

IUPAC

Basics compounds

Organic

Living organism

(Plants & Animals)

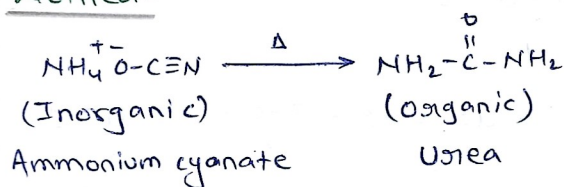
Inorganic

Non-living organism

(Minerals & gases)

Berzelius - Impossible to convert inorganic into organic compound.

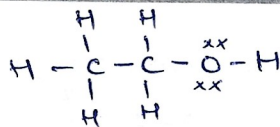
Wohler -



Representations of organic compounds

1. Molecular formula: $\text{C}_2\text{H}_6\text{O}$

2. Lewis structure (non condensed):



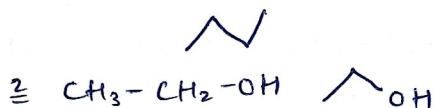
3. Condensed formula: $\text{CH}_3\text{CH}_2\text{OH}$.

4. Partially condensed: $\text{CH}_2\text{CH}_2 - \overset{\text{xx}}{\underset{\text{xx}}{\text{O}}} - \text{H}$

5. Bond line structure:

- Only C-C bonds are represented.
- Heteroatoms are always represented.
- Longest C-C chain is represented in zig-zag pattern.
- Double bonds are shown with two lines and triple bonds with three lines.

Examples. $\equiv \text{CH}_3 - \text{CH}_2 - \text{CH}_2 - \text{CH}_3$



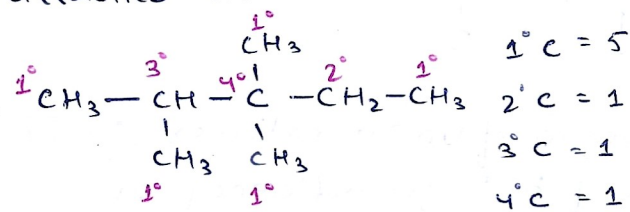
$\equiv \text{CH}_3\text{CH}_2\text{CH}_2\text{CHO}$

$\equiv \text{CH}_3\text{CH}_2\text{NHCH}_2\text{CH}_3$

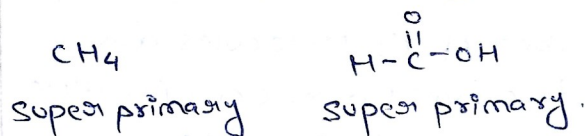
$\equiv \text{CH}_3\text{CH}_2\text{CH}_2\text{COOH}$

Degree of Carbon.

Defination: - The no. of C atoms directly attached with the carbon.

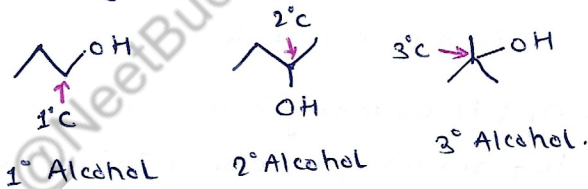


OP Point - Super primary carbon.



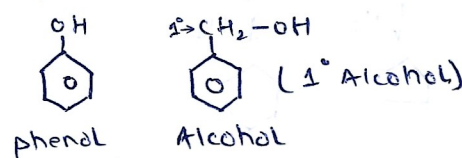
Degree of Alcohols

Defination: - The degree of carbon at which OH group is present.



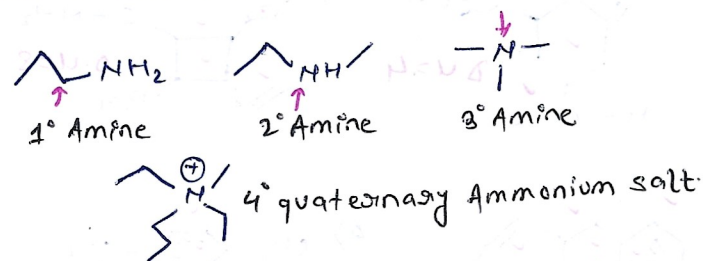
OP Point - degree of phenol

Aisa kuch nahi hota hai.

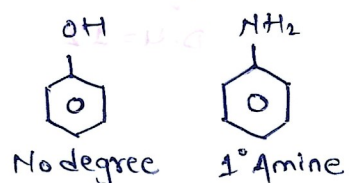


Degree of Amines

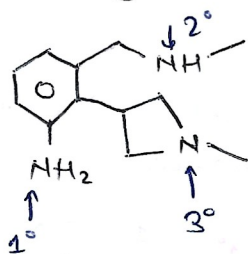
Defination: - The no. of C atoms directly connected with the N.



OP Point: - Degree of Aniline.



Q find degree.



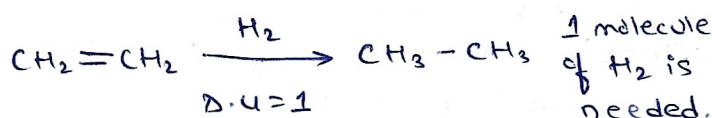
(D.U) Degree of Unsaturation or (I.H.D):

Index of hydrogen deficiency. or

(U.I): Unsaturation index or

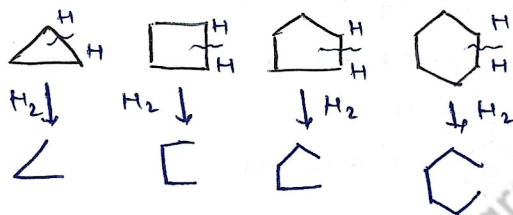
(D.B.E): Double bond equivalents.

Case 1: Number of H_2 Molecules are required to convert a molecule (multiple bond) into open chain saturated comp.



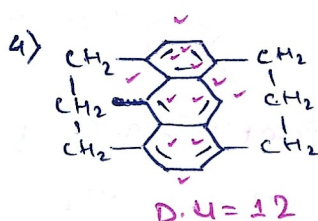
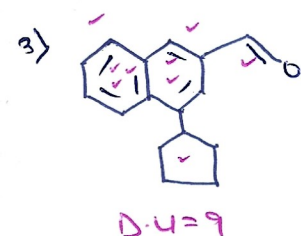
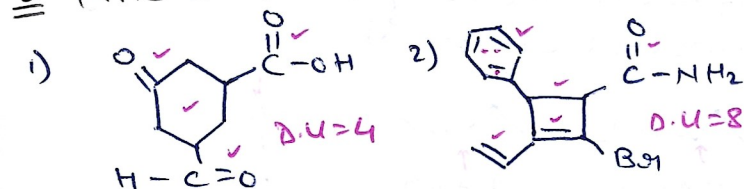
1 π Bond ki D.U 1 Hoti hai

Case 2: Ring; How many bonds are cleaved to form an open chain saturated compound.



1 Ring ki D.U 1 Hoti hai

Q Find D.U?



