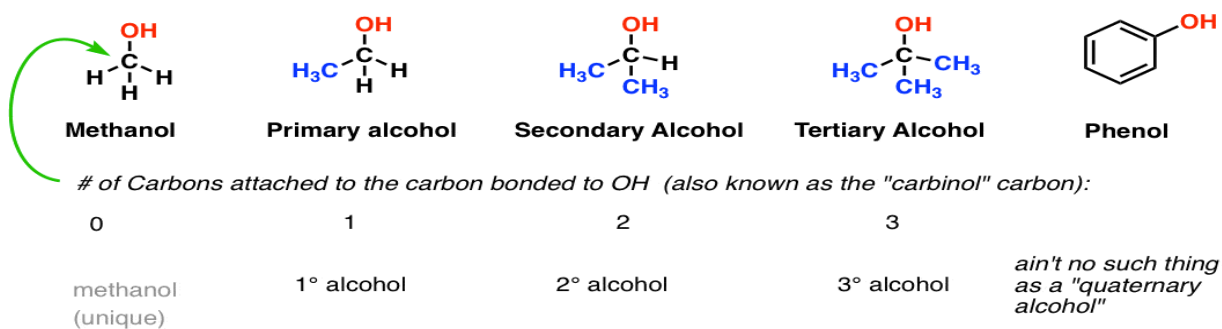


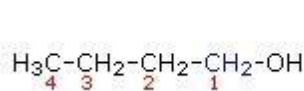
BP 202T - PHARMACEUTICAL ORGANIC CHEMISTRY - I**UNIT: 1 CLASSIFICATION, NOMENCLATURE & ISOMERISM**

CLASS: 3

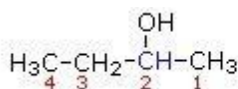
TOPIC: IUPAC NOMENCLATURE OF ALCOHOLS, ALDEHYDES, KETONES & ETHERS

- Alcohols are compounds in which a hydroxyl group (-OH) is bonded to a saturated carbon.
- Alcohols are classified as Primary, secondary or tertiary alcohol depending upon whether the -OH group is attached to a primary, secondary, tertiary or quaternary carbon atom
- The name of alcohol is obtained by naming the alkyl group attached to the -OH group and adding alcohol as a separate word.

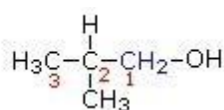
Primary, secondary, tertiary alcohol - what does it mean?**IUPAC RULES FOR ALCOHOLS****Rule 1:** Select the longest carbon chain to which hydroxyl group is attached.**Rule 2:** Name the longest chain. (Alkane – e + ol) is Alkanol**Rule 3:** Give numbering to the chain from the end closer to the carbon attached to the hydroxyl group.**Rule 4:** Indicate the position of the hydroxyl group by the number of the carbon atom attached to the hydroxyl group.**Rule 5:** Alkyl groups and other substituent's are numbered, named and placed as prefixes in the alphabetical order**Rule 6:** Alcohols containing two or three – OH groups are named as **Alkanediols** and **Alkanetriols**.



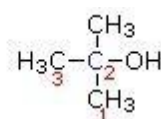
1-butanol
(butyl alcohol)
a 1°-alcohol



2-butanol
(*sec*-butyl alcohol)
a 2°-alcohol



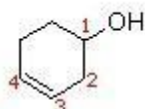
2-methyl-1-propanol
(*isobutyl* alcohol)
a 1°-alcohol



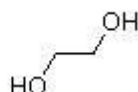
2-methyl-2-propanol
(*tert*-butyl alcohol)
a 3°-alcohol



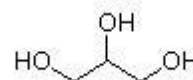
2-propen-1-ol
(allyl alcohol)



3-cyclohexen-1-ol



1,2-ethanediol
(ethylene glycol)



1,2,3-propanetriol
(glycerol)

ALDEHYDES

Aldehydes are the compounds in which the carbonyl group (C=O) is bonded to one alkyl group and hydrogen of an organic molecule.

Compound	Common name	IUPAC name
HCHO	Formaldehyde	Methanal
CH ₃ -CHO	Acetaldehyde	Ethanal
CH ₃ -CH ₂ -CHO	Propionaldehyde	Propanal

IUPAC NAMING OF ALDEHYDES:

Rule 1: Select the longest carbon chain to which aldehyde group is attached.

