

NOMENCLATURE IN ORGANIC CHEMISTRY

Contents

1. INTRODUCTION	3
2. HYDROCARBONS	3
(i) Alkanes	3
A. Unbranched Chains	3
B. Unbranched chains	4
(ii) Alkenes	5
A. One double bond	5
B. More than one double bond	5
C. <i>EZ</i> Isomers in Alkenes	6
(iii) Alkynes	8
(iv) Combined Alkenes and Alkynes	8
(v) Cyclic Hydrocarbons	9
3. COMPOUNDS CONTAINING HALOGENS AND NITRO GROUPS	10
4. COMPOUNDS WITH FUNCTIONAL GROUPS NAMED AS SUFFIXES	12
(i) General Naming Scheme	12
A. Choosing the Principal Chain	13
B. Naming the Principal Chain	13
C. Numbering the Principal Chain	13
(ii) Naming Various Classes of Organic Compounds	14
A. Ethers and Thioethers	14
B. Alcohols and Thiols	14
C. Acids, Salts of Acids and Acid Anhydrides	15
D. Esters	17
E. Acid Halides	18
F. Amides	18
G. Nitriles	19
H. Aldehydes	19
I. Ketones	21
J. Amines and Ammonium Salts	22
5. AROMATIC COMPOUNDS	23
(i) General Notes	23
(ii) Aromatic Hydrocarbons	23
(iii) Substituted Aromatic Hydrocarbons	24

A. Halogen and Nitro- Substituted Aromatics	24
B. Carboxylic Acids and Derivatives	24
C. Phenols and Thiophenols	25
D. Aldehydes and Ketones	26
E. Sulfonic acids and Sulfonic Acid Derivatives	27
F. Aromatic Amines	28
G. Diazonium Salts	29
6. RADICOFUNCTIONAL NAMING	29
A. Alkyl Halides	29
B. Alcohols	29
C. Ketones	30
D. Nitriles (or Cyanides)	30
E. Grignard Reagents	30

Revised and updated
Professor L D Field
May 2004

NOMENCLATURE IN ORGANIC CHEMISTRY

1. INTRODUCTION

It is important that organic compounds are correctly and unambiguously named so that there can be absolutely no confusion about what compounds are actually being reported or described. There have been many conventions for naming organic compounds - some have had limited scope or become embedded in common usage and some have persisted over time.

The International Union of Pure and Applied Chemistry (I.U.P.A.C.) periodically reviews naming practice, attempting to standardise nomenclature. The following guidelines for organic nomenclature are based on the definitive rules published by I.U.P.A.C.¹ (the International Union of Pure and Applied Chemistry).

2. HYDROCARBONS

(i) The Alkanes (C_nH_{2n+2})

A. Unbranched Chains

The first four (n=1-4) unbranched chain saturated hydrocarbons are called methane, ethane, propane and butane. After this, there is a numerical term (of Greek origin) followed by the ending "-ane". The first twelve members are given in Table 1.

Table 1. The names of the first 12 linear alkanes

n	Name	Molecular formula	Constitutional formula
1	methane	CH ₄	CH ₄
2	ethane	C ₂ H ₆	CH ₃ CH ₃
3	propane	C ₃ H ₈	CH ₃ CH ₂ CH ₃
4	butane	C ₄ H ₁₀	CH ₃ CH ₂ CH ₂ CH ₃
5	pentane	C ₅ H ₁₂	CH ₃ CH ₂ CH ₂ CH ₂ CH ₃
6	hexane	C ₆ H ₁₄	CH ₃ CH ₂ CH ₂ CH ₂ CH ₂ CH ₃
7	heptane	C ₇ H ₁₆	CH ₃ CH ₂ CH ₂ CH ₂ CH ₂ CH ₂ CH ₃
8	octane	C ₈ H ₁₈	CH ₃ CH ₂ CH ₂ CH ₂ CH ₂ CH ₂ CH ₂ CH ₃
9	nonane	C ₉ H ₂₀	CH ₃ CH ₂ CH ₂ CH ₂ CH ₂ CH ₂ CH ₂ CH ₂ CH ₃
10	decane	C ₁₀ H ₂₂	CH ₃ CH ₂ CH ₂ CH ₂ CH ₂ CH ₂ CH ₂ CH ₂ CH ₂ CH ₃
11	undecane	C ₁₁ H ₂₄	CH ₃ CH ₂ CH ₂ CH ₂ CH ₂ CH ₂ CH ₂ CH ₂ CH ₂ CH ₂ CH ₃
12	dodecane	C ₁₂ H ₂₆	CH ₃ CH ₂ CH ₂ CH ₂ CH ₂ CH ₂ CH ₂ CH ₂ CH ₂ CH ₂ CH ₂ CH ₃

The group derived from one of these alkanes by removal of a terminal (end) hydrogen is called an alkyl group. The group name is found by removing "ane" from the alkane name and adding "yl".

Example: CH₃-CH₂-CH₂-CH₃ butane
becomes CH₃-CH₂-CH₂-CH₂- butyl

Note: The free valence must be on the terminal carbon.

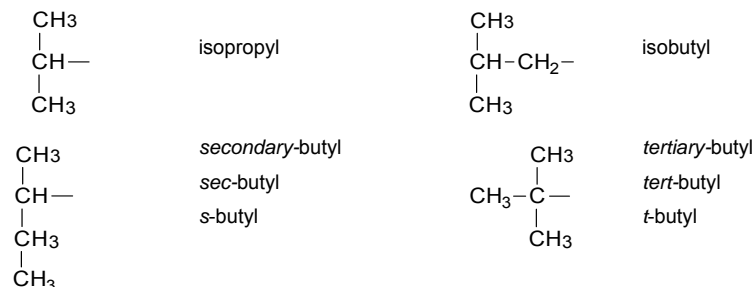
¹ I.U.P.A.C. *Nomenclature for Organic Chemistry*, Sections A, B and C (combined edition), Butterworths Scientific Publications, London, 1971.