Calculation of D.U:

If Molecular formula is given

$$D.U = (C+1) - \frac{(H+X-N)}{2}$$

C = no. of 'C' atoms X = no. of 'X' atoms

H = no. of 'H' atoms N = no. of 'N' atoms

Q find D.U of Glucose $C_6H_{12}O_6$

$$D.U = (6+1) - \frac{12+0-0}{2} = 7-6 = 1$$

Q find D.U

1) C_4H_8 D.U = $4+1 - \frac{8+0-0}{2} = 5-4 = 1$

2) $C_5H_{10}Cl_2$ D.U = $(5+1) - \frac{10+2-0}{2} = 6-6 = 0$

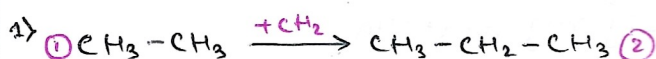
3) C_3H_6O D.U = $(3+1) - \frac{6+0-0}{2} = 4-3 = 1$

OP Point: D.U can be fractional.

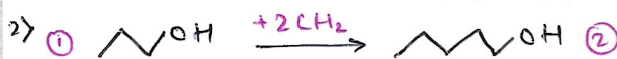
$$H-C(=O)-O^- \text{ , } HCO_2^- \quad D.U = (1+1) - \frac{1+0-0}{2} = 2 - \frac{1}{2} = 1.5$$

HOMOLOGUES:-

- Same functional group (same general formula) same family.
- Different Molecular Formula.
- " " Weight.
- Diff. in CH_2 units.

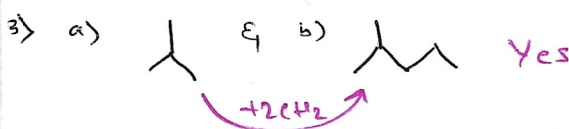
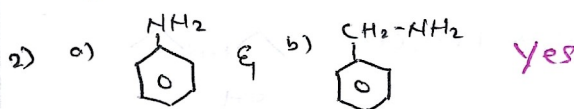
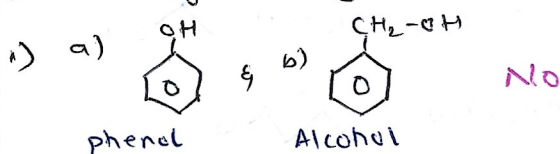


① and ② are homologues



① and ② are homologues

Q Identify Homologues or not?



Functional Group

1. A functional group may be defined as an atom or group of atoms joined in a specific manner which is responsible for the characteristics chemical properties of the organic compounds.

2. The examples are hydroxyl group (-OH), aldehyde group (-CHO) and carboxylic acid (-COOH) etc.

3. Alkenes ($C=C$) and Alkynes ($C\equiv C$) are F.G
Calculation of σ & π Bonds & lone pairs

$A-B$	$A=B$	$A\equiv B$
1 σ	1 σ	1 σ
	1 π	2 π

Q Find σ and π Bonds in following compounds?

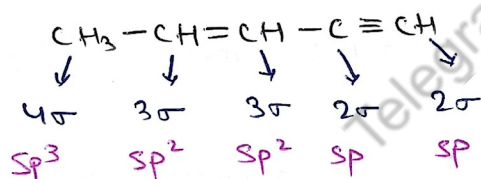
1. $CH_3-CH_2-CH=CH_2$ 11 σ , 1 π

2. $HC\equiv C-CH_2-CH_3$ 9 σ , 2 π

Hybridisation of 'C' in Organic C.

4 $\sigma \rightarrow sp^3$ 3 $\sigma \rightarrow sp^2$ 2 $\sigma \rightarrow sp$

Q Find hybridisation of each 'C' atom.



E.N of hybrid orbitals

% s charac	sp	% s = 50%
	sp^2	% s = 33.33% [$\%s \propto E.N$]
	sp^3	% s = 25%

E.N $sp > sp^2 > sp^3 \Rightarrow$ OP Point

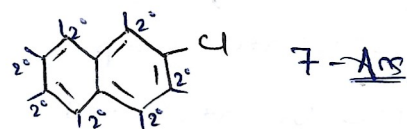
Electronegativity: $F > O > C_{sp} > N > C_{sp^2} > C_{sp^3}$

Practice

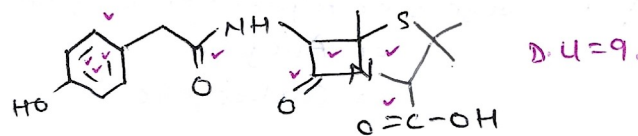
Q Find Homologous pairs?



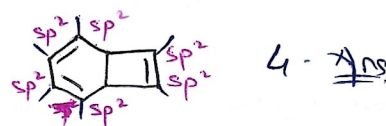
Q How many $2^\circ H$ are present.



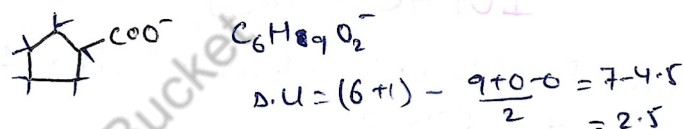
Q Find D.U in amoxicillin.



Q The no. of sp^2-sp^2 σ Bonds in.



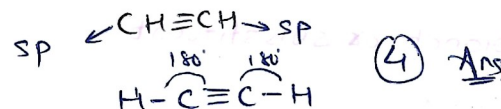
Q Find D.U



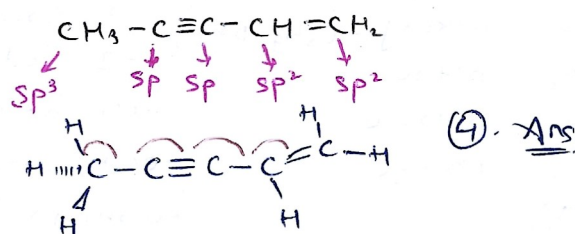
Q Find D.B.E : $C_6H_8Cl_4$

$D.B.E = (6+1) - \frac{8+4-0}{2} = 7-6 = 1$

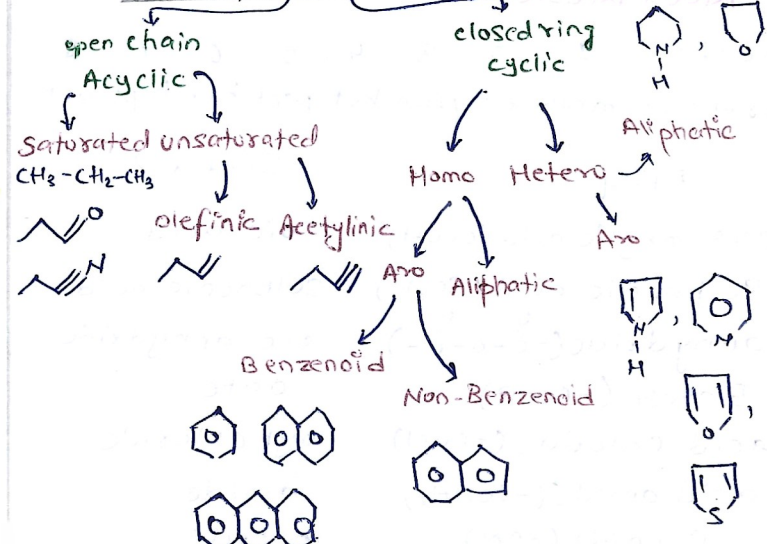
Q How many atoms are linearly arranged



Q How many 'C' atoms are linearly arranged

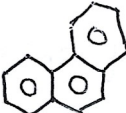


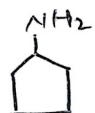
Classification of O.C



8. Identify the type of organic Comp.

1.  Saturated comp.
2. $\text{CH}_2=\text{CH}-\text{CH}=\text{O}$ Unsaturated.
3. $\text{CH}_3-\text{CH}_2-\text{CH}=\text{O}$ Saturated.
4.  Homocyclic or Aliphatic homocyclic or Alicyclic or Carbocyclic

5.  Aliphatic Heterocyclic
6.  Benzenoid.

7.  Homocyclic

IUPAC Naming

Rule: Prefix + Word Root + Suffix-1 + Suffix-2.