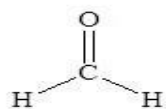
Rule 2: Name the longest chain. (Alkane – e + al) is Alkanal

Rule 3: Give numbering to the chain from the end closer to the carbon attached to the carbonyl carbon.

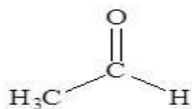
Rule 4: Indicate the position of the carbonyl group by the number of the carbon atom attached to the carbonyl group.

Rule 5: Alkyl groups and other substituent's are numbered, named and placed as prefixes in the alphabetical order

Rule 6: Aldehydes containing two or three carbonyl groups are named as **Alkanedials** and **Alkanetrials**.



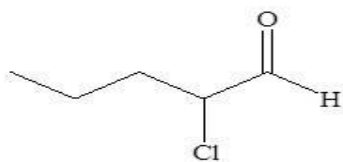
Methanal
(Formaldehyde)



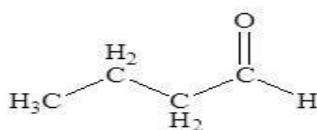
Ethanal
(Acetaldehyde)



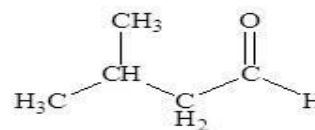
Pentanal
(Valeraldehyde)



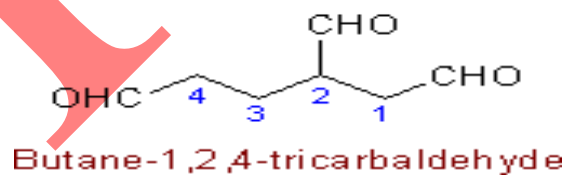
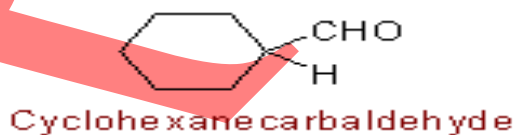
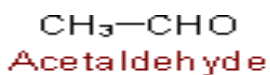
2-Chloropentanal
(α-Chlorovaleraldehyde)



Butanal
(Butyraldehyde)

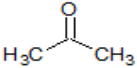
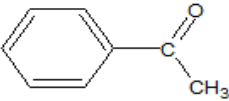
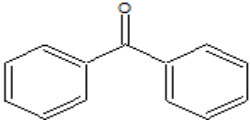


3-Methylbutanal
(isovaleraldehyde)



KETONES

Ketones are the compounds in which the carbonyl group (C=O) is bonded to two organic groups in an organic molecule.

Compound	Systematic	Common
	propane ↓ propanone	acetone or dimethyl ketone
	1-phenylethane ↓ 1-phenylethanone	acetophenone or methyl phenyl ketone
	benzophenone	diphenyl ketone

IUPAC NAMING OF KETONES:

Rule 1: Select the longest carbon chain to which carbonyl carbon is attached.

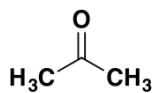
Rule 2: Name the longest chain. (Alkane – e + one) is Alkanone

Rule 3: Give numbering to the chain from the end closer to the carbon attached to the carbonyl carbon.

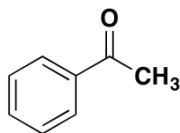
Rule 4: Indicate the position of the carbonyl group by the number of the carbon atom attached to the carbonyl group.

Rule 5: Alkyl groups and other substituent's are numbered, named and placed as prefixes in the alphabetical order

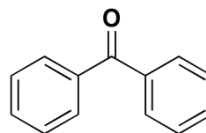
Rule 6: ketones containing two or three carbonyl groups are named as **Alkanedione** and **Alkanetrione**.



