IUPAC Rules For Naming Carboxylic acids –

– Carboxylic acids are compounds which contain the carboxyl group (–COOH). Their common names end in –ic acid.

Formula	Common Name	IUPAC Name
$H-\overset{O}{\overset{\|\|}{C}}-OH$	Formic acid	Methanoic acid
$CH_3-\overset{O}{\overset{\|\|}{C}}-OH$	Acetic acid	Ethanoic acid
$CH_3CH_2-\overset{O}{\overset{\|\|}{C}}-OH$	Propionic acid	Propanoic acid
$CH_3CH_2CH_2-\overset{O}{\overset{\|\|}{C}}-OH$	Butyric acid	Butanoic acid

IUPAC Rules for carboxylic Acids

(1) In the IUPAC system, carboxylic acids are named as **Alkanoic acids**.

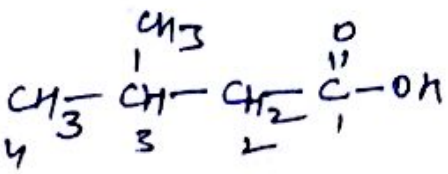
(2) Select the longest chain containing the carboxylic group (–COOH)

(3) Naming the longest chain – The name is obtained by

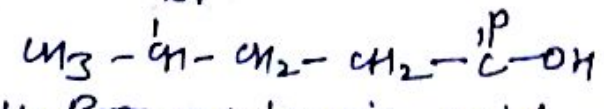
Alkane – e + Oic acid = Alkanoic acid

(4) Number the chain – In this starting the numbering with carboxyl carbon as number 1. The number 1 is not used to indicate the position of the carboxyl carbon (located at the end of the chain)

(5) other substituents are numbered, named and placed as prefixes in alphabetic order. For Example,

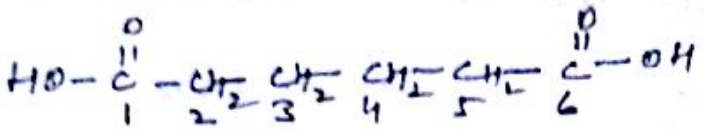


3-Methylbutanoic acid



4-Bromopentanoic acid

(6) When there are two carboxyl groups in a molecule, it is named as Alkanedioic acid. The -e of the corresponding alkane name is retained.



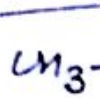
1,6 - Hexanedioic acid.

Carboxylic Acid derivatives

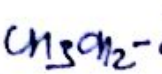
- Carboxylic acid derivatives are compounds in which the hydroxyl part of the carboxyl group is replaced by various other groups.

(a) Acid chlorides - The name is obtained by replacing OH group by Cl atom and changing the ending -ic acid of the corresponding carboxylic acid to -yl chloride.

For Example



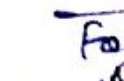
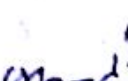
- Common name is Acetyl chloride
- IUPAC name is Ethanoyl chloride



- Common name is Propionyl chloride
- IUPAC name is Propanoyl chloride

(b) Esters - The name is obtained by replacing the OH group by OR group. Their names consist of two words. The first word is the name of the alkyl group attached to the oxygen atom. The second word is derived from the carboxylic acid name with -ic acid changed to -ate.

For Example

Formula	Common name	IUPAC Name
	Methyl formate	Methyl methanoate
	Ethyl acetate	Ethyl ethanoate

(c) Anhydrides — Anhydrids are derived from acids by replacing OH by OCOR. They are named by changing the suffix acid of the parent acid to anhydride.

Formula	Common Name	IUPAC Name
$CH_3-\overset{\overset{O}{\|\|}}{C}-O-\overset{\overset{O}{\|\|}}{C}-CH_3$	Acetic anhydride	Ethanoic anhydride
$C_2H_5-\overset{\overset{O}{\|\|}}{C}-O-\overset{\overset{O}{\|\|}}{C}-C_2H_5$	Propionic anhydride	Propanoic anhydride.

(d) Amides — Amides are derived from acids by replacing OH by NH_2. They are named by replacing the ending -oic acid (IUPAC name) or -ic acid (common name) of the corresponding carboxylic acid with the ending -amide.