B. Branched Chains

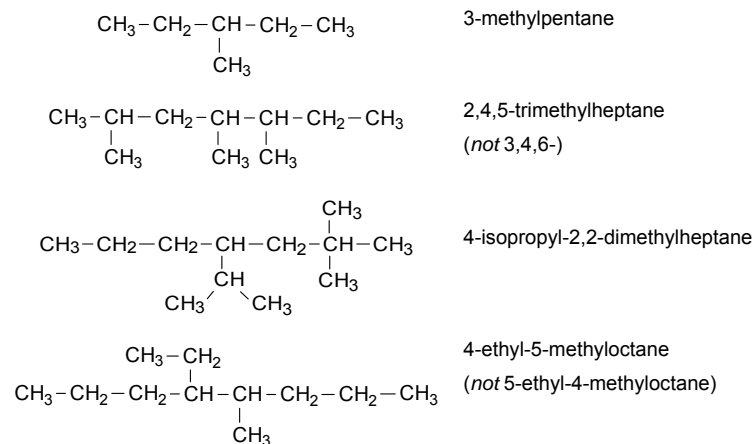
The following steps are taken in naming an alkane with a branched chain:

- Find the longest continuous carbon chain and select the appropriate alkane name from Table 1. (Side chains are not included in the carbon count.)
- Name all of the side chains (carbon chains attached to the longest chain) and list them in alphabetical order. Ignore multiplicative prefixes such as "di-" (2), "tri-" (3), "tetra-" (4) etc. Also ignore "sec-" and "tert-" but *not* "iso".
- Number the longest chain so that substituents have the lowest possible numbers and insert location numbers before each of the side chain names.

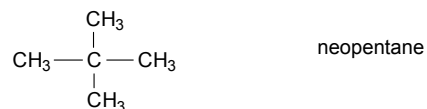
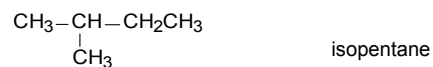
Special Note: The following groups have the special names indicated:



Examples

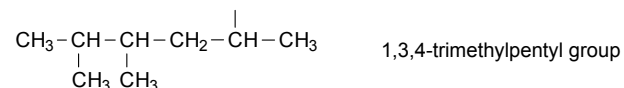


The following compounds have special names:

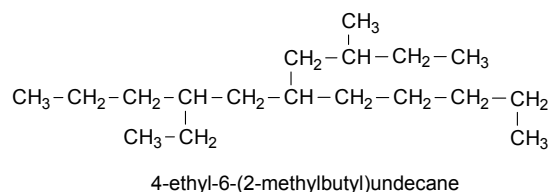


Branched side chains are named by renumbering the alkyl group giving the carbon with the free valence (*i.e.* point of attachment to the main chain) the number 1 and giving substituents the appropriate number in the usual way.

Examples



The following example gives the name of an alkane having a branched side chain:

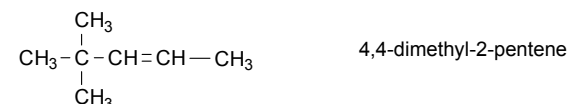
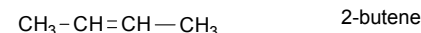


(ii) The Alkenes (C_nH_{2n})

A. One double bond

- Find and name the longest carbon chain **containing the double bond**.
- Change the "ane" of the alkane name to "ene".
- Number the carbon chain giving the double bond the lowest possible location number.
- Name side chains in the usual way.

Examples (note position of numbers and punctuation)



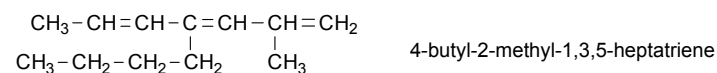
Special Note

$\text{CH}_2=\text{CH}_2$ has the special name "ethylene".

B. More than one double bond

- Find and name the longest carbon chain containing the maximum number of double bonds.
- Change the "ane" of the alkane name to:
 - "adiene" 2 double bonds
 - "atriene" 3 double bonds
 - "atetraene" 4 double bonds *etc.*
- Number the chain so as to give the double bonds the lowest possible numbers.
- Name the alkyl side chains in the usual way.

Examples (note position of numbers and punctuation)



Special Note

$\text{CH}_2=\text{C}=\text{CH}_2$ has the special name "allene".

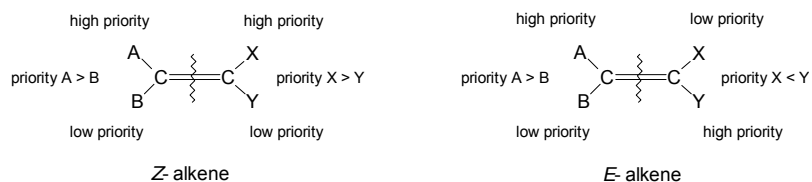
C. E/Z Isomers in Alkenes

In the past, the terms *cis* and *trans* have been used to differentiate the isomers; *cis* to indicate the isomer in which the substituents are on the same side of the double bond, *trans* when they are on opposite sides. This nomenclature is still used in some older texts, however, the approved nomenclature for alkene stereoisomers involves the prefixes *Z*- or *E*-.

There are two substituents attached to each of the carbon atoms which form a C=C. The carbon atoms at either end of the C=C are considered separately and at each end, the two attached substituents are ranked according to a simple set of *priority rules* (or sequence rules). The priority of the two groups attached to each carbon atom of the C=C is based initially on the atomic number of the atom at the point of attachment. For example, a chlorine

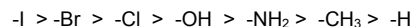
substituent would have a higher priority than a CH₃- which in turn would have a higher priority than a H-.

When the C=C is considered as a whole, if the groups with the highest priorities are on the same side of the double bond then the name of the alkene is prefixed with a Z (from the German 'zusammen' meaning 'together'). If they are on opposite sides then the prefix is E (from 'entgegen' meaning 'opposite').



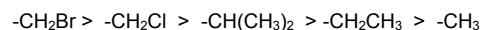
Priority Rules

Each of the atoms attached directly to the C atom of a C=C is assigned a priority based on its atomic number: the higher the atomic number, the higher the priority. In terms of priority, if there is a hydrogen attached to one carbon of the C=C, it must always have the lowest priority. Groups which have an oxygen atom attached directly to the C=C (eg. -OH, -OCH₃) have higher priority than groups which have a nitrogen atom attached directly to the C=C atom (eg. -NH₂, -N(CH₃)₂) and so on.



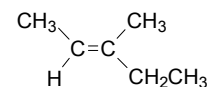
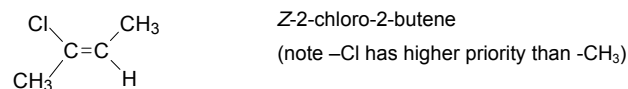
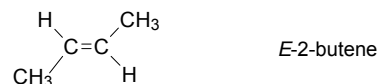
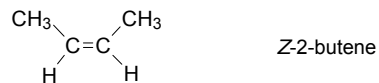
If two of the groups attached to the same carbon of a C=C begin with the same element (eg. -CH₃, -CH₂CH₃), then look to the next atoms away from the C=C. If the groups at this point are still the same, then move further from the C=C until the point of difference is found (there must be a point of difference somewhere). The group priority is then assigned based on the atomic numbers of the atoms at the point of difference.