Priority: PFG > Multiple Bonds > No. of Carbons > Max^m no. of Substituents > Lowest Locant > alphabetical order.

PFG = Principle functional group.

① Prefix = Branch or substituent.

Branch	Prefix	
-R	Alkyl	-CH ₃ methyl -F Fluoro
-X	halo	-C ₂ H ₅ ethyl -Cl chloro
-OR	alkoxy	-C ₃ H ₇ propyl -Br Bromo
-NO ₂	nitro	-I iodo
-NO	nitroso	-OCH ₃ methoxy
-Ph	phenyl	-OC ₂ H ₅ ethoxy
		-OC ₃ H ₇ propyl

② Word root =

No. of 'C'	1	2	3	4	5	6	7	8
word root	meth	eth	prop	but	pent	hex	hept	oct

P.F.G	Suffix-2
carboxylic acid (COOH)	oic acid
Sulphonic acid (SO ₃ H)	Sulphonic acid
anhydride (-C(=O)-O-C(=O)-)	oic anhydride
Ester (-COOR)	oate
acid chloride (-COCl)	oyl chloride
acid amide (-CONH ₂)	amide
Cyanide (-CN)	nitrile

isocyanide (-NC)

aldehyde (-CHO)

ketone (-C(=O)-)

alcohol (-OH)

thiol (-SH)

amine (-NH₂)

isonitrile

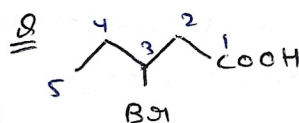
al

one

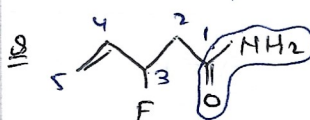
ol

thiol

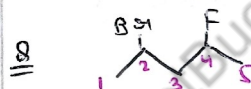
amine



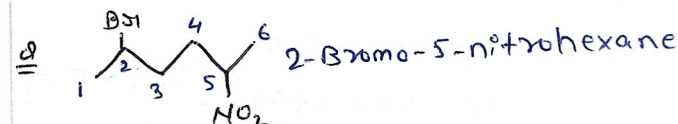
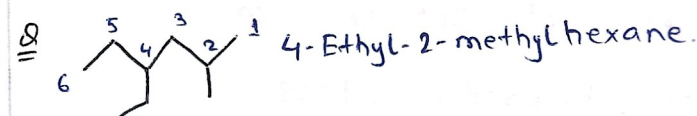
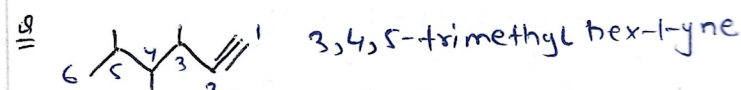
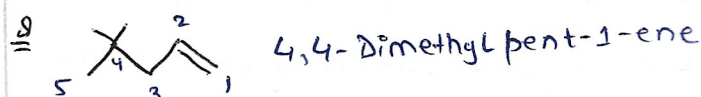
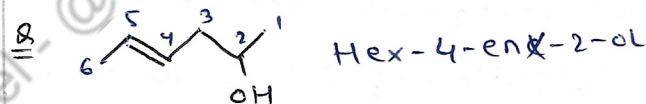
3-Bromopentanoic acid.



3-Fluoropent-4-en-1-amine

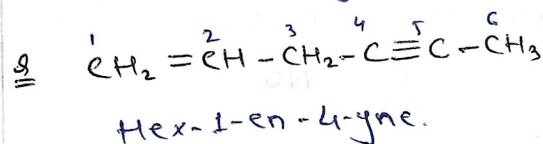
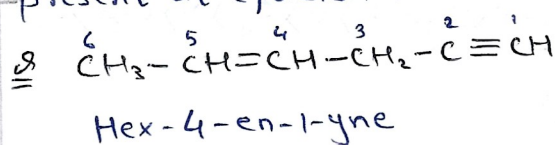


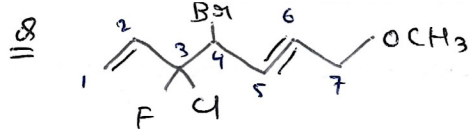
2-Bromo-4-fluoropentane



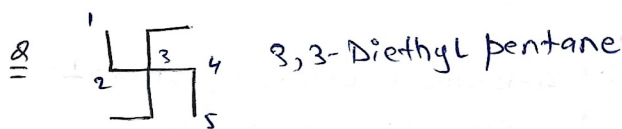
Rule

Priority double bond > Triple bond when present at equidistant

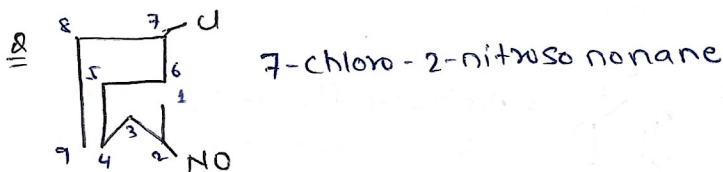




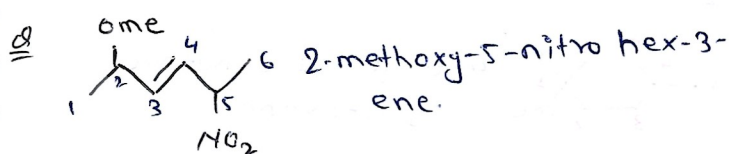
4-Bromo-3-chloro-3-fluoro-7-methoxy
hept-1-en-5-yne.



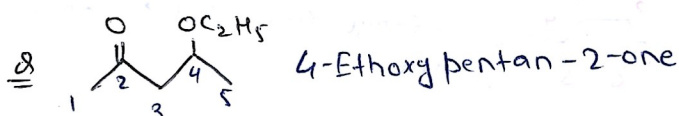
3,3-Diethyl pentane



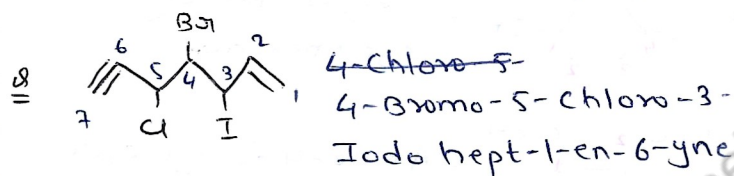
7-chloro-2-nitroso nonane



2-methoxy-5-nitro hex-3-ene.



4-Ethoxy pentan-2-one

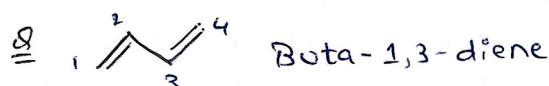


~~4-Chloro-5-~~
4-Bromo-5-chloro-3-
Iodo hept-1-en-6-yne

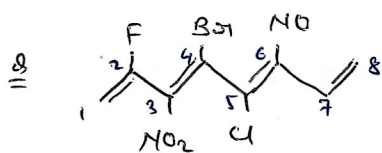
Rule - If more than one double bonds
are present then we should add 'a'
in word root.

hex + a → hexa.

hept + a → hepta.