Formula	Common name	IUPAC Name
$H-\overset{\overset{O}{\|\|}}{C}-NH_2$	Formamide	Methanamide
$CH_3-\overset{\overset{O}{\|\|}}{C}-NH_2$	Acetamide	Ethanamide

IUPAC Rules For Naming Ethers —

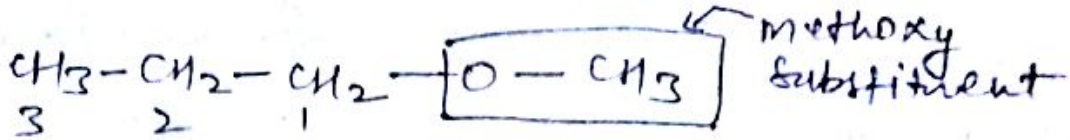
- Ethers are compounds in which an oxygen atom is bonded to two organic groups. (R-O-R)
- In the common system, the two alkyl groups attached to the oxygen atom are named in alphabetic order and word ether is added. If the groups are same, the prefix di- is used.

CH_3OCH_3 — Dimethyl ether

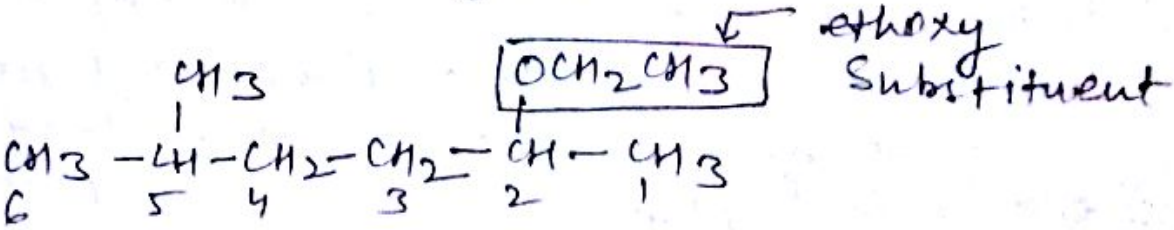
$CH_3CH_2OCH_3$ — Ethyl methyl ether

- In the IUPAC system, ethers are named as alkoxy-alkanes, the smaller alkyl group plus the oxygen atom is called an alkoxy substituent.

For Examples



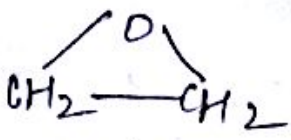
1-methoxy propane



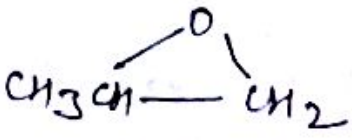
2-Ethoxy-5-methylhexane.

OXIRANES (Epoxides)-

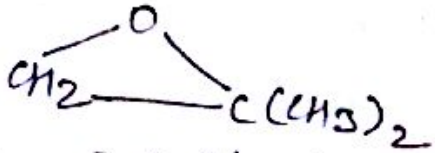
- Oxiranes are cyclic ethers in which the ether oxygen is part of the three membered ring. Oxiranes are also called epoxides.
- Because they are readily prepared from alkenes, they are commonly known as Alkene oxides.
- In the IUPAC System, they are named as Alkyloxiranes.
- Substituents on the oxirane ring require a numbering system. the oxygen atom is given the number 1.



Oxirane
(ethylene oxide)



2-methyloxirane
(propylene oxide)



2,2-Dimethyl-oxirane
(Isobutylene oxide)

AMINES

- Amines are derivatives of ammonia (NH_3) in which one or more hydrogen atoms are replaced by alkyl or aryl groups.
- They are classified as primary, secondary, or tertiary depending on the number of groups attached to the nitrogen atom.

$R-NH_2$ – (Primary amines – one alkyl group (R) attached to N)

R_2-NH – (Secondary amines – two alkyl groups (R) attached to N)

R_3-N – (Tertiary amines – three alkyl groups (R) attached to N)

- the R groups in secondary and tertiary amines may be same or different.
- In the common system, amines are named by adding the suffix – amine to the name of the alkyl groups or groups. the entire name is written as one word and the names of the alkyl groups are arranged in alphabetic order

for example

CH_3NH_2 – Methyl amine

CH_3NHCH_3 – Dimethyl amine

$CH_3-\overset{CH_3}{\underset{|}{N}}-CH_3$ – Trimethyl amine

$CH_3-\overset{CH_3}{\underset{|}{CH}}-NH_2$ – Isopropylamine

$CH_3-NH-CH_2CH_3$ – Ethylmethyl amine

$CH_3-\overset{CH_3}{\underset{|}{N}}-CH_2CH_3$

Ethyldimethylamine

- In the IUPAC system, primary amines are named by replacing the final -e of the parent alkane by -amine. If necessary, a number is added to indicate the position of $-NH_2$ group. Such as

$CH_3CH_2NH_2$

Ethanamine

$CH_3-\overset{CH_3}{\underset{|}{CH}}-NH_2$

2-propanamine

- Sec. or tertiary amines are named as N-substituted derivatives of primary amines. the largest of the primary amine. the remaining alkyl groups are named as substituents by using the prefix -N- to indicate that they are attached to nitrogen.

