Cyanate	xxx	NCO^-	xxx	xxx
17	Thiocyanate***	xxx	SCN^-	xxx	xxx
18	Thiosulfate***	xxx	$S_2O_3^{2-}$	xxx	xxx

* Sulfur has two anions that are often referred to as persulfate. They are peroxomonosulfate (or peroxymonosulfate) ion, SO_5^{2-} and peroxodisulfate (or peroxydisulfate) ion, $S_2O_8^{2-}$.

**The organic anions.

*** Thiocyanate and thiosulfate are formed by substituting a sulfur for an oxygen into the cyanate and sulfate ions.

Some polyatomic anions are formed by the attachment of one or more hydrogen atoms. When adding a hydrogen to form the bi-root-ate form, notice that the negative charge decrease by one for each proton added. For example, the carbonate ion has a negative two charge whereas the bicarbonate has only a negative one charge.

C (carbon)	**carbonate**	**hydrogen carbonate or bicarbonate**	
	CO_3^{2-}	HCO_3^{-}	
P (phosph)	**phosphate**	**(mono)hydrogen phosphate**	**dihydrogen phosphate or biphosphate**
	PO_4^{3-}	HPO_4^{2-}	$H_2PO_4^{-}$
S (sulf)	**sulfate**	**hydrogen sulfate or bisulfate**	**hydrogen sulfite or bisulfite**
	SO_4^{2-}	HSO_4^{-}	HSO_3^{-}

Acids

Binary acids are binary compounds that contain a hydrogen atom and either a halogen (F, Cl, Br, I) or sulfur (S). It is important to note that nitrogen, phosphorus, and oxygen do not form binary acids with hydrogen.

The naming convention for binary acids is as follows:

"Hydro-" + nonmetal root + "-ic" + "acid"

The nonmetal roots are determined as follows. For the halogens, simply remove the "ine" and for sulfur remove the "ur". Thus, the roots for fluorine, chlorine, bromine and iodine are fluor-, chlor-, brom-, and iod- ; and for sulfur, sulf- .

So to determine the name for HCl:

hydro + chlor + ic + acid → hydrochloric acid

If the acid is in a gaseous form or an anhydrous form, the "-ic" is replaced by "-ide" and the "acid" suffix is removed.

So, acids are formed by adding protons to atoms or radicals with negative valence numbers. The names of acids that do not contain oxygen are formed like those of binary acids by adding the prefix *hydro*- to the root name for the element and adding the suffix *–ic* and the word "*acid*".

Formula	Acid Name
HF	hydrofluoric acid
HCl	hydrochloric acid
HBr	hydrobromic acid
HI	hydriodic acid
HCN	hydrocyanic acid
H_2S	hydrosulfuric acid
HN_3	hydrazoic acid

If only **one type of oxygen acid** is formed, then the name is that of the characteristic element plus the suffix *–ic* and the word acid.

Formula	Acid Name
H_3BO_3	boric acid
H_2CO_3	carbonic acid
H_4SiO_4	silicic acid

Acids formed from **polyatomic ions** have a naming system similar to that of the polyatomic ions themselves. The difference being that for "-ate" we substitute "-ic" and for "-ite" we substitute "ous" and add the word acid..

Hypochlor-ite then becomes hypochlorous acid; and perchlor-ate becomes perchloric acid. The number of hydrogens added to the polyatomic ion is equal to the charge on the cation.