Buta-1,3-diene



4-Bromo-5-chloro-2-fluoro-3-nitroso-
6-nitroso octa-1,3,5,7-tetraene.

acid amide $-\text{C}(=\text{O})-\text{NH}_2$

carbomoyl

cyanide $-\text{CN}$

cyano

isocyanide $-\text{NC}$

isocyano

aldehyde $-\text{CHO}$

aldo & formyl *

Ketone $-\text{C}(=\text{O})-$

Keto or oxo

alcohol $-\text{OH}$

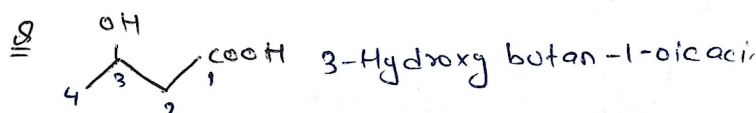
hydroxy

thiol $-\text{SH}$

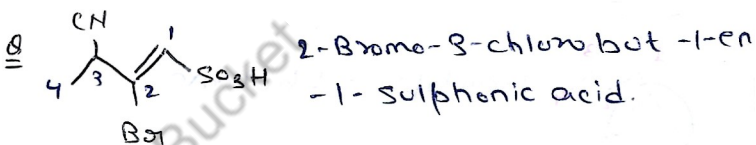
mercapto

amine $-\text{NH}_2$

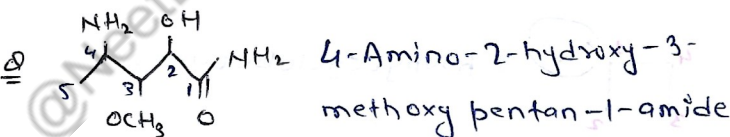
amino



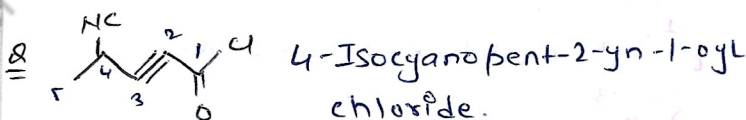
3-Hydroxy butan-1-oic acid



2-Bromo-3-chloro but-1-en-
-1-sulphonic acid.

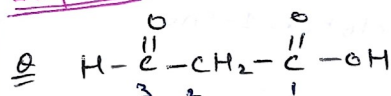


4-Amino-2-hydroxy-3-
methoxy pentan-1-amine

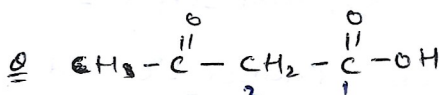


4-Isocyanopent-2-yn-1-oyl
chloride.

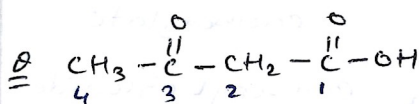
Imp point



3-Aldo propan-1-oic acid.



2-Formyl ethan-1-oic acid.



3-oxo butan-1-oic acid

or

3-keto butan-1-oic acid.

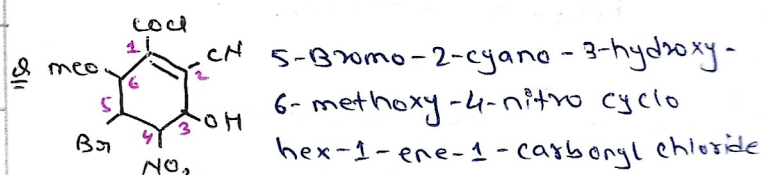
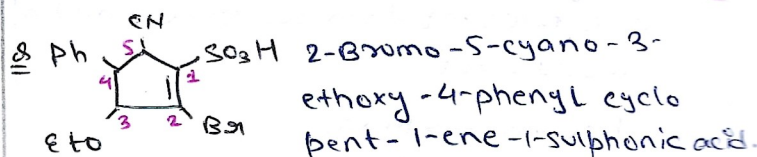
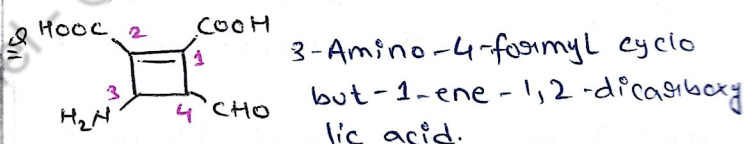
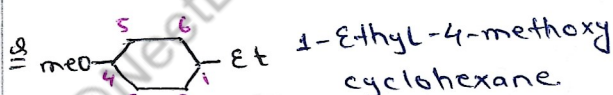
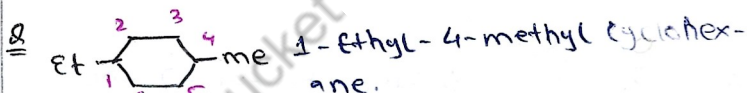
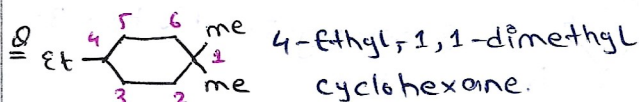
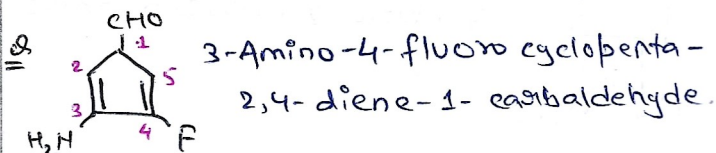
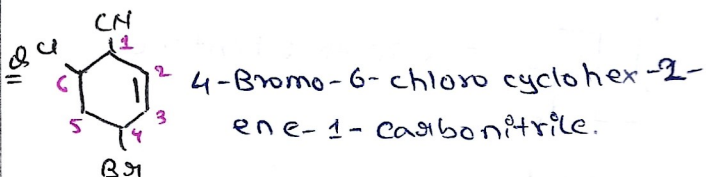
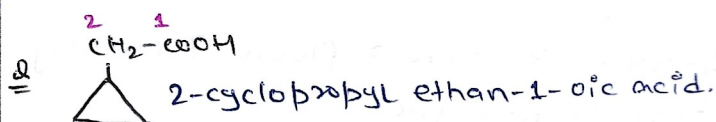
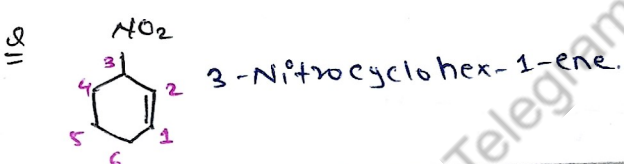
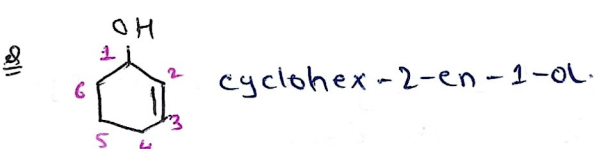
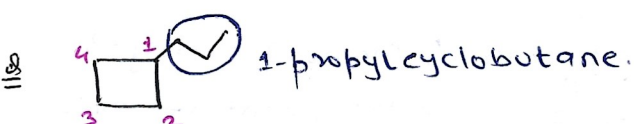
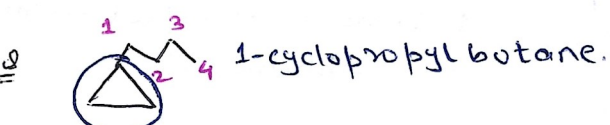
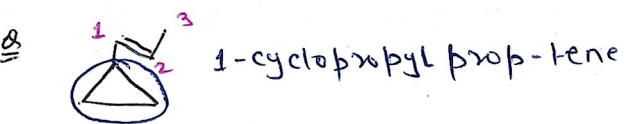
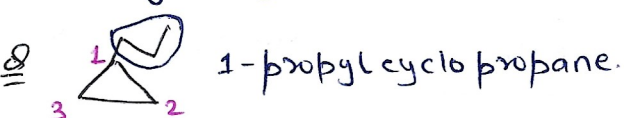
FG	Prefix
Carboxylic acid $-\text{COOH}$	carboxy
Sulphonic acid $-\text{SO}_3\text{H}$	Sulpho
anhydride	-
Ester $-\text{C}(=\text{O})-\text{OR}$	Alkoxy carbonyl
acid chloride $-\text{C}(=\text{O})-\text{Cl}$	chloro carbonyl

IUPAC Naming of cyclo compound.