So for example -CH₂Cl has a higher priority than -CH₂OH.

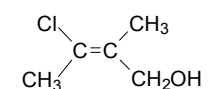


For the purposes of assigning group priorities, double bonds or multiple bonds are expanded to be an equivalent number of atoms attached by single bonds. So a -CH=CH₂ group is considered as equivalent to -CH(-CH₂)₂.

Examples



E-3-methyl-2-pentene
(note that -CH₂CH₃ has greater priority than -CH₃)



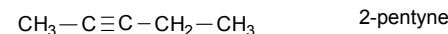
E-3-chloro-2-methyl-2-penten-1-ol
(note that -Cl has higher priority than -CH₃ and -CH₂OH has higher priority than -CH₃)

(iii) The Alkynes (C_nH_{2n-2})

These are named in identical fashion to alkenes except that "ene" in the alkene name is replaced by:

"yne"	1 triple bond
"adiyne"	2 triple bonds
"atriyne"	3 triple bonds <i>etc.</i>

Example (note position of numbers and punctuation)



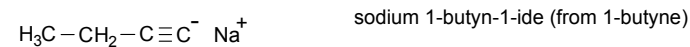
Special Note

H-C≡C-H has the special name "acetylene".

Salts of Alkynes

The salts of hydrocarbon anions are named by adding the ending "-ide" together with a location number.

Examples



Special Note:

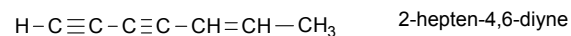
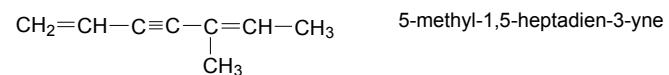
$H-C \equiv C^- Na^+ \quad Na^+ C \equiv C^- Na^+$ are called monosodium acetylide and disodium acetylide respectively

(iv) Combined Alkenes and Alkynes

If a compound has double and triple bonds then the longest chain is selected so as to contain the maximum number of double **and** triple bonds and is named by replacing the "ane" of the corresponding alkane by "en(e)", "adien(e)" *etc.* followed by "yne", "diyne" *etc.* The "e" is omitted before a vowel or a "y".

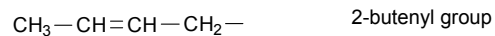
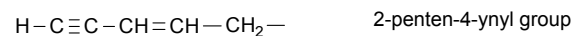
The chain is numbered so as to give the lowest numbers to the double bonds, **then** triple bonds.

Examples (note positions of numbers and punctuation)

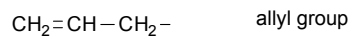


Groups derived from alkenes, alkynes or combined hydrocarbons are named by dropping the final "e" and replacing it by "yl". The chain is renumbered to give the carbon with the free valence the number 1 position:

Examples (note positions of numbers and punctuation)



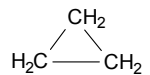
Special Note: The following have special names:



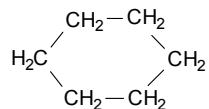
(v) Cyclic Hydrocarbons

Compounds with hydrocarbon rings are named by the insertion of "cyclo"- before the name of the hydrocarbon corresponding to the open chain compound containing the same number of carbons.

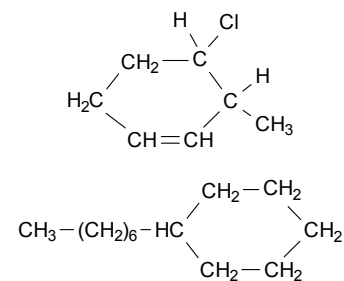
Examples



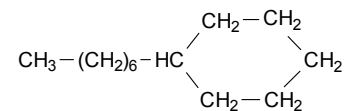
Cyclopropane



Cyclohexane



4-chloro-3-methyl-1-cyclohexene



1-cyclohexylheptane

(note that the carbon chain has more carbons than the ring)

3. COMPOUNDS CONTAINING HALOGENS AND NITRO GROUPS

The halogens (F, Cl, Br, I) and the nitro group (-NO₂) are always named as prefixes in the same way as side chains on hydrocarbons. The prefixes are as follows:

Group	Prefix
F-	fluoro
Cl-	chloro
Br-	bromo
I-	iodo
NO ₂ -	nitro

Examples

CH ₃ -I	Iodomethane
$\begin{array}{c} \text{CH}_3-\text{CH}-\text{CH}_3 \\ \\ \text{Cl} \end{array}$	2-chloropropane
$\begin{array}{c} \text{CH}_3 \\ \\ \text{CH}_3-\text{C}-\text{CH}_3 \\ \\ \text{Br} \end{array}$	2-bromo-2-methylpropane
$\begin{array}{c} \text{CH}_3-\text{CH}_2 \\ \\ \text{CH}_3-\text{CH}_2-\text{CH}-\text{CH}_2-\text{CH}_2-\text{F} \end{array}$	3-ethyl-1-fluoropentane
CH ₃ -CH ₂ -NO ₂	nitroethane
$\begin{array}{c} \text{CH}_2-\text{CH}_2-\text{CH}_2 \\ \quad \quad \\ \text{Cl} \quad \quad \text{Br} \end{array}$	1-bromo-3-chloropropane
CH ₂ =CH-CH ₂ -CH ₂ -Cl	4-chloro-1-butene

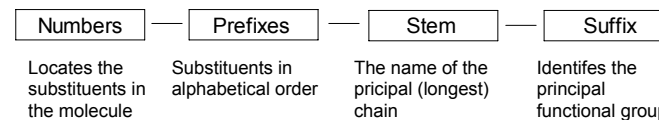
Special Note: The following have special names:

F ₃ C-H	fluoroform
Cl ₃ C-H	chloroform
Br ₃ C-H	bromoform
I ₃ C-H	iodoform
CCl ₄	carbon tetrachloride
CBr ₄	carbon tetrabromide

3 COMPOUNDS WITH FUNCTIONAL GROUPS NAMED AS SUFFIXES

(i) General Naming Scheme

The name of every organic molecule containing a functional group whose name appears as a suffix may be thought of as made up of four parts:



The Principal Functional Group (PFG) whose suffix name is used is selected from Table 2. The list is in order of **decreasing** priority.