Ion	Ion name	Acid Formula	Acid Name
ClO^-	hypochlorite	$HClO$	hypochlorous acid
$ClO_2^{\ -}$	chlorite	$HClO_2$	chlorous acid
$ClO_3^{\ -}$	chlorate	$HClO_3$	chloric acid
$ClO_4^{\ -}$	perchlorate	$HClO_4$	perchloric acid
$NO_2^{\ -}$	nitrite	HNO_2	nitrous acid
$NO_3^{\ -}$	nitrate	HNO_3	nitric acid
$CO_3^{\ 2-}$	carbonate	H_2CO_3	carbonic acid
$SO_3^{\ 2-}$	sulfite	H_2SO_3	sulfurous acid
$SO_4^{\ 2-}$	sulfate	H_2SO_4	sulfuric acid
$PO_3^{\ 3-}$	phosphite	H_3PO_3	phosphorous acid
$PO_4^{\ 3-}$	phosphate	H_3PO_4	phosphoric acid
$CrO_4^{\ 2-}$	chromate	H_2CrO_4	chromic acid
$Cr_2O_7^{\ 2-}$	dichromate	$H_2Cr_2O_7$	dichromic acid
$C_2H_3O_2^{\ -}$	acetate	$HC_2H_3O_2$	acetic acid
$CHO_2^{\ -}$	formate	$HCHO_2$	formic acid
$C_2O_4^{\ 2-}$	oxalate	$H_2C_2O_4$	oxalic acid
$NCO^{\ -}$	cyanate	$HOCN$	cyanic acid
$S_2O_3^{\ 2-}$	thiosulfate	$H_2S_2O_3$	thiosulfuric acid
SCN^-	thiocyanate	$HSCN$	thiocyanic acid

Organic Compounds

Organic compounds contain carbon. All other compounds are defined as inorganic. However, for the sake of convenience, some carbon compounds are considered inorganic: carbon monoxide (CO), carbon dioxide (CO_2), carbon disulfide (CS_2), and those containing the anions cyanide (CN^-), carbonate ($CO_3^{\ 2-}$) and bicarbonate (HCO_3^-).

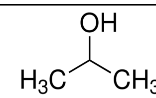
Carbon is located in the fourth column in the periodic table. Carbon then has four electrons in its outer shell and forms four covalent bonds to create a closed shell. The simplest carbon compounds are called alkanes. The **alkanes** consist only of carbon and hydrogen held together by single bonds. The first four alkanes have common names. The higher ones have names reflecting the Greek/Latin prefixes used in the covalent naming system.

Organic Compounds	
CH_4	methane
C_2H_6	ethane
C_3H_8	propane
C_4H_{10}	butane
C_5H_{12}	pentane
C_6H_{14}	hexane
C_7H_{16}	heptane
C_8H_{18}	octane
C_9H_{20}	nonane
$C_{10}H_{22}$	decane

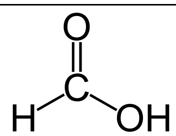
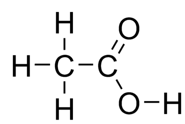
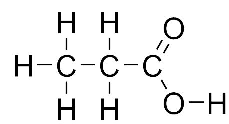
The **alkenes** have a double bond between two of the carbons. Every double bonded carbon can only form two other bonds. So there are two less hydrogens for every corresponding alkene. The **alkynes** have a triple bond between two of the carbons. So every triple-bonded carbon can only form one other bond. For example, ethane, ethene, and ethyne.

$H_3C\text{-}CH_3$	$H_2C{=}CH_2$	$HC{\equiv}CH$
ethane **a = single bond**	**ethene** **e = double bond**	**ethyne** **y = triple bond**

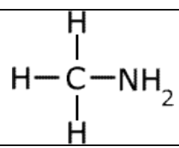
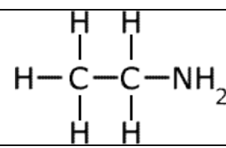
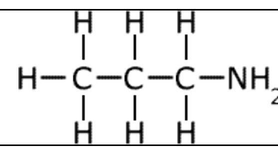
For the **alcohols**, one of the hydrogens is replaced by a hydroxide (-OH) group. The name maintains the *root –e +ol.*

$H_3C\text{-}OH$	$H_3C\text{-}CH_2\text{-}OH$	$H_3C\text{-}CH_2\text{-}CH_2\text{-}OH$	
methanol **methyl alcohol**	**ethanol** **ethyl alcohol**	**1-propanol**	**2-propanol** **isopropyl alcohol**