Priority:- PFG > Multiple Bonds > No. of Carbons > Ring.

If carbon containing F.G. is directly attached with the ring then they are taken as part of the ring.

If no. of carbon atoms are same then priority Ring > chain.

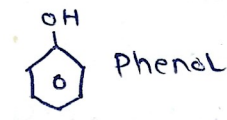
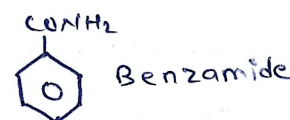
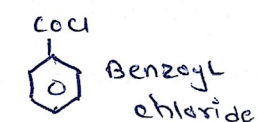
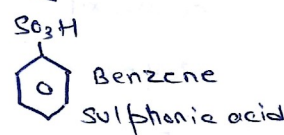
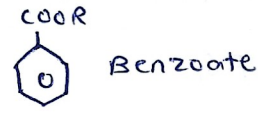
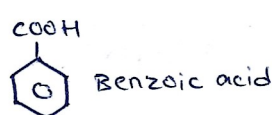


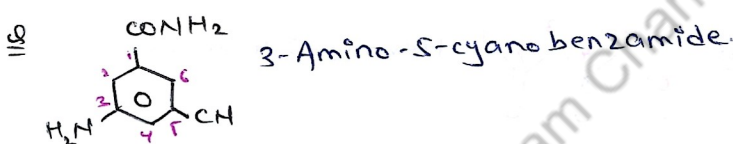
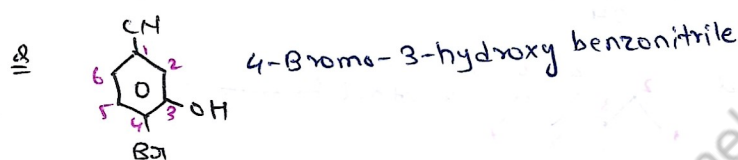
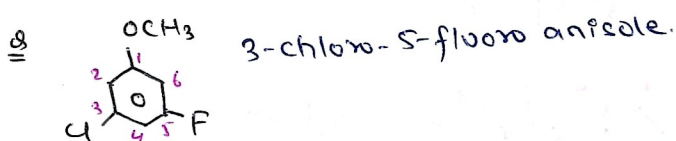
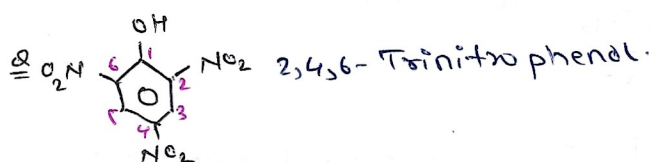
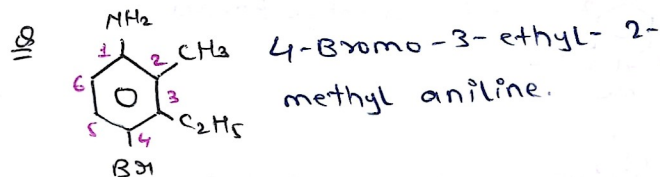
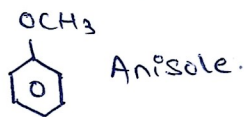
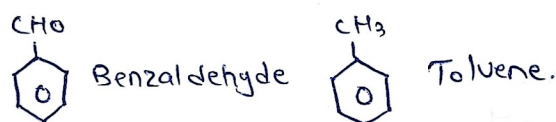
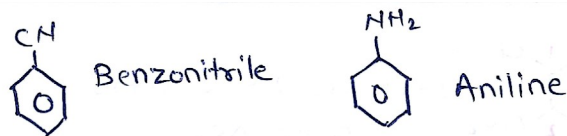
F.G	Special Suffix - 2
carboxylic acid -COOH	carboxylic acid.
Sulphonic acid	Sulphonic acid.
Ester -COOR	carboxylate.
Acid chloride -COCl	Carbonyl chloride
Acid amide -CONH ₂	Carboxamide
cyanide -CN	carbonitrile
Aldehyde -CHO	Carbaldehyde
Ketone	one
alcohol	ol
thiol	thiol
amine	amine.

IUPAC Naming of Benzene Derivative

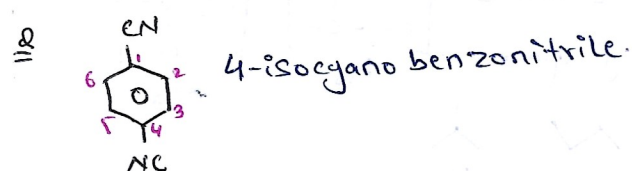
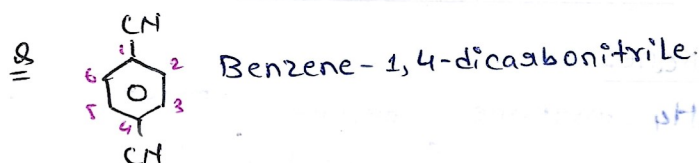
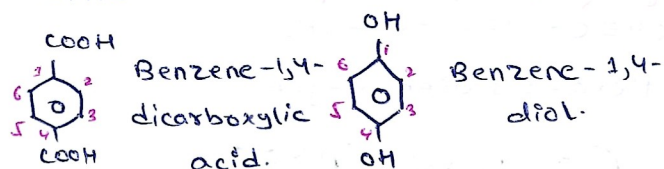
Rules

1. If organic compound is having one F.G. then common name is retained in IUPAC.

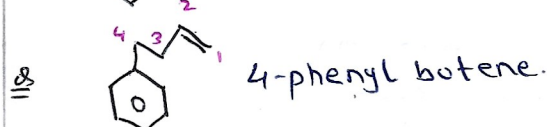
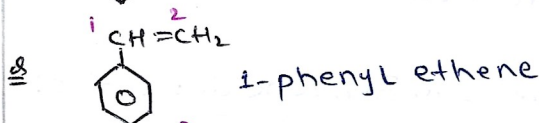
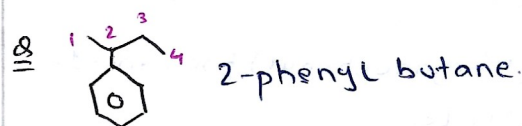
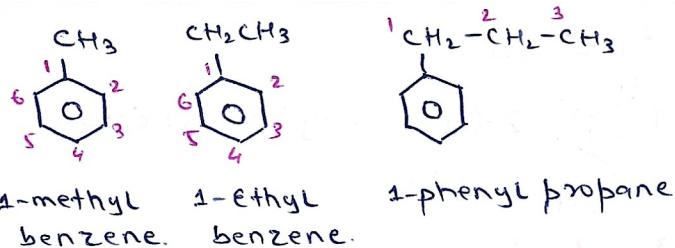