Table 2. Table of Functional Groups (descending order of priority)

Class	Formula	Prefix	Suffix
Cation	-NR ₃ ⁺	ammonio-	-ammonium
Carboxylic acid	-COOH	carboxy-	-oic acid
Sulfonic acid	-SO ₂ OH	sulfo-	-sulfonic acid
Salt of Carboxylic Acid	-COO ⁻ M ⁺	carboxylato-	cation name ...oate
Ester	-COOR	R-oxycarbonyl-	R-...-oate
Acid Halide	$\begin{array}{c} \text{---C---X} \\ \\ \text{O} \end{array}$	haloformyl-	-oyl halide
Amide	$\begin{array}{c} \text{---C---NH}_2 \\ \\ \text{O} \end{array}$	carbamoyl-	-amide
Nitrile	-C≡N	cyano-	-nitrile
Aldehyde	$\begin{array}{c} \text{---C---H} \\ \\ \text{O} \end{array}$	formyl-	-al
Ketone	$\begin{array}{c} \text{---C---} \\ \\ \text{O} \end{array}$	oxo-	-one
Alcohol	-OH	hydroxy-	-ol
Thiol	-SH	mercapto-	-thiol
Amine	-NH ₂	amino-	-amine
Imine	=NH	imino-	-imine
Ether	-OR	R-oxy-	-
Thioether	-SR	R-thio-	-

Wherever "R" appears in the prefix or suffix table then the group name (*i.e.* alkyl, alkenyl, etc.) for the R group is used.

A. Choosing the Principal Chain

The **Principal Chain** is chosen according to the following rules, applied in order:

- The chain must contain the (maximum number of) principal functional group(s); then
- it must contain the maximum number of double and triple bonds; then
- it must be the longest possible carbon chain (the carbons of the $-\text{CO}_2\text{H}$, $-\text{C}\equiv\text{N}$, $-\text{C}(=\text{O})\text{H}$ etc. groups are counted when they form part of the principal chain).

B. Naming the Principal Chain

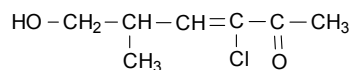
The principal chain is named after the alkane having the same number of carbon atoms, and is modified when unsaturated by the replacement of "ane" by "en(e)", "enyn(e)", "adiene", etc. The final "e" of the name is omitted before "y" or a vowel (e.g. methaneol becomes methanol).

C. Numbering the Principal Chain

The principal chain is numbered according to the following rules, taken in order:

- the PFG.'s must be given the lowest possible numbers; then
- the double and triple bonds must be given the lowest possible numbers; then
- the remaining functional groups and substituents must be given the lowest possible numbers.

The following example illustrates the basic approach to naming:



Principal group	$\begin{array}{c} -\text{C}- \\ \parallel \\ \text{O} \end{array}$	-one
Principal chain	$\text{C}-\text{C}-\text{C}-\text{C}-\text{C}-\text{C}$	hexane
Principal chain name plus principal group	$\text{C}-\text{C}-\text{C}-\text{C}-\overset{\text{O}}{\parallel}{\text{C}}-\text{C}$	2-hexanone
Modified name ("ane" becomes "en")	$\begin{array}{cccccc} 6 & 5 & 4 & 3 & 2 & 1 \\ \text{C} & - & \text{C} & = & \text{C} & - & \text{C} & - & \text{C} \\ & & & & \parallel & & & & \text{O} \end{array}$	3-hexen-2-one
Prefixes (alphabetical with location number)	$-\text{Cl}$ $-\text{OH}$ $-\text{CH}_3$	3-chloro 6-hydroxy 5-methyl

Complete name: 3-chloro-6-hydroxy-5-methyl-3-hexen-2-one

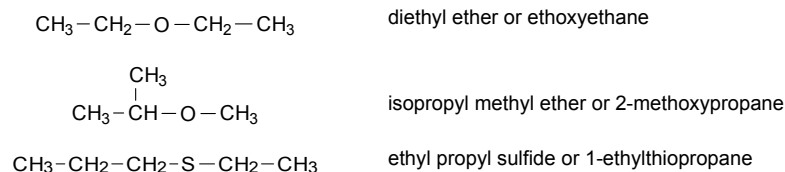
(ii) Naming Various Classes of Organic Compounds

A. Ethers and Thioethers

In the naming of ethers as **alkyloxy** derivatives of alkanes, it is general practice to shorten the names of compounds containing four or less carbons to alkoxy derivatives (*i.e.*, omit the syllable "-yl-"), e.g., methyloxy becomes methoxy, ethyloxy becomes ethoxy, but pentyloxy (for $\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{CH}_2\text{O}-$) is correct.

An alternative system for naming ethers (or thioethers) is to name the alkyl groups on oxygen (sulfur) and list them in alphabetical order as separate words before the name "ether" (or sulfide).

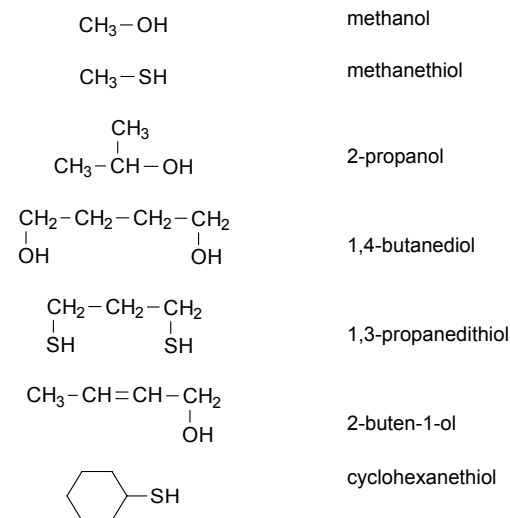
Examples



B. Alcohols and Thiols

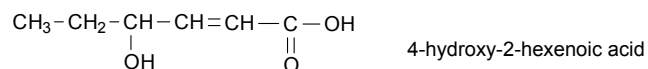
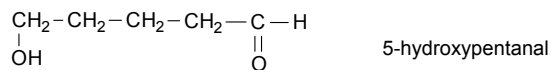
(a) -OH or -SH as the principle functional group

Examples



(b) -OH or -SH as other than the principle functional group

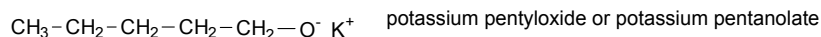
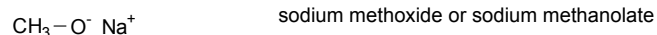
Examples



Alcohol and Thiol Salts

The salts of alcohols and thiols are most simply named by adding "-ate" after the "-ol" of the name. Alternatively, the alcoholates may be named as alkoxides (dropping the "yl" syllable for the first four members as in ether naming).