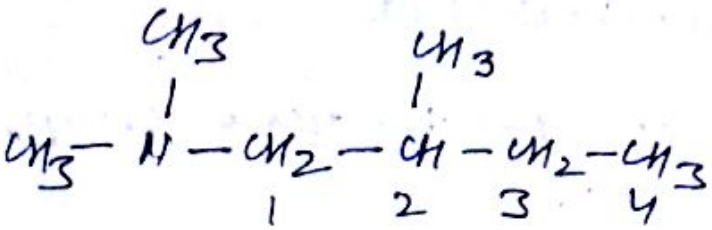
examples:

$CH_3-CH_2-NH-CH_3$

N-Methylethanamine

$CH_3CH_2-\underset{\displaystyle CH_3}{\overset{|}{N}}-CH_2CH_2CH_2CH_3$

N-Ethyl-N-methylbutanamine.



2-Methyl-N,N-dimethylbutanamine.

- For diamines the final -e of the hydrocarbon name is retained.

$H_2NCH_2CH_2CH_2CH_2CH_2CH_2NH_2$ 1,6-Hexanediamine.

When it is necessary to name $-NH_2$ as a substituent, it is called the amino group.

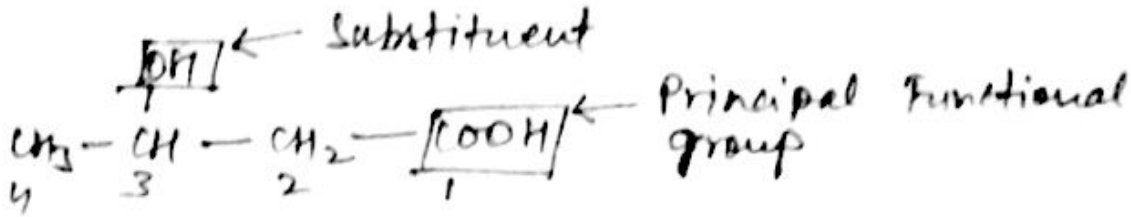
$H_2NCH_2CH_2CH_2CH_2OH$ 4-Amino-1-butanol.

NOMENCLATURE OF POLYFUNCTIONAL COMPOUNDS

The functional group present in a molecule determines its class. If it contains an -OH group, the molecule is an alcohol. If it contains a -COOH group, it is carboxylic acid. But when compound or molecule contains the both -OH and -COOH functional groups then what will be compound-alcohol or carboxylic acid. The IUPAC system gives higher priority to -COOH over -OH and structure will be carboxylic acid. the -OH group is considered as a substituent.

When a compound contains two or more different types of functional groups (Polyfuntional compound), the functional group which specifies its class is called the principal functional group. the other functional groups

are referred to as substituents. For Example



3-Hydroxybutanoic acid

the -COOH group is the principal functional group, while -OH group is a substituent.

Selection of the Principal Functional Group

The IUPAC system has laid down the priority of functional groups for determining the class of a polyfunctional compound. The Table given below has a list of functional groups in decreasing order of priority for citation as the principal functional group. That is, the functional group which occurs higher up in the priority table is the principal functional group and specifies the class.

Table:

Nomenclature priority for determining the principal functional Group. Highest Priority Group is at the TOP.

Class	Functional group	Suffix used
(1) Carboxylic acid	$-\overset{O}{\overset{\|}{C}}-OH$	-oic acid
(2) Sulphonic acid	$-SO_3H$	-Sulphonic acid
(3) ester	$-\overset{O}{\overset{\|}{C}}-O-$	alkyl-oate.
(4) Acid halide	$-\overset{O}{\overset{\|}{C}}-X$	-oyl halide
(5) Amide	$-\overset{O}{\overset{\|}{C}}-NH_2$	-amide
(6) nitrile	$-CN$	-nitrile
(7) aldehyde	$-\overset{O}{\overset{\|}{C}}-H$	-al
(8) Ketone	$-\overset{O}{\overset{\|}{C}}-C$	-one
(9) alcohol	$-OH$	-ol
(10) amine	$-\ddot{N}-$	-amine
(11) ethers	$-O-$	(ether)
(12) alkene	$-C=C-$	-ene
(13) alkyne	$-C\equiv C-$	-yne