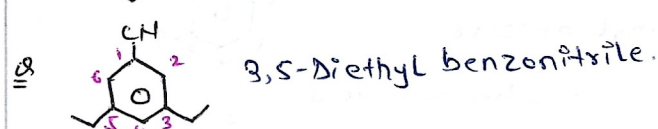
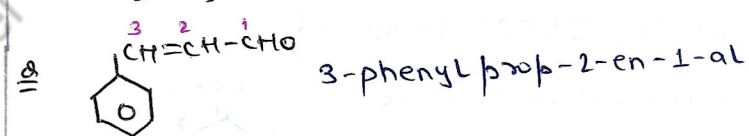
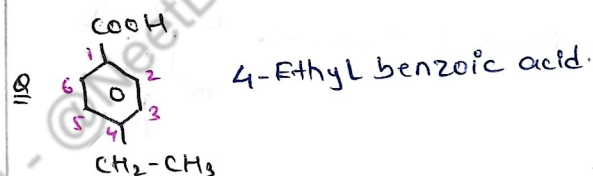
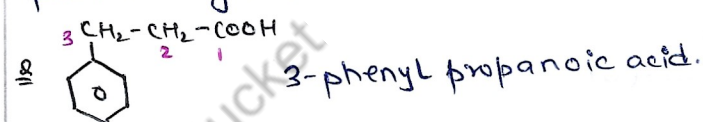
2. If more than one F.G are present then numbering is done according to IUPAC.



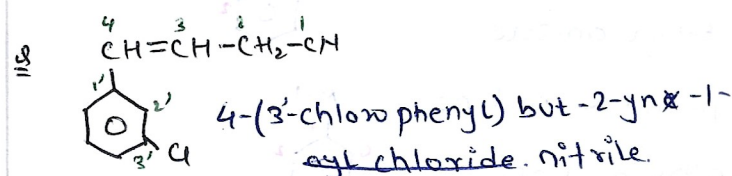
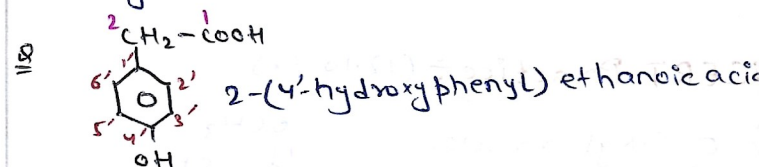
3. If Hydrocarbon is combination of both open and ring part then except Me & Et open part is taken as main part.



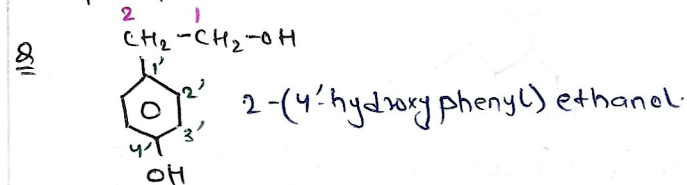
4. If organic compound is having F.G then part having F.G is taken as main part.

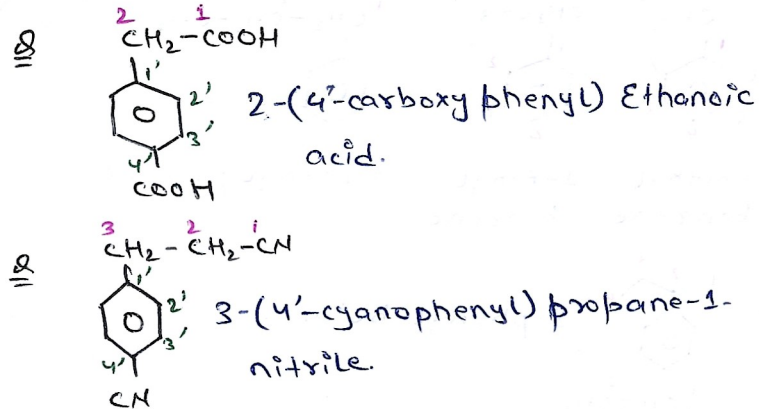


5. If both parts are having F.G then part having P.F.G is taken as main part.

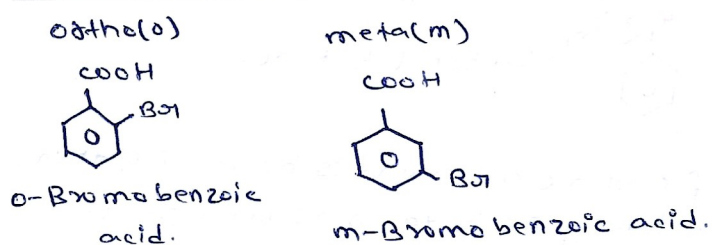


6. If there is choice priority is given to open part

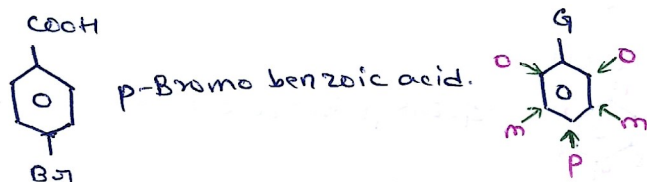




Common names in Benzene derivative:-



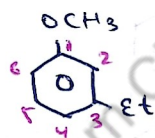
para(p)



8 Write IUPAC name of

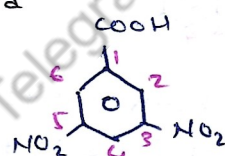
a) m-Ethyl anisole.

3-Ethyl anisole.



b) m-dinitro benzoic acid

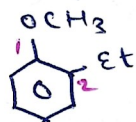
3,5-dinitro benzoic acid.



NCERT Practice (12.10 Ex).

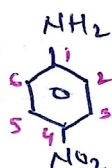
1) o-Ethyl anisole.

2-Ethyl anisole.