Examples



C. Acids, Salts of Acids and Acid Anhydrides

Carboxylic acids are named by identifying the longest carbon chain containing the carboxylic acid functional group and using this carbon chain as the stem for the carboxylic acid name. The ending "-anoic acid" is added to the stem to indicate that the compound is a carboxylic acid.

Examples

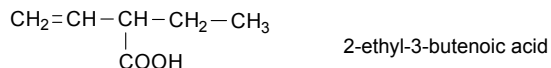
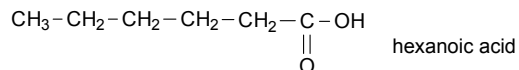


Table 3 lists the carboxylic acids that have special (trivial) names which are preferred to the formal (systematic) names.

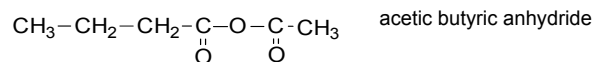
Table 3. Special Names of Common Carboxylic Acids

Formula	Trivial Name	Systematic Name
$\begin{array}{c} \text{H}-\text{C}-\text{OH} \\ \\ \text{O} \end{array}$	formic acid	methanoic acid
$\begin{array}{c} \text{CH}_3-\text{C}-\text{OH} \\ \\ \text{O} \end{array}$	acetic acid	ethanoic acid
$\begin{array}{c} \text{CH}_3-\text{CH}_2-\text{C}-\text{OH} \\ \\ \text{O} \end{array}$	propionic acid	propanoic acid
$\begin{array}{c} \text{CH}_3-\text{CH}_2-\text{CH}_2-\text{C}-\text{OH} \\ \\ \text{O} \end{array}$	butyric acid	butanoic acid
$\begin{array}{c} \text{HO}-\text{C}-\text{C}-\text{OH} \\ \quad \\ \text{O} \quad \text{O} \end{array}$	oxalic acid	ethanedioic acid
$\begin{array}{c} \text{HO}-\text{C}-\text{CH}_2-\text{C}-\text{OH} \\ \qquad \qquad \qquad \\ \text{O} \qquad \qquad \qquad \text{O} \end{array}$	malonic acid	propanedioic acid
$\begin{array}{c} \text{HO}-\text{C}-\text{CH}_2-\text{CH}_2-\text{C}-\text{OH} \\ \qquad \qquad \qquad \qquad \qquad \\ \text{O} \qquad \qquad \qquad \qquad \qquad \text{O} \end{array}$	succinic acid	butanedioic acid
$\begin{array}{c} \text{H} \quad \text{COOH} \\ \diagdown \quad / \\ \text{C}=\text{C} \\ / \quad \diagdown \\ \text{HOOC} \quad \text{H} \end{array}$	fumaric acid	<i>E</i> -butenedioic acid
$\begin{array}{c} \text{H} \quad \text{H} \\ \diagdown \quad / \\ \text{C}=\text{C} \\ / \quad \diagdown \\ \text{HOOC} \quad \text{COOH} \end{array}$	maleic acid	<i>Z</i> -butenedioic acid
$\begin{array}{c} \text{CH}_3-\text{CH}-\text{C}-\text{OH} \\ \qquad \qquad \qquad \\ \text{OH} \qquad \qquad \qquad \text{O} \end{array}$	lactic acid	2-hydroxypropionic acid

The stem name formed by removal of "-ic" from the trivial name is also used in naming other acid derivatives and aldehydes.

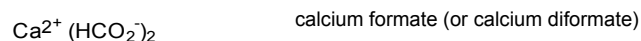
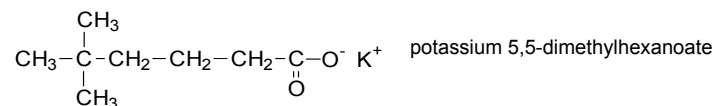
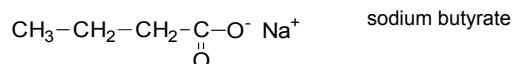
Acid anhydrides are named when symmetrical by replacement of the word "acid" by anhydride. When unsymmetrical, the two acid groups are named as separate words in alphabetical order and the word anhydride is added.

Examples



Acid salts are named by replacing the "ic" ending of the acid name with "ate".

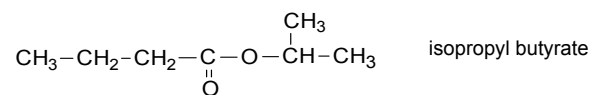
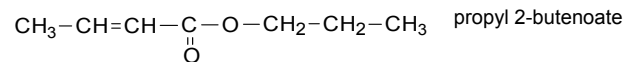
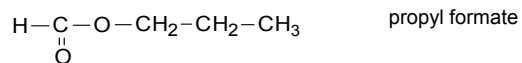
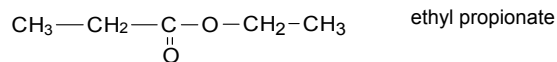
Examples



D. Esters

The alkyl (alkenyl *etc.*) group on oxygen is named as a separate word and is followed by the acid salt name ("-ic acid" becomes "-ate").

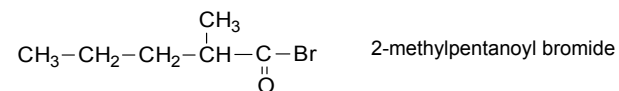
Examples



E. Acid Halides

Acid halides are named by replacing the "-ic acid" ending of the parent carboxylic acid with "-yl halide".

Examples

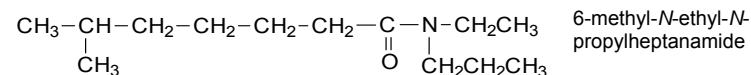
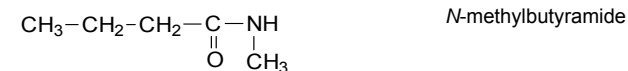
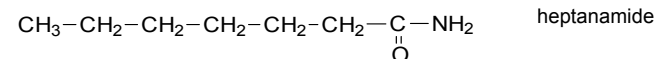


F. Amides

Primary amides are named by identifying the carboxylic acid from which the amide is derived and replacing the "-ic acid" or "-oic acid" ending of the parent carboxylic acid name with the ending "-amide".