For the **carboxylic acids**, the carbon on the end has a double bonded oxygen and a hydroxide group attached to it. In general, the name maintains the *root –e +ic* followed by the word *acid*. (In biology, these are often referred to as fatty acids.)

		
methanoic acid **formic acid**	**ethanoic acid** **acetic acid**	**propanoic acid** **propionic acid or methylacetic acid**

For the **amines**, one of the hydrogens is replaced by an amine group ($-NH_2$). The name maintains the *root – e + yl* followed by the word *amine*.

		
methyl amine	**ethyl amine**	**propyl amine**

Aromatics refer to carbon compounds containing a benzene ring. A benzene ring consists of 6 carbons in a hexagonal ring. Each carbon has one hydrogen attached to it. Within the ring, the carbons alternate single and double bonds.

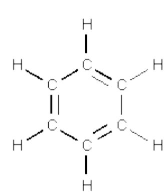


Fig. 2. Benzene ring

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http://www.chemistrygeek.com/nomenclature%20flowchart%201%20page.gif

Name: ______________________________

Sec #: ____________ Date: ______________

Nomenclature Worksheet

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
	1A	2A	3B	4B	5B	6B	7B	8B	8B	8B	1B	2B	3A	4A	5A	6A	7A	8A
1	H																	He
2	Li	Be											B	C	N	O	F	Ne
3	Na	Mg											Al	Si	P	S	Cl	Ar
4	K	Ca	Sc	Ti	V	Cr	Mn	Fe	Co	Ni	Cu	Zn	Ga	Ge	As	Se	Br	Kr
5	Rb	Sr	Y	Zr	Nb	Mo	Tc	Ru	Rh	Pd	Ag	Cd	In	Sn	Sb	Te	I	Xe
6	Cs	Ba	La	Hf	Ta	W	Re	Os	Ir	Pt	Au	Hg	Tl	Pb	Bi	Po	At	Rn
7	Fr	Ra	Ac	Rf	Db	Sg	Bh	Hs	Mt	Ds	Rg							

For the periodic table above (10 points):

1. Create a key using the color indicated for the following ions. [Note: If you do not have colored pencils or markers, then you may use monotone patterns that you create – for example, stripes, checks, dots. Indicate the pattern in the box provided.]
2. The number or elements corresponding to a given ionic charge are indicated in parentheses after the color. There may be more elements with a corresponding charge than listed, the number is based on the handout. [Don't forget that hydrogen and the transition metals will need 2 different colors (patterns) to indicate their dual nature.]
3. List the appropriate ions in the blank provided.

(+1) cations blue ______________________________ Hg_2^{2+} gray

(+2) cations purple ______________________________

(+3) cations green ______________________________

(+4) cations pink ______________________________

(+5) cations brown ______________________________

(-1) anions red ______________________________

(-2) anions orange ______________________________

(-3) anions yellow ______________________________

5. Complete the following table:

	Acid Formula	Acid Name	Formula for Sodium Salt	Name of Salt
1	$HClO_4$		$NaClO_4$	
2	$H_2S_2O_3$			Sodium Thiosulfate
3	HCN			Sodium Cyanide
4	HF	Hydrofluoric Acid		
5	$HOCN$		$NaOCN$	
6	H_3BO_3	Boric Acid		
7	$HClO$			Sodium Hypochlorite
8	$CHOOH$		$CHOONa$	
9	HNO_3	Nitric Acid		
10	H_2CrO_4		Na_2CrO_4	

6. Name the following covalent compounds (*1/2 pt each*):

a. $C_{10}H_{22}$ ________________________________

b. CH_3OH ________________________________

c. C_3H_7COOH ________________________________

d. C_2H_2 ________________________________

e. SbF_5 ________________________________

f. P_4O_{10} ________________________________

g. S_2N_2 ________________________________

h. XeF_4 ________________________________