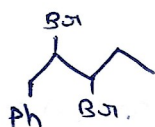


2) p-nitro aniline

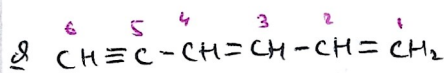
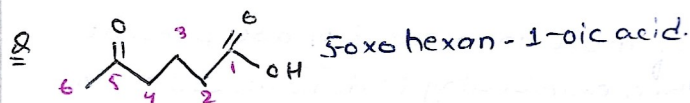
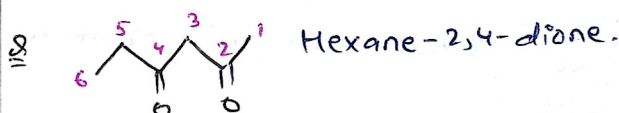
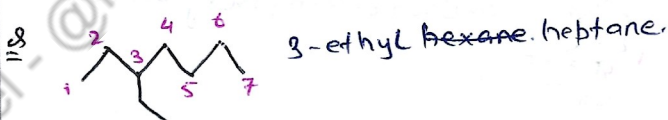
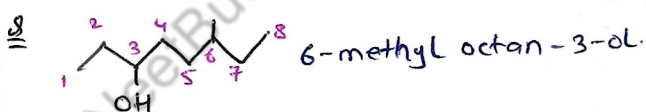
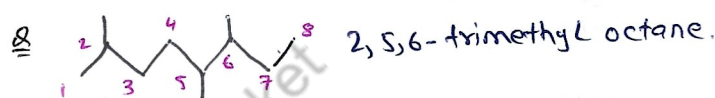
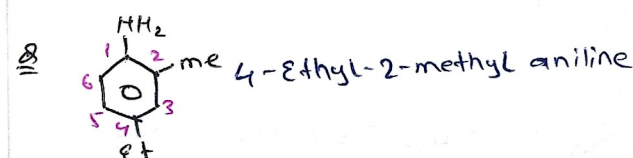
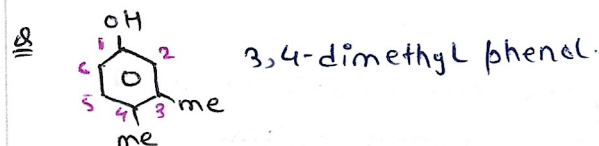
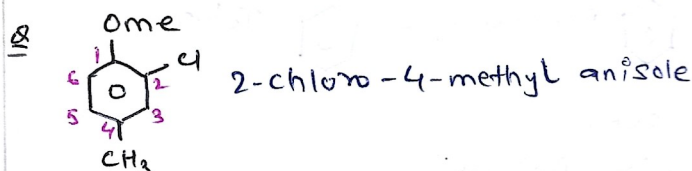
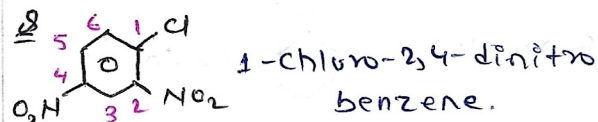
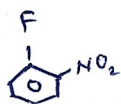
4-nitro aniline.



3) 2,3-Dibromo-1-phenylpentane.



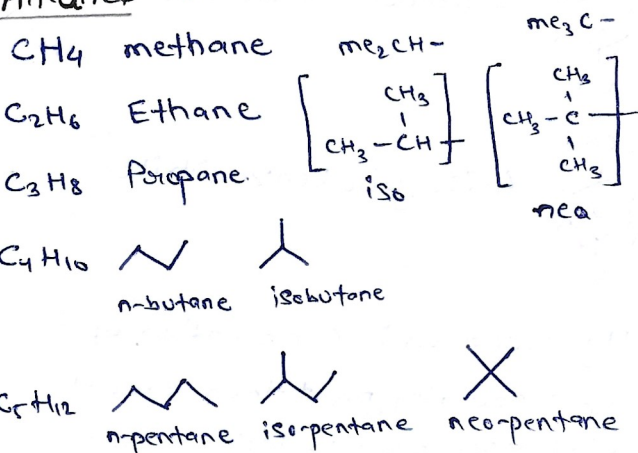
4) 4-Ethyl-1-fluoro-2-nitrobenzene.



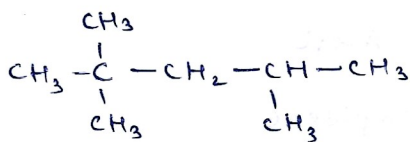
Hexa-1,3-dien-5-yne.

COMMON NAMES

Alkanes



Zindagi Ki Sabse imp baat:- Isooctane.



2, 2, 4-trimethyl pentane.

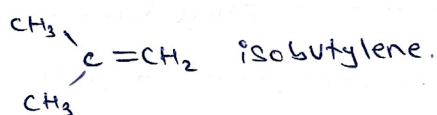
Alkenes (Alkyene)

C_2H_4 : $\text{CH}_2=\text{CH}_2$ Ethylene

C_3H_6 : $\text{CH}_3-\text{CH}=\text{CH}_2$ Propylene

C_4H_8 : $\text{CH}_3-\text{CH}_2-\text{CH}=\text{CH}_2$ α -butylene

$\text{CH}_3-\text{CH}=\text{CH}-\text{CH}_3$ β -butylene.



Alkynes

Common name - Acetylene $\rightarrow \text{CH}\equiv\text{CH}$

1) $\text{CH}_3-\text{C}\equiv\text{CH}$ methyl acetylene.

2) $\text{CH}_3-\text{C}\equiv\text{C}-\text{CH}_3$ Dimethyl acetylene.

3) $\text{C}_2\text{H}_5-\text{C}\equiv\text{C}-\text{CH}_3$ Ethyl methyl acetylene.

Naming of hydrocarbons derivative

a) Radical based.

CH_4 : CH_3 - methyl CH_3-OH methyl alcohol

CH_3-CH_3 : CH_3-CH_2 - Ethyl

$\text{CH}_3-\text{CH}_2-\text{CH}_3$: $\text{CH}_3-\text{CH}_2-\text{CH}_2$ - propyl

$\text{CH}_3-\text{CH}-\text{CH}_3$ isopropyl.

$\text{CH}_3-\text{CH}_2-\text{CH}_2-\text{CH}_3$: $\text{CH}_3-\text{CH}_2-\text{CH}_2-\text{CH}_2$ - n-butyl

$\text{CH}_3-\text{CH}_2-\text{CH}-\text{CH}_3$

sec-butyl.

CH_3
|
 $\text{CH}_3-\text{CH}-\text{CH}_3$: $\text{CH}_3-\text{CH}-\text{CH}_2$ - isobutyl

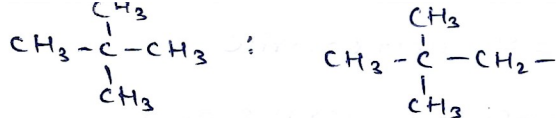
CH_3
|
 $\text{CH}_3-\text{C}-\text{CH}_3$ tert-butyl

$\text{CH}_3-\text{CH}_2-\text{CH}_2-\text{CH}_2-\text{CH}_3$:

$\text{CH}_3-\text{CH}_2-\text{CH}_2-\text{CH}_2-\text{CH}_2$ - n-pentyl

$\text{CH}_3-\text{CH}_2-\text{CH}_2-\text{CH}-\text{CH}_3$ active sec-pentyl

$\text{CH}_3-\text{CH}_2-\text{CH}-\text{CH}_2-\text{CH}_3$ sec-pentyl



neopentyl.

Write common names of:-

a) $\text{CH}_3-\text{CH}(\text{OH})-\text{CH}_3$ isopropyl alcohol

b) $\text{CH}_3-\text{C}(\text{NH}_2)(\text{CH}_3)_2$ neopentyl amine

c) $\text{C}(\text{CH}_3)_4$ neopentane

d) $\text{CH}_3-\text{C}(\text{Br})(\text{CH}_3)_2$ tert-butyl bromide

e) $\text{CH}_3-\text{O}-\text{CH}_2\text{CH}_3$ ethyl methyl ether.

f) $\text{CH}_3-\text{CH}_2-\text{CH}(\text{SH})-\text{CH}_2\text{CH}_3$ sec-butyl thiol.

g) $\text{CH}_3-\text{CH}_2-\text{CH}(\text{NH}_2)-\text{CH}_2\text{CH}_2\text{CH}_3$ Active sec-pentyl amine

h) $\text{CH}_3-\text{CH}_2-\text{CH}(\text{Cl})-\text{CH}_2\text{CH}_3$ sec-pentyl chloride.