When there are substituents on the N atom, these are named using *N*-alkyl or *N,N*-dialkyl as prefixes (note *N* or *N,N* are italicised) immediately before the main chain name.

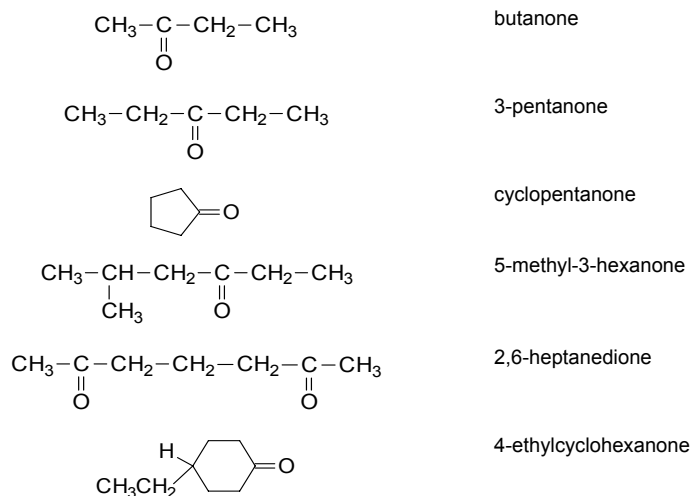
Examples



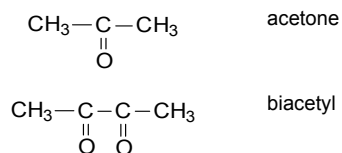
I. Ketones

Ketones are named by adding the suffix "-one" to the stem of the parent carbon chain.

Examples

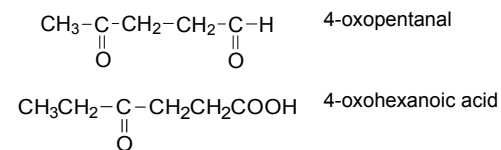


Special Note: the following compounds have special names:



Special Note: The prefix "oxo" is used when the ketone is not the principal functional group.

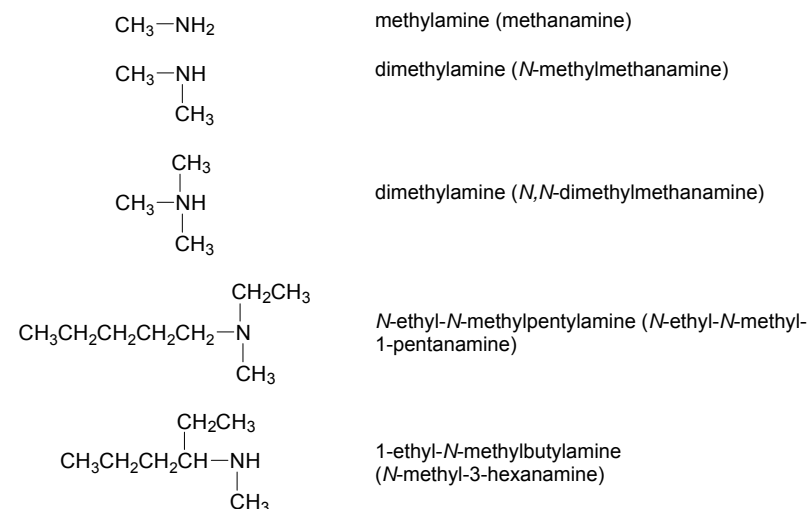
Examples



J. Amines and Ammonium Salts

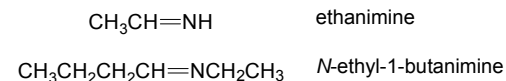
The systematic method of naming amines, whereby "-amine" is added to the principal chain name is, in practice, only rarely used and an older method is in common (I.U.P.A.C. accepted) use. Amines are named as derivatives of ammonia. The longest chain attached to the nitrogen atom is named in the usual way for an alkyl group (the carbon attached to the nitrogen is carbon 1). Any other N-substituents are named as *N*-alkyl, or *N,N*-dialkyl substituents. The alkyl name for the longest stem is then added to the suffix "amine".

Examples The following examples show this common naming in practice (together with the formal, systematic names in parenthesis):



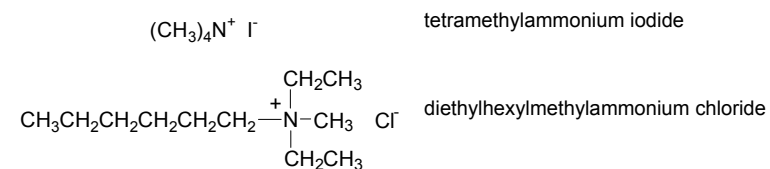
Imines are best named systematically

Examples



Ammonium Salts are named as alkyl derivatives of inorganic ammonium salts. Note that the *N*-system is not used and the four alkyl groups attached to N are listed alphabetically.

Examples



5 AROMATIC COMPOUNDS

(i) General Notes

The use of numbers to indicate the position of substituents on aromatic rings is supplemented in the case of disubstituted derivatives of **benzene** by the terms:

ortho- abbreviated *o*- indicating 1,2-disubstitution

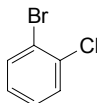
meta- abbreviated *m*- indicating 1,3-disubstitution

para- abbreviated *p*- indicating 1,4-disubstitution

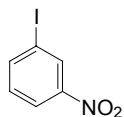
Examples



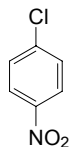
benzene



o-bromochlorobenzene



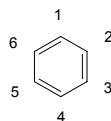
m-iodonitrobenzene



p-chloronitrobenzene

(ii) Aromatic Hydrocarbons

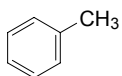
The following aromatic compounds have the special name and derived group names shown below:



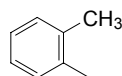
benzene



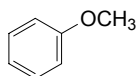
phenyl group
(abbreviated -Ph)



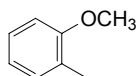
toluene



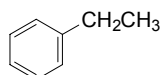
tolyl group
(*o*-tolyl shown)



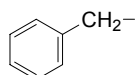
anisole



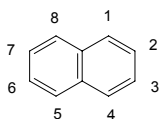
anisyl group
(*o*-anisyl shown)



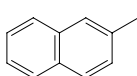
ethylbenzene



benzyl group
(abbreviated -Bz)



naphthalene



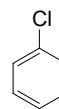
naphthyl group
(2-naphthyl shown)

(iii) Substituted Aromatic Compounds

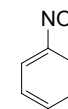
A. Halogen and Nitro- Substituted Aromatics

These are named using halo- or nitro- prefixes before the name of the aromatic **hydrocarbon** in the usual way.