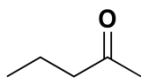
propanone
(acetone)



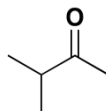
acetophenone
(methyl phenyl ketone)



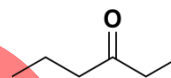
benzophenone
(diphenyl ketone)



2-pentanone
(methyl propyl ketone)



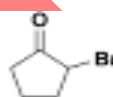
3-methyl-2-butanone
(methyl isopropyl ketone)



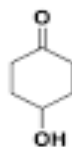
3-hexanone
(ethyl propyl ketone)



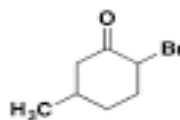
cyclopentanone



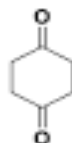
2-bromocyclopentanone



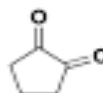
4-hydroxycyclohexanone



2-bromo-5-methylcyclohexanone



1,4-cyclohexanedione



1,2-cyclopentanedione

ETHERS (R – O – R)

- Ethers are the compounds in which an oxygen atom is bonded to two organic groups or alkyl groups.
- In IUPAC system ethers are named as Alkoxyalkanes. The smallest alkyl group attached to the oxygen atom is called an alkoxy substituent.
- In common system, two alkyl groups attached to the oxygen atom are named in alphabetical order and the word “*ether*” is added.
- If two similar groups are added the prefix *–di* is added.

Alkyl Group	Name	Alkoxy Group	Name
CH ₃ –	Methyl	CH ₃ O–	Methoxy
CH ₃ CH ₂ –	Ethyl	CH ₃ CH ₂ O–	Ethoxy
(CH ₃) ₂ CH–	Isopropyl	(CH ₃) ₂ CHO–	Isopropoxy
(CH ₃) ₃ C–	tert-Butyl	(CH ₃) ₃ CO–	tert-Butoxy
C ₆ H ₅ –	Phenyl	C ₆ H ₅ O–	Phenoxy

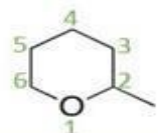
Naming ethers:

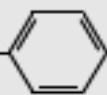
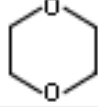
³CH₃-²CH₂-¹CH₂-O-¹CH₂-²CH₂-³CH₂-⁴CH₃ Butyl propyl ether or 1-Propoxybutane

¹CH₃-²CH₂-O-¹CH₂-²CH₃ Diethyl ether

$\begin{array}{c} \text{CH}_3 \\ | \\ \text{CH}_3-\text{O}-\text{C}-\text{CH}_3 \\ | \\ \text{CH}_3 \end{array}$ Methyl tert-butyl ether

$\begin{array}{ccccccc} & \text{OH} & & \text{O}-\text{CH}_3 & & & \\ & | & & | & & & \\ \text{CH}_3 & -\text{CH}_2- & \text{CH}_2- & \text{CH}- & \text{CH}_2- & \text{CH}_2- & \text{CH}_3 \\ 1 & 2 & 3 & 4 & 5 & 6 & 7 \end{array}$ 4-Methoxy-2-heptanol

 2-Methyloxacyclohexane

Physical properties of ethers				
name	structure	mp (°C)	bp (°C)	density (grams per millilitre)
dimethyl ether	$\text{CH}_3\text{—O—CH}_3$	-140	-25	0.66
ethyl methyl ether	$\text{CH}_3\text{CH}_2\text{—O—CH}_3$		8	0.72
diethyl ether	$\text{CH}_3\text{CH}_2\text{—O—CH}_2\text{CH}_3$	-116	35	0.71
dipropyl ether	$\text{CH}_3\text{CH}_2\text{CH}_2\text{—O—CH}_2\text{CH}_2\text{CH}_3$	-122	91	0.74
diisopropyl ether	$(\text{CH}_3)_2\text{CH—O—CH}(\text{CH}_3)_2$	-86	68	0.74
divinyl ether	$\text{CH}_2=\text{CH—O—CH}=\text{CH}_2$	-101	28	0.77
1,2-dimethoxyethane (DME)	$\text{CH}_3\text{OCH}_2\text{CH}_2\text{OCH}_3$	-58	83	0.86
methyl phenyl ether (anisole)	$\text{CH}_3\text{—O—}$ 	-37	154	0.99
cyclopropyl methyl ether	 —O—CH ₃	-119	45	0.81
diphenyl ether	 —O— 	27	259	1.07
furan		-86	32	0.94
tetrahydrofuran (THF)		-108	65	0.89
1,4-dioxane		11	101	1.03