Naming of hydrocarbons derivative.

a) Functional group based 'c'

COOH ic acid

C_1 form

COOR alkyl oate

C_2 acet

COOCO ic anhydride

C_3 propion

COCl yl chloride

C_4 butyr (n, iso)

CONH_2 amide

C_5 valer (n, iso, n)

CHO aldehyde

$\text{C}=\text{C}-\text{C}$ (acryl)

CN onitrile

$\text{C}-\text{C}=\text{C}-\text{C}$ (croton)

NC oisonitrile

CH_3CO (propionyl)

Write common names?

1) $\text{H}-\text{C}(=\text{O})-\text{NH}_2$ formamide

2) $\text{CH}_3-\text{C}(=\text{O})-\text{OH}$ acetic acid.

3) $\text{CH}_3-\text{CH}_2-\text{CH}_2-\text{COOH}$ n-butyric acid.

4) $\text{H}-\text{C}(=\text{O})-\text{OH}$ formic acid

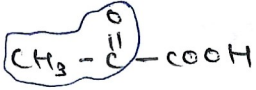
5) $\text{CH}_3-\text{CH}(\text{CH}_3)-\text{COOH}$ isobutyric acid.

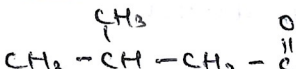
6) $\text{me}-\text{C}(\text{CH}_3)_2-\text{COOH}$ neovaleric acid.

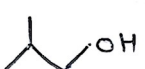
7) $\text{CH}_3-\text{C}\equiv\text{N}$ acetonitrile

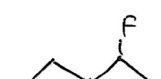
8) $\text{CH}_2=\text{CH}-\text{COOH}$ acrylic acid

9) $\text{CH}_3-\text{CH}=\text{CH}-\text{CHO}$ crotonaldehyde.

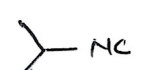
10)  pyruvic acid

11)  isovaleryl amide

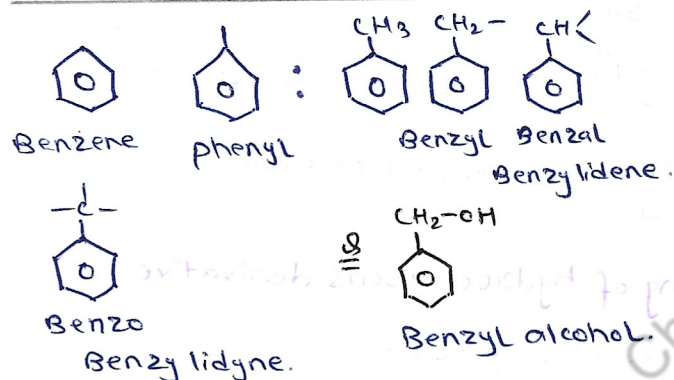
12)  isobutyl alcohol

13)  active sec-pentyl fluoride

14) $\text{CH}_3-\text{CH}=\text{CH}-\text{COOH}$ crotonic acid

15)  isopropyl isocyanide.

Common names of benzene derivative.



Some other common names:-

1) Alkenes

a) $\text{CH}_2=\text{CH}_2$ $\text{CH}_2=\text{CH}-$ ethenyl (vinyl)

b) $\text{CH}_3-\text{CH}=\text{CH}_2$ $\text{CH}_3-\text{CH}=\text{CH}-$ 1-propenyl $\text{CH}_3-\text{C}=\text{CH}_2$ isopropenyl

$-\text{CH}_2-\text{CH}=\text{CH}_2$ 2-propenyl (Allyl)

2) Alkynes

a) $\text{CH}\equiv\text{CH}$ $\text{CH}\equiv\text{C}-$ ethynyl

b) $\text{CH}_3-\text{C}\equiv\text{CH}$ $\text{CH}_3-\text{C}\equiv\text{C}-$ 1-propynyl

$-\text{CH}_2-\text{C}\equiv\text{CH}$ 2-propynyl (propargyl)

3) Alkanes (R)

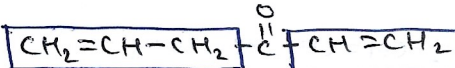
$\text{R}-\text{CH}_2-$ Alkyl

$\text{R}-\text{CH}<$ Alkylidene

$\text{R}-\text{C}<$ Alkylidyne.

8 write common names.

1) $\text{CH}\equiv\text{C}-\text{CH}_2-\text{OH}$ propargyl alcohol or 2-propynyl alcohol.

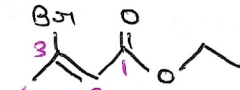
2)  Allyl vinyl ketone

3) $\text{CH}_3-\text{CH}_2-\text{Br}$ Ethyl bromide

4) $\text{CH}_2=\text{CH}-\text{CH}_2-\text{NH}_2$ Allyl amine or 2-propenyl amine

IUPAC Naming of Ester.

1) $\text{CH}_3-\text{CH}_2-\text{C}(=\text{O})-\text{O}-\text{CH}_3$ super prefix methyl propanoate

2)  Ethyl-3-bromobut-2-enoate.

IUPAC naming of cyclic ether.

1)  1,2-epoxy ethane

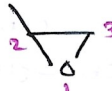
2)  1,2-epoxy propane

3)  2,3-epoxy butane.

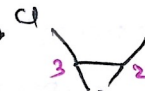
4)  1-bromo-2-chloro-1,2-epoxy ethane

Oxirane:-

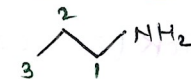
1)  oxirane

2)  2-methyl oxirane

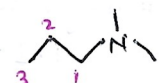
3)  2,3-dimethyl oxirane

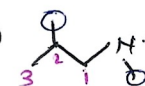
4)  2-bromo-3-chloro oxirane.

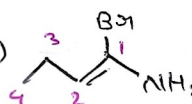
IUPAC naming of amines.

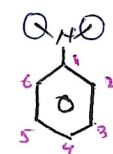
1° amine  propan-1-amine

2° amine  N-methyl propanamine

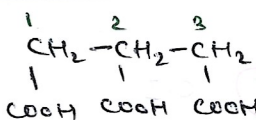
3° amine  N,N-Dimethyl propan-1-amine

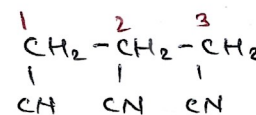
1)  2,2,2-trimethyl propan-1-amine

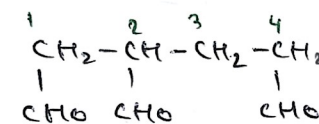
2)  1-bromo but-1-en-1-amine

3)  N,N-Dimethyl aniline.

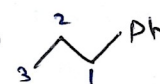
IUPAC naming of compounds having more than two carbon containing F.G.

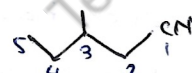
1)  propan-1,2,3-tricarboxylic acid.

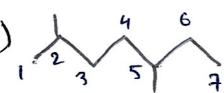
2)  propan-1,2,3-tricarbonitrile.

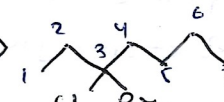
3)  Butane-1,2,4-tricarbaldehyde

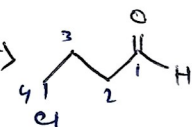
NCERT Practice (12.4 Ex).

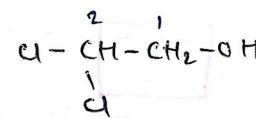
1)  1-phenylpropane

2)  3-methyl pentane-1-nitrile

3)  2,5-Dimethylheptane

4)  3-bromo-3-chloro heptane

5)  4-chloro butanal

6)  2,2-Dichloro ethanol.