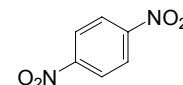
Examples



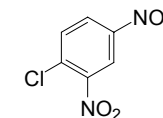
chlorobenzene



nitrobenzene



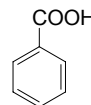
p-dinitrobenzene



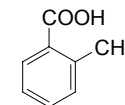
1-chloro-2,4-dinitrobenzene

B. Carboxylic Acids and Derivatives

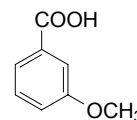
The following list gives the trivial (usually accepted) names for some of the common aromatic acids and derivatives.



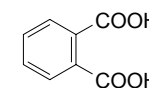
benzoic acid



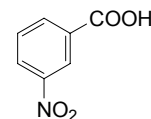
o-toluic acid



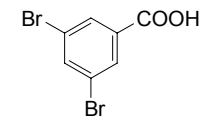
m-anisic acid



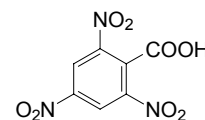
phthalic acid



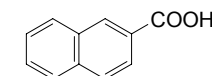
m-nitrobenzoic acid



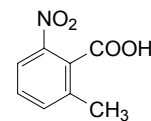
3,5-dibromobenzoic acid



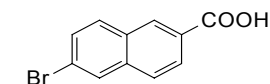
2,4,6-trinitrobenzoic acid



2-naphthoic acid



6-nitro-*o*-toluic acid

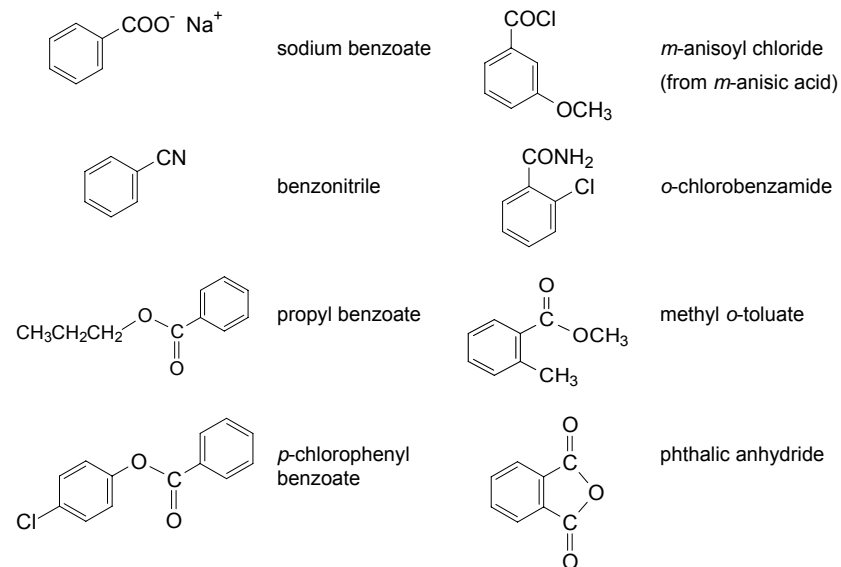


6-bromo-2-naphthoic acid

Carboxylic acid Derivatives

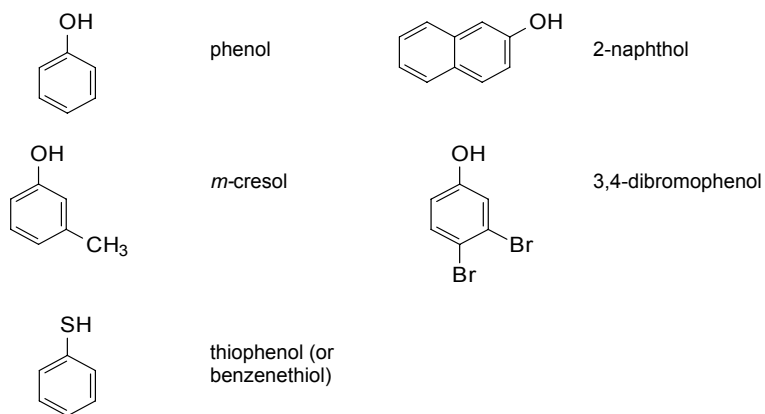
Acid derivatives, esters, anhydrides, amides and nitriles are named in the usual way, replacing "-oic" or "-ic" of the acid name with the appropriate endings.

Examples



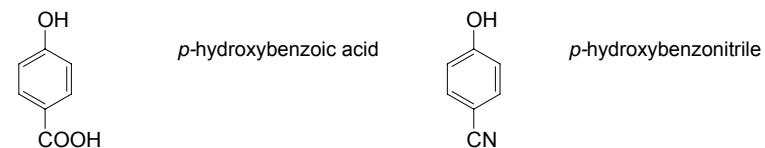
C. Phenols and Thiophenols

Phenols have an -OH group attached directly to an aromatic ring.



When the -OH group is not the principal functional group, "hydroxy" is used in the usual way.

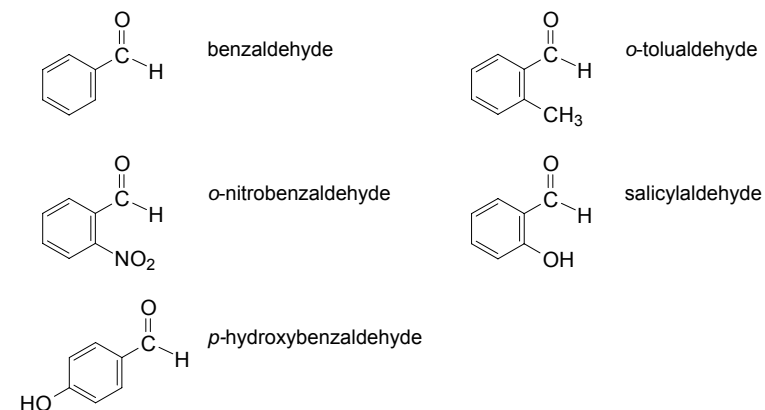
Example



D. Aldehydes and Ketones

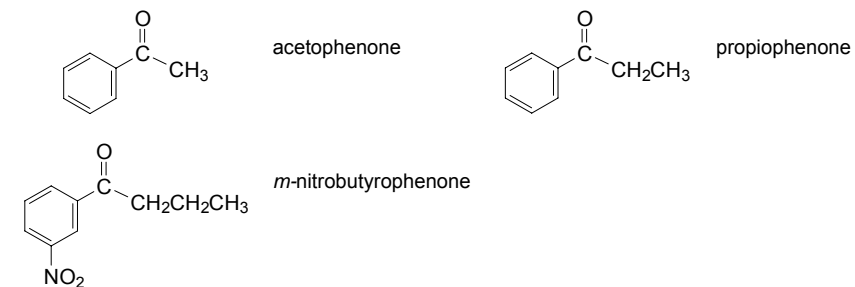
Aldehydes are named by replacing the "-ic" or "-oic" of the acid name by "aldehyde".

Examples



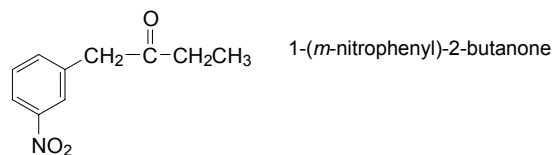
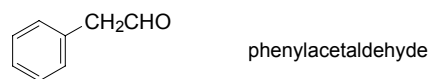
Aromatic ketones are named by changing the "ic" or "oic" ending of the acid name corresponding to the acyl group attached to the benzene ring to "-ophenone"

Examples



Aldehydes and ketones in which the carbonyl group is not directly attached to the aromatic ring are named using the corresponding group name for the aromatic system as a prefix.

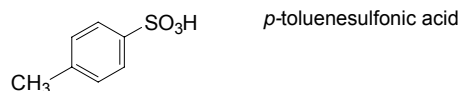
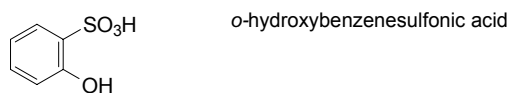
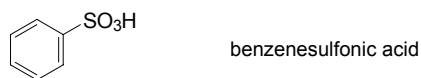
Examples



E. Sulfonic Acids and Sulfonic Acid Derivatives

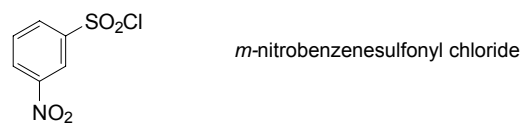
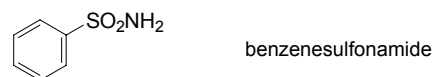
Sulfonic acids are named by adding the suffix "-sulfonic acid".

Examples



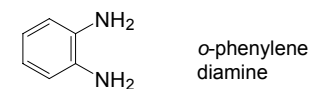
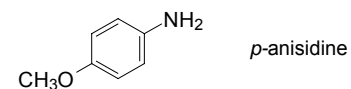
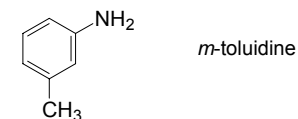
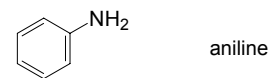
Sulfonic Acid Derivatives. Derivatives of sulfonic acids (esters, amides and sulfonic acid chlorides) are named by analogy with carboxylic acids.

Examples



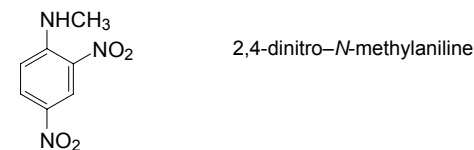
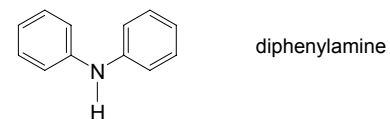
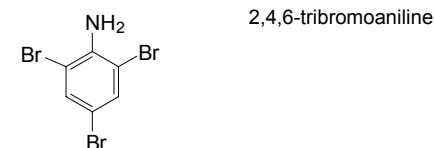
F. Aromatic Amines

Special Names



The remaining aromatic amines are named as derivatives of these or (in the presence of more important functional groups) as "amino-" derivatives, or as "phenylamines".

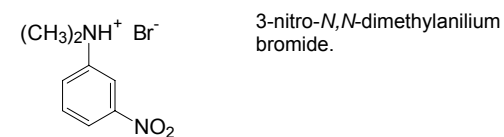
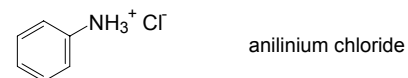
Examples



Ammonium Salts

These are named by changing the "-e" of the special names to "-ium".

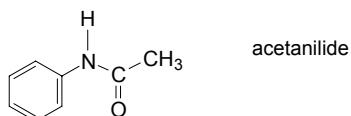
Examples



Acyl Derivatives (Amides)

Simple acyl derivatives are named by adding the trivial acid name stem to "-anilide" etc.

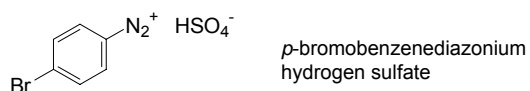
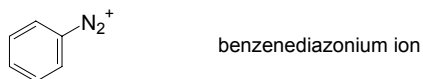
Example



G. Diazonium Ions (ArN_2^+)

These are named in an analogous fashion to sulfonic acids; the syllable "-diazonium" is added to the aromatic name.

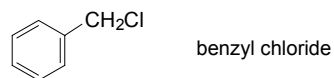
Examples



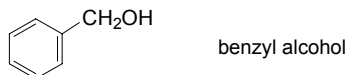
6. RADICOFUNCTIONAL NAMING

An alternate system of naming, which is still very common in many textbooks, consists of naming the alkyl or aryl groups attached to a certain functional group as separate words followed by the functional group name. The alternative naming of ethers and amines is a remnant of this system. The following examples suffice to illustrate the system.

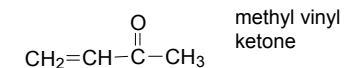
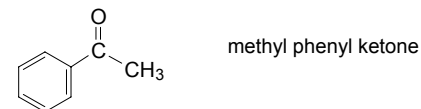
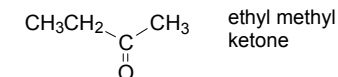
A. Alkyl Halides



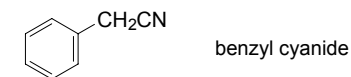
B. Alcohols



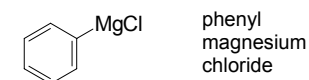
C. Ketones



D. Nitriles (Cyanides)



E. Grignard Reagents



Revised and updated
Professor L D Field
May 2004